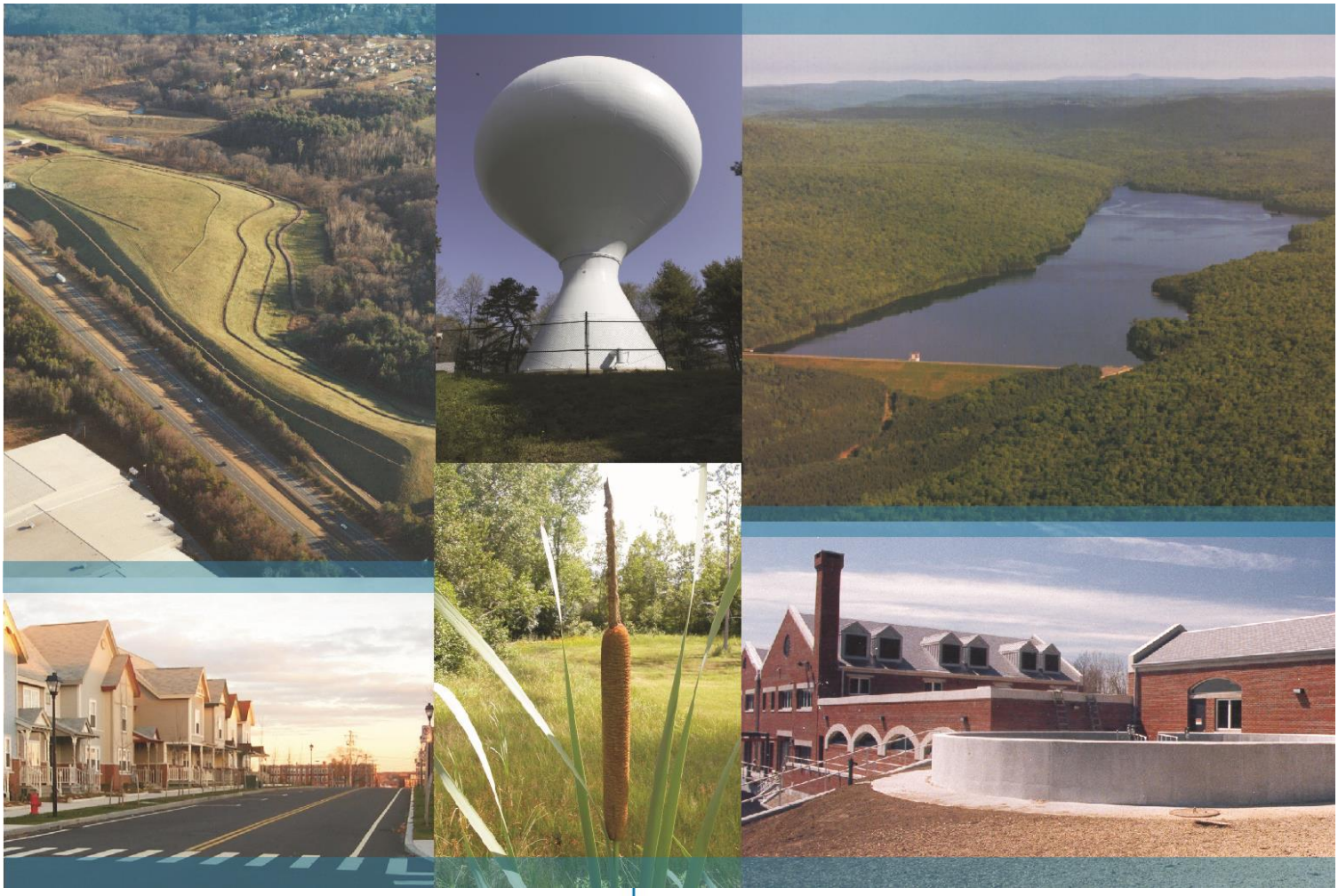

Tighe&Bond

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts
(RTN 3-35355)

Phase I/Tier Classification and IRA Status Report

Prepared For:
City of Salem

September 2019

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Section 1
Introduction

On behalf of City of Salem Department of Planning and Community Development Office, Tighe & Bond has prepared this Immediate Response Action (IRA) Status and Phase I - Tier Classification report for the Gallows Hill Park site located at 50 Proctor Street in Salem, Massachusetts in accordance with the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000). This submittal also meets the requirements for an Interim Phase Comprehensive Site Assessment (CSA) under the MCP. A "preliminary" Phase III remedial evaluation was also completed, as reviewed herein. The subject site is shown on a USGS Site Locus map (Figure 1), MassDEP Priority Resources map (Figure 2), and an Orthophotograph (Figure 3) provided in Appendix A.

On December 19, 2018, the Massachusetts Department of Environmental Protection (MassDEP) issued Release Tracking Number (RTN) 3-35355 to the site for a condition that could pose an Imminent Hazard (IH) to human health in accordance with MCP. On January 17, 2019, Tighe & Bond submitted an IRA Plan to MassDEP for site RTN 3-35355. Under the IRA Plan, further mitigation measures were scheduled to address the IH condition, and further assessment was also scheduled to delineate the site release. In May 2019, an IRA Status report was submitted to MassDEP, which reviewed the mitigation measures that were installed, and briefly summarized the assessment activities that were completed. Our findings indicate that the IH condition still exists and requires further maintenance and monitoring, and that cleanup response actions are warranted to achieve a future Permanent (or Temporary) Solution, as further described herein.

1.1 Conceptual Site Model

The Gallows Hill Park property contains approximately 24 acres of land consisting of two parcels and a right-of-way parcel. The subject site parcel is located at 50 Proctor Street off Proctor Street and Mansell Parkway, and is situated to the east of the "main" park parcel. This park parcel contains a basketball court and a grass covered area that is sometimes reportedly used for soccer practice. This portion of the park is sometimes referred to as "Mansell Park". This parcel is subject of RTN 3-35355, as further described herein.

The "main" park parcel is located to the west of the 50 Proctor Street parcel and is listed at 53 Hanson Street. This parcel contains connected baseball and softball field areas, a skate park, and parking area for the park, as well as undeveloped tree covered area with walking trails. The infield portion of the baseball field this parcel is subject of a separate release (RTN 3-35669), which is not being linked to nor is it associated with the subject RTN 3-35355, as further described herein. A right-of-way parcel is situated between the two park parcels and contains a playground area.

During due diligence investigations that were being completed at the site in November 2018 in preparation for future park renovation work, elevated levels of arsenic were detected in shallow soils in a grass covered area off from the playground on the 50 Proctor Street parcel. Subsequent hand boring soil sampling program in December 2018 indicated that a condition that could pose an Imminent Hazard to human health was triggered in accordance with MCP. This portion of the park has since closed to the general public.

Several utilities, including water, sewer, and stormwater, intersect the developed portions of the park. The site is not mapped within sensitive resource areas other than potential vernal pool areas in a limited "upslope" portion of the undeveloped area on the 53 Hanson Street parcel.

At this time, the City is in the process of beginning a park renovation project that is scheduled to include reconstruction of the baseball field with a new irrigation system, construction of new skate park, and construction of a new stormwater infiltration basin, all on the main park parcel at 53 Hanson Street.

Historical records indicate that a tannery facility was located on the far eastern portion of the subject 50 Proctor Street parcel in the late 1800s. At that time, there appears to have been a stream channel that crossed this portion of the property, which is in the general location where a storm water drain system currently exists. The tannery facility was reportedly "vacant" in 1906 based on historical fire insurance mapping, and the former tannery building(s) were demolished by 1930s (or earlier). Circa 1910s to 1950s there was a ponded area in the general area where elevated levels of arsenic have been detected in shallow soils. Historical records also indicate there were also tannery operations on nearby properties further to the east across Proctor Street, possibly through the 1960s.

The City of Salem took ownership of the subject 50 Proctor Street parcel in 1940, and the City took ownership of the other main park parcel (at 53 Hanson Street) in 1912.

Subsurface investigations completed during the due diligence investigations included a soil boring program conducted across much of the developed portions of the park parcels, followed by a limited hand boring program in the identified area of concern. The initial soil boring program included a suite of laboratory analyses for soil samples, including RCRA 8 metals. During this event, there was no evidence of visual contamination and/or historic anthropogenic fill materials observed in the borings, and only arsenic was detected at slightly elevated levels in one soil boring location. The findings from a subsequent hand boring program indicated that very high levels of arsenic (triggering the potential IH condition) were present in shallow soils in the area of concern. However, no elevated arsenic concentrations were detected in shallow soils within the playground area.

Subsequent to the initial findings at the park site, elevated arsenic levels were also reported in shallow soil samples collected by MassDEP from abutting off-site residential properties off Langdon Street. That issue is being addressed by MassDEP under a separate RTN 3-35400 with assistance from the Environmental Protection Agency's (EPA's) Emergency Response and Removal Section.

Since reporting of the IH condition at the subject site, a six-foot high chain link construction fence was installed around the area of potential concern (with warning signs posted) prior to beginning additional subsurface investigations at the site in January 2019 under the IRA Plan. This serves a "temporary measure" to restrict access for the general public to this portion of the park.

The goals of the additional site investigations completed under the IRA Plan were to further delineate the horizontal and vertical extent of contamination across the park area and to help determine if there was buried tannery "debris" and/or abandoned infrastructure of concern associated with former tannery operations. These investigations included ground penetrating radar (GPR) survey, test pit explorations, additional soil boring advancement,

and monitoring well installations. Between these programs, a total of 95 additional soil samples were analyzed for potential contaminants of concern, and four groundwater samples were also analyzed for potential contaminants of concern (COCs) in general accordance with the IRA Plan.

The findings indicate that site soil is the primary environmental media significantly impacted by the release on the site parcel, with arsenic being the primary COC for the site. Arsenic levels in site soils not only exceed MCP Method 1 standards in numerous soil samples, but arsenic was also consistently detected above MCP Method 3 Upper Concentration Limits (UCLs) over a significant portion of the site. Three other metals (total chromium, barium and lead) and one petroleum carbon range and one target polycyclic aromatic hydrocarbon (PAH) were detected above Method 1, S-1 soils in a limited number of soil samples, which generally correspond to locations where elevated arsenic levels are also present in soils. Elevated arsenic levels are present within the top three feet of surface grade across a significant portion of the subject parcel, and apparently up to the property lines in some areas, including at the abutting three residential properties off Langdon Street. Elevated arsenic levels at depths below three feet appear to be more confined to the southern/central portion of the subject parcel.

It is unclear how the arsenic from the former tannery operations became predominately located in the shallower soils beneath the currently grass-covered park area. However, at least in part, it may have been from filling of a former ponded area on the parcel and/or with historical application of arsenic as a pesticide for the hides on the rear portion of the former tannery facility. In general, there were no tannery wastes (e.g., hides) encountered during our subsurface investigations, and only limited debris (e.g., brick pieces) was observed in the subsurface where tannery buildings were formerly located.

Based on conversations with MassDEP and our recent site visit, there are also concerns a drainage swale to the rear of a neighboring resident at 37 Proctor Street (i.e., east of the park across Proctor Street) may be impacted by former tannery operations at the subject site (or possibly from other off-site tannery operations). Based on our research, the swale is connected to and receives flow from the underground storm drain system that crosses 50 Proctor Street park parcel, and historical mapping indicates that it was likely part of an open stream channel that previously crossed the subject site and the properties across (to the east of) Proctor Street during earlier tannery operations. The current swale is approximately 60 feet in length before the stormwater system is culverted again until it ultimately discharges to the channelized North River less than ½ mile further to the northeast of the site. The assessment of the swale area is the reason a Phase II CSA for subject RTN 3-35355 is not considered complete at this time.

Also, until either permanent fencing is installed around the area where the IH condition exists or cleanup response actions are completed on the subject 50 Proctor Street parcel, the IH condition requiring continued "maintenance and monitoring" under the IRA remains active. Based on site findings and the site use as a park area, the cleanup alternatives available are limited to a contaminated soil removal for off-site disposal, an engineered barrier or cap system, and/or placement of an Activity Use Limitation (AUL) on the property deed, as further discussed herein.

Section 2
Site Description

2.1 Existing Conditions

Existing site conditions were extensively reviewed in the IRA Plan submittal and are updated (as warranted) in the sections below.

2.1.1 General Site Use and Description

The Gallows Hills Park area consists of two parcels, listed at 53 Hanson Street and 50 Proctor Street. The 53 Hanson Street property is considered the main park parcel, while the 50 Proctor Street property located on the eastern portion of the park is the primary area associated with RTN 3-35355, as further described herein. The latitude and longitude of the approximate center of the release area is 42.51646 and 70.91036, respectively.

Salem Assessor's records indicate that the subject 50 Proctor Street parcel contains 1.49 acres of land. This parcel is abutted to the east by Proctor Street and to the south by Mansell Parkway, and this portion of the park is sometimes referred to as "Mansell Park" on street maps. This parcel is mostly grass covered area reportedly used for soccer practice for younger children on a limited basis. [Note: Field observations indicate this grass area has an undulating surface, and there are no soccer posts in this area.] A basketball court area is located on the northern portion of the parcel. The two park parcels are separated by a right-of-way area owned by the City, with the park's playground area located within this right-of-way. These site features are depicted on Figure 3. There is also an approximate four to five-foot change in elevation between this right-of-way area and the lower 50 Proctor Street parcel. Since a condition that could pose an Imminent Hazard to human health was encountered at the site, the subject 50 Proctor Street parcel and the nearby playground area have been closed to the general public, as further described herein.

Also for reference, the 53 Hanson Street parcel contains approximately 21.83 acres of land. This parcel currently has baseball and softball field areas on the central portion of the site, and also contains a skate park and a parking area off Mansell Parkway and Witch Hill Road on the eastern portion of the parcel. The park building on the site property is located on the north/northwestern portion of the parcel, off Hanson Street, separate from the rest of the developed park area. The remainder of this parcel is mostly tree covered, with areas of exposed bedrock ledge, situated to the north, west and south of the baseball field area at higher elevations (see Figure 1). These undeveloped areas, which contain walking trails, are visible on the Orthophotograph (Figure 3). There is also a water storage tank is located on the far western portion of this park parcel.

On the on-line Assessors property cards, the two park parcels are listed as being owned by the City of Salem, with sale date of "January 1, 1900" listed for both subject parcels. The Salem Assessor's office provided further ownership information for the 53 Hanson Street parcel, which indicated that this parcel became registered land (document number 29043) dated October 25, 1933.

As reviewed in the January 2019 IRA Plan submittal, further information for the site was obtained from the Essex County Registry of Deeds. In summary, a property deed for the

50 Proctor Street parcel (dated January 11, 1940) indicated the sale of the property was from Clotilde Jones to the City of Salem for "constructing public streets or boulevards, parks or other municipal purposes." A Plan of Land for this parcel shows the property as 2.32 acres of land off Proctor Street, with three abutting residential parcels at 1, 3 and 5 Langdon Street to the north and the City of Salem land to the west (i.e., the current 53 Hanson Street parcel). At that time, there was no Mansell Parkway, and this roadway was presumably constructed after this land transfer. Copies of the deed and plan of land were provided in the January 2019 IRA Plan submittal.

2.1.2 Site Utilities

Based on Salem GIS information provided to Tighe & Bond, site area utilities are provided on Figure 3. The site utility information was updated based on utility line camera survey work subsequently completed at the site by the City during the IRA. Based on that information, there is a 36-inch reinforced concrete pipe (RCP) stormwater line that crosses the 50 Proctor Street parcel to Proctor Street. There is a connected 8-inch PVC stormwater line on the southwestern portion of this parcel, and a separate "unknown" 12-inch vitrified clay pipe also connected to this drain line system which was encountered (and partially damaged) during test pitting activities, as further described herein. Another 12-inch vitrified clay (VC) stormwater line also crosses the northern portion of this parcel to Proctor Street. The City's GIS layer also indicates there are two 8-inch water line stubs off the eastern portion of the 50 Proctor Street parcel.

Earlier plan records from pre-1900 provided to Tighe & Bond by MassDEP suggest the storm drain system on the subject 50 Proctor Street parcel may be associated with a former brook channel that apparently crossed this property at an earlier time. [Note: There is apparently "constant flow" in this current storm drain system which begins further west of the park site based on site observations.] This current storm-drain culvert system crosses Proctor Street and temporarily "daylights" to the rear of a property located at 37 Proctor Street to the east/northeast of the subject site, before continuing in a culverted system that ultimately discharges to the channelized North River less than ½ mile further to the northeast of the site.

2.1.3 Surrounding Property Description

As shown on Figure 3, residential properties abut the 50 Proctor Street parcel to the north, and residential properties are also located across Proctor Street (to the east) and across Mansell Parkway (to the south).

2.1.4 Surrounding Resource Areas

As shown on the Site Locus Map (see Figure 1), there are no surface water bodies are currently located on site, but there is a small pond area located in the undeveloped, wooded (upslope) portion of the park to the south of the baseball field. The nearest major water body is the North River situated less than ½ mile to the north/northeast of the subject site.

According to the Priority Resource Map (see Figure 2), the site is mapped as a Protected and Recreational Open Space area. There is also a Natural Heritage & Endangered Species Program (NHESP) potential vernal pool area mapped in the location of the ponded area shown on Figure 1 (i.e., in the undeveloped, wooded area). The site is not located within a MassDEP Approved Wellhead Protection Area (Zone II) or an Interim Wellhead Protection

Area. Also, no Potentially Productive Aquifers, areas of Critical Environmental Concern, Sole Source Aquifers or Solid Waste Landfills are identified within 500 feet of the site.

According to an *EDR Radius Map with GeoCheck®* report that was provided in our IRA Plan submittal, the nearest private well is located within ½ mile to the south/southeast of the site, and no other private well is mapped within ½ mile of the site.

2.2 Redevelopment Plans

At this time, the City is preparing for a park renovation project on the main park parcel at 53 Hanson Street, which is scheduled to include the following:

- Reconstruction of baseball field to high school size, with a new irrigation system
- Construction of new skate park (replacing the current skate park area)
- Construction of a new stormwater infiltration basin to collect and treat stormwater runoff from the site's impervious areas
- New tree plantings and other minor site improvements

The park renovation work is scheduled to begin in late July 2019. Note: No park renovation work is scheduled to occur on the subject 50 Proctor Street parcel and/or within the Disposal Site Boundary associated with the subject RTN 3-35355, as further reviewed herein.

2.3 Physical Characteristics

2.3.1 Site Topography and Drainage

The site location is illustrated on the USGS Topographic Map for the Salem Massachusetts Quadrangle (see Figure 1 in Appendix A). As shown, the site area topography generally slopes to the east/northeast, with higher elevations on the undeveloped portions of the adjacent park parcel at 53 Hanson Street parcel. On the subject site, the elevation is between approximately 36 and 40 feet above mean sea level.

Specific to the subject 50 Proctor Street parcel, this area is generally flat but there is a slight pitch off the abutting Mansell Parkway and, to a lesser extent, off the abutting Proctor Street toward the center of the parcel. There is also an approximate four-foot difference in elevation between the approximate boundary of the right-of-way parcel (higher) and the subject 50 Proctor Street parcel (lower), with a stone wall east of the playground area and a grass slope to the south of the playground.

A review of the site's storm drainage system is provided in other sections of this report.

2.3.2 Site Geology

According to the Surficial Geologic Map of the Salem Depot (compiled by Stone, Stone and DiGiacomo-Cohen; 2006), the site area is mapped as within glacial stratified deposits, with shallow bedrock or outcrops on the undeveloped, western portion of the park.

During test pitting and drilling activities at the site, the native soils beneath fill generally consisted of sand to silty sand with varying amounts of gravel. The depth to apparent

bedrock (or hard till) on the subject park parcel ranged from approximately eight feet BSG to at least 15 feet BSG, as further discussed in Section 3.

2.3.3 Site Hydrogeology

During site investigations, the groundwater table was encountered between approximately two and five feet BSG on the subject 50 Proctor Street parcel, and groundwater flow was determined to be to the north/northeast across the site, as further reviewed herein.

2.4 Disposal Site History

Site history information was obtained from Environmental Data Resources (EDR) of Shelton, Connecticut, as further discussed below. Copies of EDR's historical documents and reports were provided in the January 2019 IRA Plan submittal.

2.4.1 Historical Fire Insurance Maps

Historical Sanborn Fire Insurance Maps for the years 1890, 1906, 1950, 1957, 1965, and 1970 were provided for the site area. The maps depict the 50 Proctor Street parcel location, and the eastern portion of the 53 Hanson Street parcel. Other pertinent details are summarized below.

- **1890**: This map shows a "finishing" building (under company name of John Looney) associated with apparent tannery operations located on the eastern portion of the subject site (i.e., on the eastern portion of the 50 Proctor Street parcel). There are also small sheds and stable areas on this portion of the site. To the east/southeast of the subject site across Proctor Street (and off current Pope Street) is a "tan house – finishing/drying" building under company name of Michael Looney.
- **1906**: This map shows several buildings on the eastern portion of the subject site, listed as "formerly Morrill Leather Company – Morocco Factory" that is "now vacant." This map depicts two tanks to the rear of the street-front building. Another potential tank symbol (based on our review of historical fire insurance legend sheets) is shown further to the rear of the facility. Abutting the subject site to the north are three residential dwellings located at 1, 3 and 5 Langdon Street, which appear consistent with the residences that are currently located in this area (see Figure 3 for reference). To the east/southeast of the subject site across Proctor Street (and off current Pope Street) are additional tannery buildings/operations listed as "Michael Looney Currier" and "J.F. Ingram Jr, Morocco Factory."
- **1950**: This map shows the subject site as vacant; however, there is still a symbol that is potentially a tank designation on the south/central portion of the 50 Proctor Street parcel. The tannery buildings to the east/southeast of the subject site across Proctor Street (and off current Pope Street) are listed as "O.F. Goldsmith Leather Co." and a staging building for "pickled skins" is shown on these maps.
- **1957, 1965, and 1970**: These maps also depict the subject site as vacant, but the western portion of the site is now listed as a park. The off-site tannery operations (and company name) across Proctor Street are similar to the 1950 map for each of the years. Beginning on the 1965 map, several residential dwellings are now depicted across Mansell Parkway (i.e., to the south of the 50 Proctor Street

parcel), which appear consistent with the residences that are currently located in this area.

2.4.2 Historical Aerials

Historical aerial photographs for the years 1938, 1952, 1955, 1960, 1969, 1978, 1986, 1995, 2008, 2012, and 2016 were provided for the site area. Pertinent details are summarized below.

- **1938**: On this aerial, none of the current park features are shown. There appears to be a structure on south/central portion of the 50 Proctor Street parcel, as well as a possible pond area on the west/southwestern portion of this parcel. The main park area (i.e., on the 53 Hanson Street parcel) where the current baseball field is located appears to be disturbed, with several roadways or trails depicted across this parcel area. The abutting property features to the north and east of the 50 Proctor Street parcel appear consistent with Sanborn maps for 1950.

- **1952**: On this aerial, the 50 Proctor Street parcel appears vacant and grass covered. An apparent tree line separates the two subject site parcels, and there's a baseball diamond visible on the 53 Hanson Street parcel. The abutting property features to the north and east of the 50 Proctor Street parcel appear consistent with Sanborn maps for 1950.

- **1955**: In general, this aerial is consistent with the 1952 aerial imagery, except the current baseball field area is not shown and some of that area appears to be covered in surface water. There is also apparent surface water on the western portion of the 50 Proctor Street parcel at that time.

- **1960**: The quality of this aerial imagery is relatively poor, but site conditions appear more consistent with the 1952 aerial imagery.

- **1969**: On this aerial, a potential basketball court is visible in the current basketball court area on the subject 50 Proctor Street parcel. On the adjacent 53 Hanson Street park parcel, there is a baseball diamond in the approximate location of the current softball, and there appears to surface water across some of the current baseball field area. The residential development to the across Mansell Parkway (i.e., to the south of the 50 Proctor Street parcel) appears consistent with the 1965 Sanborn map.

- **1978**: The quality of this aerial imagery is relatively poor, but the site appears consistent with the 1969 aerial imagery with the addition of impervious surface in the current skate park area, and a baseball diamond is more evident on the adjacent 53 Hanson Street park parcel. By this time, it appears the former off-site tannery buildings to the east/southeast of the site may no longer exists (current residential area).

- **1986, 1995, 2008, 2012, and 2016**: In general, the site features shown on these aerials are consistent with current site features.

2.4.3 Historical Topographic Maps

Historical USGS topographic maps for the years 1888/1892, 1893, 1915, 1919, 1943, 1944/1946, 1947, 1949, 1956, 1970, 1979, 1985, 2005 and 2012 were provided. Pertinent details are summarized below.

- **1888/1892, and 1893**: On these maps, the park area appears to be undeveloped, with a ponded area on the western portion of the adjacent 53 Hanson Street park parcel.
- **1915 and 1919**: These maps are consistent with the earlier maps, except a building structure is depicted on the far eastern portion of the subject 50 Proctor Street parcel, which may have been associated with the former tannery facility discussed above.
- **1943**: This map year is very limited in details (e.g., no nearby roads are shown) and is not consistent with previous or subsequent map years.
- **1944/1946, 1947, and 1949**: These maps depict site topography more consistent with current topography across the Gallows Hill Park area. No building structure is shown on the eastern portion of 50 Proctor Street parcel by 1944.
- **1956, 1970 and 1979**: Site features depicted on this map on the subject 50 Proctor Street parcel are consistent with the previous years discussed above. On the adjacent park parcel at 53 Hanson Street, there is a larger ponded area shown on a portion of the current baseball and softball diamond field areas on the 1956 map.
- **1985, 2005 and 2012**: By these map years, the site features across the Gallows Hill Park are consistent with current conditions.

2.4.4 Historical City Directories

Historical City Directories for the years 1924, 1926, 1941, 1947, 1950, 1957, 1961, 1964, 1969, 1974, 1979, 1983, 1988, 1992, 1995, 2000, 2005, 2010, and 2014 were provided. Pertinent details are summarized below.

- **1924 and 1926**: The 50 Proctor Street property is listed as "Cook Bros Lea Co Inc."
- **1941 through 2014**: For available years during this time-period, the 50 Proctor Street property is not listed.

2.4.5 Environmental Records

The subject site was not listed in any of the databases searched. In addition, there are no listed releases on nearby properties that should affect the subject site. A copy of the *EDR Radius Map with GeoCheck®* report was provided in the January 2019 IRA Plan submittal.

2.4.6 Other Historical Information

Since the submittal of the IRA Plan, additional historical records for the site area were reviewed, including the following:

- A 1912 photograph apparently taken from the hill to the immediate northwest of the 50 Proctor Street parcel. In this photo, the tannery complex layout appears

similar to the layout shown on the 1906 Sanborn map, and the tannery building wing along Proctor Street appears to be four stories in height with a smokestack present adjacent to this building area. In this photo, a large ponded area is also shown off the rear (west) of the tannery building complex. This photo is available on the City's website page for the project site @ https://gallowshillsite.wordpress.com/2019/01/02/emergency-emergency-everybody-to-get-from-gallows-hill-park/.

- A Plan of Land entitled "Land of Ellen D Looney" dated January 1898, which was reportedly recorded in the Southern Essex Registry of Deeds on April 12, 1905. MassDEP personnel provided a copy of the plan to the City and Tighe & Bond. This plan depicts a "factory" building on the eastern/southeastern portion of the 50 Proctor Street parcel (similar to the 1890 Sanborn map), but it also shows a brook channel crossing the parcel in a similar orientation as the current storm drain system on the site. The brook is shown to be channelized under Proctor Street, then is shown to daylight again to the east and continuing toward Pope Street.

2.4.7 Site Release History

As further defined in the MCP, 310 CMR 40.0321(2)(b), a condition that could pose an Imminent Hazard to human health is triggered when:

> *A release to the environment indicated by the measurement of concentrations of hazardous material, equal to or greater than any of the following concentrations at the ground surface or within a depth of twelve inches below the ground surface, at any location within 500 feet of a residential dwelling, school, playground, recreation area or park, unless access by children is controlled or prevented by means of bituminous pavement, concrete, fence, or other physical barrier.*

As further reviewed below, arsenic was detected in top 12 inches of soils above the Imminent Hazard (IH) threshold value of 40 milligrams per kilogram (mg/kg). Following verbal notification to MassDEP for the two-hour reporting condition on December 19, 2018, MassDEP issued RTN 3-35355 to the site for a condition that could pose an Imminent Hazard to human health in accordance with MCP.

On December 20, 2018, the City of Salem issued a public notice regarding the IH condition and the need for closing of the affected park area. On December 21, 2018, a snow fence barrier and signage were posted at the closed park area. On January 11, 2019, representatives from the City of Salem, MassDEP, and Tighe & Bond met on site to review site conditions and to discuss additional fencing needs to restrict site access.

On January 15, 2019, the City of Salem was informed by a representative of the owner of the 1 Langdon Street residential property, which abuts the park area to the northeast at the corner of Proctor Street, that another consultant collected five shallow soil samples from that property for arsenic analysis. Arsenic concentrations in one or more of those samples reportedly were also above the IH threshold value of 40 mg/kg on that off-site property. On January 17, 2019, MassDEP subsequently issued new RTN 3-35400 for that release finding, and MassDEP (with assistance from EPA's Emergency Response and Removal Section) has conducted additional investigations under that separate RTN at that residence as well as the residences located at 3, 5, and 12-14 Langdon Street and at residential properties to the south of Mansell Parkway. No further review of that RTN is presented herein.

On behalf of the City, Tighe & Bond submitted an IRA Plan to MassDEP for the subject RTN 3-35355 on January 17, 2019. In emails dated January 24, 2019, MassDEP provided comments on the IRA Plan, which were addressed in the scope of work we completed, as further reviewed herein. On May 19, 2019, Tighe & Bond submitted an IRS Status report for the subject release.

Finally, it should also be noted that a separate release (RTN 3-35669) was assigned to a portion of the "main" park parcel to the west at 53 Hanson Street on June 6, 2019. That "release" was attributed to the presence of historic fill, as the term is defined in the MCP. On behalf of the City, Tighe & Bond closed out RTN 3-35669 with a Permanent Solution with Conditions (non-Activity Use Limitation) on July 9, 2019. As further documented in that separate submittal, that RTN is not considered to be related to arsenic sources associated with the former tannery operations and the contamination on the 50 Proctor Street parcel (i.e., subject RTN 3-35355). The Disposal Site Boundary for that closed RTN is the general infield portion of the baseball field on the 53 Hanson Street parcel, as depicted on Figure 4 provided in Appendix A.

2.4.8 Waste Management and Environmental Permit History

There are no known waste management and/or other environmental permit records associated with the former tannery facility.

2.5 Overview of Previous Investigations

A review of the subsurface investigations completed at the site in November 2018 (as part of initial due diligence in preparation for future park renovation work) and in December 2018 (completed to further investigate a potential reporting condition identified in site soils on a portion of the site) was provided in our January 2019 IRA Plan submittal. A brief overview of those investigations is also provided below for reference.

2.5.1 November 2018 Drilling Program

On November 5, 2018, seven soil borings (B-1 through B-7) were advanced across the developed portion of the park in general areas where soil disturbance was likely to occur during future park renovation work. That program included one boring on the western portion of the subject 50 Proctor Street parcel (B-7) and six soil borings on the adjacent 53 Hanson Street parcel (B-1 through B-6). An Earlier Subsurface Investigation Plan depicting the approximate locations of these earlier soil borings is provided as Figure 4 in Appendix A.

The borings were advanced using a tracked-mounted vibratory direct-push rig under Tighe & Bond observation. During boring advancement, soil samples were collected continuously using macro core liners. Each boring was advanced to at least five feet below surface grade (BSG), with borings B-2 (10') and B-6 (10') advanced to deeper depths to log site stratigraphy.

During the drilling program, Tighe & Bond screened the soil samples in the field for volatile compounds using a photo-ionization detector (PID) instrument. PID responses for all soil samples were non-detect. Consistent with these findings, no physical evidence of contamination (i.e., visual staining or olfactory odors) and/or anthropogenic fill were observed in the soil borings.

From each of the borings, shallow soil samples collected from approximately 0.5 to 2-feet below surface grade (BSG) were submitted for laboratory analysis, and one deeper sample (B-6 collected from 3 to 5 feet BSG) was also randomly selected for laboratory analysis. The soil samples were submitted for the following laboratory analysis:

- RCRA 8 metals – 7 samples
- Extractable Petroleum Hydrocarbons (EPH) with target Polycyclic Aromatic Hydrocarbons (PAHs) – 5 samples
- Volatile Organic Compounds (VOCs) – 2 samples
- Polychlorinated biphenyls (PCBs) – 2 samples
- Pesticides – 2 samples

Due to an elevated detection of arsenic in soil boring sample B-7 (0.5-2'), additional hand boring investigations were conducted in that area.

2.5.2 December 2018 Hand Boring Program

On December 10, 2019, Tighe & Bond personnel advanced 10 hand borings (B-8 through B-17) in the general area of earlier soil boring B-7. The hand boring program included five hand borings in the grass covered area generally on the western portion of the 50 Proctor Street parcel and five hand borings in the playground area located within the right-of-way area situated between the two park parcels. These hand boring locations were surveyed using global positioning system (GPS) equipment and are shown on Figure 4 in Appendix A.

Each hand boring was advanced to approximately two feet BSG. There was no evidence of contamination and/or historic anthropogenic fill materials observed in the hand boring soils. From each hand boring, the soil sample collected from the top 12 inches was submitted for laboratory analysis of arsenic, with lead and total chromium also subsequently reported by the laboratory per request. In addition, soil samples collected from 1 to 2 feet BSG from hand borings B-15, B-16, and B-17 were subsequently submitted for arsenic analysis based on the arsenic results for the upper shallow soils in these hand borings.

2.5.3 Laboratory Results

Soil results from these previous investigations are summarized in Table 1 provided in Appendix B. Within the table, soil results are compared to MCP Method 1 standards and to Method 3 UCLs for reference. As summarized in Table 1:

- In soil boring sample B-7 (0.5-2'), arsenic was detected at 36 milligrams per kilogram (mg/kg), which is above the Method 1 standard of 20 mg/kg. Arsenic concentrations in the other six soil boring samples submitted for RCRA 8 metals analysis ranged between 3.92 mg/kg and 14.4 mg/kg, respectively.
- In the initial soil borings, trace levels of EPH carbon ranges were reported in samples B-2 (0-5-2')* and B-4 (0.5-2')*, and no target PAHs were detected above laboratory reporting limits. It should be noted that this included boring sample B-7 (0.5-2') where the "beginning edge" of elevated arsenic in soils was encountered.
- In boring samples B-3 (0-5-2')* and B-7 (0.5-2'), no VOC analyte was detected above laboratory reporting limits.

- In boring samples B-1 (0-5-2')* and B-5 (0.5-2')*, PCBs were not detected above laboratory reporting limits.
- In boring sample B-4 (0.5-2')*, three pesticide analytes were detected at concentrations below Method 1 standards by at least two orders of magnitude.
- In hand boring samples B-15 (0-1'), B-16 (0-1), and B-17 (0-1'), arsenic concentrations were 348 mg/kg, 221 mg/kg, and 633 mg/kg, respectively. In hand boring samples B-15 (0-1') and B-17 (0-1'), total chromium and lead were also detected above Method 1 standards of 100 mg/kg and 200 mg/kg, respectively. In hand boring samples B-15 (1-2'), B-16 (1-2), and B-17 (1-2'), arsenic concentrations were 331 mg/kg, 169 mg/kg, and 504 mg/kg, respectively. As shown on Figure 4, these three hand borings were advanced in the grass covered area to the east/southeast of the playground area.
- In the other hand borings, including the five hand borings advanced in the playground area, arsenic concentrations ranged from non-detect to 19.5 mg/kg.

Further discussion on the Nature and Extent of Contamination is provided below in Section 4. [*Note: Earlier boring locations B-1 through B-6 were advanced on the 53 Hanson Street park parcel, which is subject of the separate RTN 3-35400, and not further reviewed herein.]

Section 3
Summary of IRA Work Completed

Subsurface investigations conducted at the site under the IRA Plan included test pit explorations and a separate drilling event. Subsurface investigations were completed by Technical Drilling Services, Inc. (TDS) of Sterling, Massachusetts under Tighe & Bond observation. Prior to conducting these activities, test pit and soil boring locations were pre-marked, and TDS notified DigSafe and the appropriate municipal offices for marking underground utilities. In addition, a Trench Permit application to the City was also completed.

An IRA Subsurface Investigation Plan that shows the test and drilling locations is provided as Figure 5 in Appendix A for reference.

3.1 Exploratory Test Pit Program

Test pit explorations occurred across the central portions of the 50 Proctor Street property. TDS completed test pitting activities using a New Holland 55 Backhoe. Prior to completing the test pit excavations, a site-specific dust monitoring action level was developed and a GPR survey was completed, as further described below.

3.1.1 Development of Dust Action Level

In our January IRA Plan, we proposed that "real-time" dust monitoring be conducted during test pitting activities for particulate matter with an aerodynamic-equivalent diameter of 10 microns or less (i.e., PM10), and that the permissible concentration of 150 micrograms per cubic meter (µg/m^3 or PM10/ m^3) be used in the field which is the USEPA National Ambient Air Quality Standard for PM10.

In response to MassDEP's concerns regarding the proposed action level of 150 PM10/ m^3 (comments received from MassDEP via an email dated January 24, 2019), Tighe & Bond contracted with health risk assessor from Sovereign Environmental, Inc. to develop site-specific action levels for PM10. The highest arsenic concentration that had been detected in site soil to date (i.e., 633 mg/kg) was used in their calculations as a conservative measure. [Note: Arsenic provided nearly 100% of the non-carcinogenic health hazards and carcinogenic risks from the site.]

In their calculations, it was assumed that "soil excavation will result in PM10 concentrations that construction/utility workers and off-site residents are exposed to for 8 hours per day, 5 days per week, for a 6-month exposure period." As indicated, this was a very conservative exposure duration assumption since only two days of test pit excavation work were scheduled under the IRA Plan. Also, since soil ingestion or dermal contact were not considered in their calculations, the risk assessor used a conservative target hazard index (HI) of 0.2 to derive a PM10 action level for the non-carcinogenic endpoint and a conservative target cancer risk of 1x10-6 to derive a PM10 action level for the carcinogenic endpoint. Based on these conservative assumptions, an action level of 12 PM10/m3, was calculated for the site. [Note: If other pathways were controlled (i.e., ingestion) and arsenic continues to be the risk driver, then the alternate action level of 60 PM10/m was calculated for the site.] The complete letter report prepared by our risk assessor is provided in Appendix C for reference.

3.1.2 GPR Survey

During initial test pitting activities conducted on February 1, 2019 (see below for further discussion), an unknown clay utility line and another suspect concrete structure were encountered. Therefore, the test pit work ceased on this date and the City was notified. Tighe & Bond subsequently scheduled a GPR survey to assist in identifying these and other potential buried objects (e.g., tanks) or abandoned infrastructure at the site. In addition, the City conducted a separate camera survey of the service lines across and near the site.

Tighe & Bond subcontracted with Radar Solutions International, Inc. (RSI) for completing the GPR survey, which was conducted on February 5, 2019 under Tighe & Bond observation. As part of this survey, RSI used a 250 MHz GPR antenna, as well as EM-61 equipment (a time domain metal detector used to help locate pipes and cable), Electromagnetic Induction (EMI) equipment (used to help locate buried utilities and foundations), and an EM-31 a terrain conductivity meter (used to help locate possible sources of contamination).

In general, there were a lot of subsurface anomalies or other subsurface "interferences" (possible false positives) detected by the different instrumentation used. Some of this could have been caused by boulders or cobbles, metals in fill, previous soil disturbances, etc. In any event, SIS combined the results of the all the instrumentation used and, based on their interpretations, RSI identified the following areas of potential concern where they recommend further exploration:

- The west/central portion of the parcel to the south/southwest of the basketball court. This is the general area where earlier hand boring B-15 was advanced, and where test pit TP-1 and soil borings B-30 and B-31 were subsequently completed, as further described herein.

- The central portions of the parcel. This is the general area where test pits TP-4 and TP-4A and where soil boring B-42 were subsequently completed, as further described herein.

- The east/central portion of the parcel to the south of the 1, 3 and 5 Langdon Street properties abutting the site to the north (i.e., in the area where the former tannery facility was identified on 1890 and 1906 Sanborn maps). This is the general area where test pits TP-7, TP-8, and TP-9 and soil borings B-44 and B-45 were subsequently completed, as further described herein.

In addition, RSI identified a potential "septic tank or vault" in the test pit TP-3 area (i.e., where test pit work ceased on February 1, 2019, as further described below). SRI also verbally indicated that this area was difficult to survey because of the existing stockpiled soils from the test pit work, which had temporarily not been returned to the excavation because of the City's concerns about the damaged utility. [Note: This is the general area where a potential "tank symbol" was also shown on the 1950 Sanborn map when the site was vacant, as reviewed earlier.]

Lastly, although there were several subsurface anomalies and possible metal debris detected during their survey, SRI verbally indicated that there was not conclusive evidence that there were abandoned USTs on the site.

The complete GPR survey report is provided in Appendix D for reference.

3.1.3 Test Pit Excavations

Exploratory test pit excavation occurred on January 29, 2019, and then were continued between February 11-12, 2019. During these activities, a total of 11 exploratory test pits (TP-1 through TP-3, TP-3A, TP-4, TP-4A, and TP-5 through TP-9) were excavated. Each test pit location was each surveyed using a Trimble R1 Global Positioning System (GPS) unit and their approximate locations are depicted on Figure 5.

In general, test pit excavations occurred to at least approximately five feet BSG and/or until the groundwater table was encountered. During this work, the top one foot of excavated materials was stockpiled separately from the materials excavated from the lower depths. Both the "upper" and "lower" depth materials were temporarily stockpiled on polyethylene sheeting to limit the commingling of these materials with the grass covered ground surfaces outside of the test pits. No personnel entered the test pit excavations during this work. Also, each temporary test pit was backfilled prior to beginning excavation at the next test pit location. When completed, TDS returned the excavated materials to the open excavation in the order removed, and TDS returned the removed grass cover to its previous condition, to the extent feasible. TDS also scraped off loose soils from the backhoe bucket with a brush and soapy water to prevent cross-contamination between test pit areas. At the completion of each test pit location, TDS covered the disturbed ground surfaces of the test pit areas with polyethylene sheeting (with sand bags, or other weighted material placed on top) to protect this area during the interim period until future response actions can occur.

In general, evidence of anthropogenic fill was encountered below a top one to two feet layer of organic soils in the test pits, with total "fill" depths generally less than six feet BSG. There was little to no physical evidence (i.e., staining or odors) of petroleum-type contamination in the test pits, and there was limited evidence of building debris, other than pieces of brick, and trace metal and wood. There was evidence of organic peat in test pits TP-3A (approximately 2.5 to 6 feet BSG), TP-4 (approximately 2.5 to 4 feet BSG), and TP-5 (approximately 3.5 to 5.5 feet BSG), as well little peat in TP-6. As shown, these test pits were located on the central portion of the study area where the former "pond" was likely located.

From the test pit work, it should also be noted that:

- During the initial test pit work conducted on January 29, 2019, an apparent storm drain line (clay construction) was encountered at approximately 2.5 feet BSG in test pit TP-3. A small section of this exposed line was damaged, and the test pit work ceased. Also encountered at this test pit location was a concrete structure (an apparent vault), and a small section of that structure was also damaged (i.e., hole created) during this test pit work. Subsequent to this finding, the City conducted camera survey of the storm drain system in this area and determined that the damaged pipe was an unknown line that may have at one time connected to the site's storm drain system but is currently clogged (see Figure 5 for location reference) and serves no use. The City subsequently "sealed" the openings of both damaged structures with wood and then grouted around these areas as a temporary measure.

- Test pit TP-4A was ultimately "abandoned" after it was determined that this excavation was further south than originally planned. In any event, no significant differences were noted in this test pit location.

- An isolated piece of roofing material was observed on the sidewall of the fill in test pit TP-6. During the test pitting at the other locations, no other building debris was observed. The presence of building debris can indicate the potential presence of asbestos materials.

Complete test pit logs are provided in Appendix E for further reference.

3.1.4 Test Pit Soil Sample Selection

From the test pits, the following number of soil samples from varying depths were submitted for laboratory analyses of the 14 MCP Metals (8 samples), arsenic (15 samples), lead (6 samples), total chromium (8 samples), hexavalent chromium (8 samples), PCBs (4 samples), EPH with target PAHs (5 samples), VOCs (2 samples), total cyanide (2 samples), and/or pesticides (2 samples), as further summarized below.

	MCP Metals	As	Lead	Cr (total)	Hex Cr	EPH	Pesticides	PCBs	VOCs	Cyanide
TP-1 (0-2')	x				x		x	x		
TP-1 (3-5')						x				
TP1- (5')	x				x				x	x
TP-1 (6.5')		x	x	x						
TP-2 (0-2')		x	x	x	x					
TP-2 (5')		x	x	x	x					
TP-2 (6-6.5')		x								
TP-3A (0-2')		x	x	x	x					
TP-3A (2-5.5')						x				
TP-3A (5.5-6.5')		x								
TP-4 (0-2')		x								
TP-4 (4-5.5')	x									
TP-5 (0-2')		x	x	x						
TP-5 (3-5')	x				x		x	x		x
TP-5 (5-6')	x									
TP-6 (0-2')		x								
TP-6 (2-5')	x					x		x		
TP-7 (0-2')		x		x	x					
TP-7 (2-5')		x				x				
TP-7 (5-5.5')	x									
TP-8 (0-2')		x								
TP-8 (2-6')		x	x	x						
TP-9 (0-2')		x		x	x				x	
TP-9 (2-3')	x					x		x		
TP-9 (3-5')		x								

3.1.5 Dust Monitoring

In accordance with the IRA Plan, Tighe & Bond monitored fugitive dust levels during soil disturbing activities associated with the test pit work. During these activities, a hand-held dust monitoring devise was positioned immediately "downwind" of each test pit area. During these activities, the highest dust level reading was 3 PM10/m3, which is below the conservative site-specific action level of 12 PM10/m^3 calculated for the site, as reviewed above. Therefore, test pitting activities were completed without the need for dust control measures (e.g., use of water) or temporary work stoppage.

3.2 Drilling Program

3.2.1 Soil Boring Advancement

Drilling occurred at the site between February 25 and 26, 2019. As part of the IRA drilling program, a total of 35 borings (IDs: B-17 through B-50) were advanced at the Gallows Hill Park site, which included the following:

- Borings B-17*, B-18, B-19/B-19A, B-20, and B-21 were advanced on the 53 Hanson Street park parcel, with B-17 and B-18 advanced in the infield portion of the baseball field. [*Note: B-17 was inadvertently reused as a boring ID for the "site," as earlier hand boring "B-17" was advanced on the 50 Proctor Street parcel, as reviewed earlier.]
- Borings B-21 through B-27 were advanced on the right-of-way park parcel, with five of the borings (B-23 through B-27) advanced within the playground area.
- Borings B-28 through B-50 were advanced across the 50 Proctor Street parcel, including along the perimeters of the parcel.

Each drilling location was each surveyed using a Trimble R1 GPS unit, and their approximate locations are depicted on Figure 5. [Note: IRA soil borings B-17 and B-18 are depicted separately on Figure 4.]

TDS used a track-mounted vibratory direct-push drilling unit for boring advancement. During boring advancement, soil samples were collected continuously using macro-core liners. In each boring, macro-core advancement for sample collected occurred from 0-2 feet BSG, from 2-4 feet BSG, and then every four feet thereafter. In general, the borings were advanced to at least eight feet BSG, except at borings B-19, B-19A, and B-23 where boring refusal occurred prior to eight feet BSG. In addition, borings B-48, B-49, and B-50 were only advanced to two feet BSG due to nearby utility concerns on the northeastern portion of the site (see Figure 5 for reference). Deeper boring advancement occurred in the four well borings (B-28/MW-1, B-31/MW-2, B-41/MW-3, and B45/MW-4) and in borings B-42 and B-44.

In general, evidence of apparent fill soils was only encountered in borings advanced on the subject 50 Proctor Street parcel. In some areas, the fill soils contained evidence of ash, coal and/or brick pieces. Consistent with the test pit findings, the upper (approximate) 0 to 2-foot interval of soils had little or no evidence of anthropogenic fill in most of the borings. There was little to no physical (i.e., staining or odors) evidence of petroleum or other contamination in the soil borings, except there was some evidence of petroleum contamination in fill soils at depth in boring B-43. The native soils beneath the

fill generally consisted of sand to silty sand with varying amounts of gravel. In boring B-37 on the central portion of the 50 Proctor Street parcel, a peat layer was encountered beneath the fill, which had little to some unidentified odors. The depth to apparent bedrock (or hard till) ranged from seven feet BSG in boring B-23 advanced to the north of the playground area (i.e., in the park right-of-way parcel) to at least 15 feet BSG on the subject 50 Proctor Street parcel. The groundwater table was generally encountered at five feet BSG during drilling. The findings from the IRA soil boring program is further summarized in Table 2 provided in Appendix B.

On March 13, 2019, Tighe & Bond personnel also advanced shallow hand borings B-51 and B-52 immediately outside the existing fence line along the northern portion of the 50 Proctor Street parcel within "tree belt" ground cover adjacent to the paved parking area associated with Langdon Street. The approximate locations of these two additional hand borings are also shown on Figure 5. [Note: MassDEP had identified this limited area outside the existing park fence as a potential concern following our IRA Plan submittal.] As part of this event, Tighe & Bond personnel also advanced shallow hand boring B-53 to the immediate north of the basketball court area, as depicted on Figure 5.

3.2.2 Soil Sample Selection

From the soil borings (and hand borings), the following number of soil samples were submitted for laboratory analyses of MCP 14 Metals (5 samples), arsenic (70 samples), total chromium (3 samples), hexavalent chromium (4 samples), PCBs (2 samples), EPH with target PAHs (3 samples), VOCs (1 sample), and/or total cyanide (2 samples), as further summarized in Table 2 provided in Appendix B. As indicated in Table 2, the 0 to 2-foot sample in each boring was submitted for arsenic (or MCP metals) analysis (i.e., the primary contaminant of concern for the site), with shallower intervals in borings B-48 through B-53. Several of the underlying 2 to 4-foot samples were also submitted for arsenic analysis for further delineation at depth. The soil samples submitted for laboratory analysis are summarized in Table 2 provided in Appendix B.

3.2.3 Monitoring Well Installations

In accordance with IRA Plan, TDS completed four soil borings as groundwater monitoring wells (i.e., B-28/MW-1, B-31/MW-2, B-41/MW-3, and B45/MW-4). The groundwater monitoring wells were installed using two-inch diameter, Schedule 40 PVC riser and 10 feet of 0.010-inch slotted well screen set across the groundwater table, as encountered during drilling. The wells were completed at the surface with a flush-mounted road box cemented in place. Well boring logs are provided in Appendix E for further reference.

3.3 Groundwater Sampling

A groundwater sampling event was conducted on March 14, 2019.

Prior to collecting groundwater samples, the depth to the groundwater table was measured in each monitoring using a water level indicator. During this event, Tighe & Bond personnel also surveyed the elevations of each well (top of PVC) to an arbitrary elevation of 100 feet located at the center of the manhole cover for the storm drain system to immediate east/southeast of well MW-1. Using surveyed elevations for the wells and the depth to groundwater measurements, groundwater elevations were calculated and are summarized in Table 3 provided in Appendix B. As summarized, the depth to groundwater was measured between 1.55 and 4.2 feet below grade (from top of PVC) in the wells. In

general, this is at shallower levels than what was observed during earlier test pit activities and may in part be a function of early spring snow melt.

Using these calculated elevations, a groundwater contour plan was developed using the Surfer® program and is presented as Figure 6 in Appendix A. As depicted on Figure 6, groundwater flow across the 50 Proctor Street parcel appears to follow the general direction of the storm drain system, with a north to northeastern flow pattern.

During sampling, groundwater sample collection was conducted in general conformance with EPA's low-flow/low-stress methodology. Each groundwater sample was submitted for dissolved RCRA 8 metals analysis, with the samples filtered in the field. The sample collected from the most downgradient well (i.e., MW-4) was also submitted for laboratory analysis of hexavalent chromium, PCBs, EPH, and total cyanide.

3.4 IRA Status

In addition to the additional assessment activities completed at the site as discussed above, the current status of the IRA condition is reviewed in the sections below.

3.4.1 Construction Fence Installation

As also reviewed in the May 19, 2019 IRA Status Report, a six-foot high chain link construction fence system was installed at the site to better restrict site access in the area of concern (or potential concern). The construction fence was installed along the property lines abutting Proctor Street (east) and Mansell Parkway (south), and it enclosed the playground area within the park's right-of-way parcel (i.e., to the west of the 50 Proctor Street parcel). The construction fence was weighed down using sandbags to help secure the fencing and further prevent access. Along the northern portion of the park in this area, connecting fence sections were used in areas where there is currently no existing six-foot chain link fence or where it is damaged or open. The approximate locations where this occurred is shown on the Fence Installation Plan provided as Figure 7 in Appendix A.

3.4.2 Fence Maintenance and Monitoring

With no current plans to install a permanent fence surrounding the area where the IH condition exists prior to future site remediation occurring, the City began a "maintenance and monitoring program" for the temporary construction fencing. As reviewed in the May 19, 2019 IRA Status Report, this program, which is being conducted by the City's Planning and Community Development office, involves weekly inspections to confirm that the fencing system is intact and that there are no signs of site activity within the fenced area. Copies of field sheets for the inspection events completed since the May 19, 2019 IRA Status Report are provided in Appendix F.

Tighe & Bond also visited the site on July 16, 2019 with Tom Devine from the City's Planning and Community Development office, and noted or discussed the following:

- We observed that the fencing system was generally intact, but there was evidence that the two fence connections along Langdon Street were slightly open. Therefore, we discussed the City better securing these fence attachments with chain locks.
- We discussed re-posting more "No Trespassing – Contaminated Soil" signs along the fencing system.

- We observed that the polyethylene sheeting that was placed over each of the former test pit areas within this fenced-in area were each still intact (i.e., weighted down), with taller grass (i.e., not mowed) immediately adjacent to these areas. [Note: The condition of these covered former test pit areas is also being monitored as part of the City's weekly inspections.]
- We observed that the grass within this area had been mowed by the City since the growing season because of concerns of overgrowth and potential tick issues for the abutting properties. Under this program being handled by the City's DPW under Mr. Devine's supervision:
    - The City is to use a high cut setting (i.e., 3 inches or higher).
    - The City is not to mow or cross with any equipment the covered former test pit areas
    - The City is to mow only in dry conditions.

Finally, with the park renovation work for the 53 Hanson Street parcel scheduled to begin in late July/early August 2019, including in the area immediately adjacent or connected to the park's right-of-way parcel, the City is planning to move the construction fence system in this area as depicted on Figure 7. As further reviewed herein, the soil contamination associated with the subject RTN 3-35355 is confined to the 50 Proctor Street parcel (i.e., the playground is not the Disposal Site Boundary). However, the City is planning to keep the playground area fenced off (see Figure 7) for safety concerns during the park renovation project work, which will include skate park renovation immediately adjacent to the playground.

3.4.3 Site Meetings and/or Discussions with MassDEP

Since the IRA Plan submittal of January 2019, MassDEP personnel (including Erik Johnson and Christopher Pyott, and Joanne Fagan of the Northeast Region) initiated site meetings and other discussions with representatives from EPA's Removal Program and the City of Salem (with some Tighe & Bond involvement) to discuss the impacts at the park area and the assessment of the abutting residential properties located at 1, 3, 5, and 12-14 Langdon Street, as well as the residential properties located 1, 3 and 11 Mansell Parkway to the south of the site. [Note: Based on historical Sanborn mapping, these properties across Mansell Parkway are where the site's former tannery facility may have also been partially located (or had potential impacts).] At this time, it is our understanding that elevated arsenic in soils were only identified at the 1, 3, and 5 Langdon Street properties, and that MassDEP with EPA assistance is planning cleanup at these three residential properties in the fall of 2019 under the off-site RTN 3-35400.

There were also discussions between the City, MassDEP, and EPA regarding potentially conducting future cleanup at the Gallows Hill Park 50 Proctor Street parcel. However, it is our understanding that MassDEP/EPA is not planning to conduct this work under the EPA removal program because the City did not take ownership of this parcel through a tax lien or a foreclosure.

Lastly, through our recent discussions with Mr. Johnson of MassDEP, the nearby neighbor at 37 Proctor Street had concerns relative to potential site-related impacts being located where the site area's current storm-drain culvert system "daylights" to the rear (east) of that property. On July 16, 2019, Tighe & Bond visited this area with Mr. Devine of the

City and the owner of the 37 Proctor Street parcel. That owner indicated that the water flow in the swale is "constant" and that there have been problems with ground settling in the past where the culvert pipe daylights behind their house. The owner also stated that there was an "upstream" release of oil in circa 2004 from a truck accident that occurred further west of the subject site (i.e., not at Gallows Hill Park). The owner stated that oil reportedly entered the area's stormwater system, and that cleanup of "floating oil" occurred in the subject swale location to the rear of their house as part of that release incident. [Note: At time of this report submittal for the subject 50 Proctor Street parcel, no information relative to that circa 2004 "release incident" reported by 37 Proctor Street owner has been identified by Tighe & Bond.]

Based on our observations on July 16, 2019, this swale is stone lined (at least partially) and the base of this swale's "stream" channel is approximately five feet lower in elevation than surrounding grade. The banks and the immediate surrounding area of this swale are overgrown with shrub, weed, and tree growth vegetation. [Note: There is also likely wetland vegetation nearer to the base on the stream channel.] Also based on our observations, there was no evidence that this overgrown area is regularly accessed or used by the neighbors. As depicted on Figure 7, this swale area is approximately 60 feet in length before the stormwater system is culverted again under (before) Pope Street. As also depicted on Figure 7, this swale area is actually located on the abutting privately-owned parcel to the south of the 37 Proctor Street residence (house listed at 41-43 Proctor Street). To date, no further assessment or investigations have been conducted in this swale, and further discussions regarding this "potential" concern are planned between the City, MassDEP, and Tighe & Bond.

3.5 Remaining Work Under the IRA

All work scheduled under the IRA Plan has been completed. However, the IRA condition has not been eliminated through these actions to date because the construction fence is "temporary" in nature, and therefore the IH condition in site soils is still a concern that requires continued "monitoring" until either permanent fencing is installed and/or cleanup response actions are completed.

Therefore, the City will continue the fence maintenance and monitoring program discussed above, until either a permanent fence is installed and/or site remediation occurs.

3.6 Remediation Waste

No remediation wastes were generated during the IRA activities described herein.

Section 4
Nature and Extent of Contamination

The soil and groundwater samples collected by Tighe & Bond during our site investigations were submitted to ESS Laboratory (ESS) of Cranston, Rhode Island for analysis. The laboratory reports are provided in Appendix G.

4.1 Soil Results

As part of IRA assessment activities described herein, a total of 25 test pit samples and 70 soil boring samples were submitted for laboratory analysis. The soil results are summarized in Table 4 (test pits) and Table 5 (soil borings) provided in Appendix B. Within the tables, soil results are compared to Method 1 standards for the three soil categories (S-1, S-2, and S-3) with the applicable groundwater categories for the site, which include GW-3. Further discussion on the site's applicable soil categories is provided below in Section 5. Within the data summary tables, soil results are also compared Method 3 UCLs in accordance with 310 CMR 40.0996.

4.1.1 Test Pit Soil Results

As summarized in Table 4:

- EPH with target PAHs: Low to non-detect levels of EPH carbon ranges were reported in the five samples submitted for EPH analysis, with all detections at least ½ below Method 1 standards. In sample TP-6 (2-5'), benzo(a)pyrene was detected at 2.97 mg/kg, above the S-1 standard of 2 mg/kg. No other target PAH was detected above Method 1 standards in this sample or in the other four samples submitted for EPH analysis.
- Arsenic: In the 23 samples submitted for analysis, arsenic was detected above Method 1 standards in 13 of the samples. In shallow samples TP-3A (0-2' at 5,150 mg/kg), TP-4 (0-2' at 2,330 mg/kg), TP-6 (0-2' at 623 mg/kg), TP-1 (0-2' at 549 mg/kg), and TP-5 (0-2' at 508 mg/kg), arsenic was also detected above the Method 3 UCL of 500 mg/kg.
- Chromium: In sample TP-1 (5'), hexavalent chromium detected at 0.6 mg/kg, well below the Method 1, S-1 standard of 100 mg/kg. In the other seven samples submitted for analysis, hexavalent chromium was detected above laboratory reporting limits in only one sample. Based on these findings, it is assumed that the majority (if not all) of the "total" chromium detections in site soils are attributed to the less toxic trivalent chromium. In sample TP-3A (0-2'; i.e., where arsenic detections were highest), the calculated trivalent chromium result of 1,820 mg/kg is above the S-1 standard of 1,000 mg/kg. In other samples 15 samples submitted for total chromium analysis, the calculated (or assumed) trivalent chromium levels were well below Method 1 standards.
- Lead: In the 14 samples submitted for lead analysis, lead was not detected above the S-1 standard of 200 mg/kg in any of the samples.
- Other MCP Metals: In the eight samples submitted for analysis, the other MCP metals (i.e., besides arsenic, chromium, and lead) were all detected below Method

1 standards. In addition, selenium, silver, and thallium were each not detected above laboratory reporting limits.

- PCBs: In the four samples submitted for analysis, PCBs were not detected above laboratory reporting limits.
- VOCs: In sample TP-1 (5'), acetone was detected at 0.0465 mg/kg, well below the S-1 standard of 50 mg/kg. No other VOC analyte was detected above laboratory reporting limits in this sample or in the other sample submitted for VOC analysis.
- Total Cyanide: In sample TP-1 (5'), total cyanide was detected at 1.11 mg/kg, below the S-1 standard of 30 mg/kg. In the other sample submitted for analysis, total cyanide was not detected above laboratory reporting limits.
- Pesticides**:** In sample TP-1 (0-2'), 4,4-DDE and 4,4-DDT were detected at concentrations below Method 1 standards by at least two orders of magnitude. In this sample and in the other sample submitted for analysis, other pesticides were not detected above laboratory reporting limits.

4.1.2 Soil Boring Results Soils

As summarized in Table 5:

- EPH with target PAHs: In sample B-43 (2-4') where evidence of petroleum-type contamination was noted in the field, one EPH carbon (C_{11}-C_{22} aromatics) was detected above a S-1 standard. Low to non-detect levels of EPH carbon ranges were reported in the other two samples submitted for EPH analysis. Low concentrations (below S-1 standards) of several PAHs were detected in sample B-35 (4-5.5'), and no target PAH was detected above laboratory reporting limits in the other two samples submitted for EPH analysis.
- Arsenic: In the 70 samples submitted for analysis, arsenic was detected above Method 1 standards in 33 of the samples. Also, in 12 of the samples, arsenic was detected above the above the Method 3 UCL of 500 mg/kg, with many of those samples collected from the top two feet of surface grade. Other key findings include:
    - Arsenic was detected at 21.2 mg/kg in sample B-51 (0-1') collected immediately outside the existing fence along the northern portion of the 50 Proctor Street parcel within "tree belt" ground cover adjacent to the paved parking area associated with Langdon Street. This finding does not trigger an IH condition in this area.
    - Arsenic was detected at 21 mg/kg in sample B-17 (0-2') collected on the southern portion of the baseball diamond (near the home plate area) on the 53 Hanson Street parcel, as shown on Figure 4.
    - Arsenic was not detected above 20 mg/kg (i.e., the S-1 standard) in any sample collected from the playground area, or in any other boring advanced within the right-of-way parcel between the two park parcels or on the 53 Hanson Street parcel (other than at B-17, as noted above).
- Chromium: In sample B-49 (0-1'), hexavalent chromium was detected at 9.3 mg/kg (i.e., less than S-1 standard of 100 mg/kg), with total chromium detected at 1,060 mg/kg in this sample. Therefore, the calculated trivalent chromium concentration is slightly above the S-1 standard of 1,000 mg/kg for trivalent

chromium. In the other three samples submitted for hexavalent chromium analysis from the soil borings, hexavalent chromium was not detected above laboratory reporting limits. Based on these findings, it is again assumed that the majority (if not all) of the "total" chromium detections in site soils are attributed to the less toxic trivalent chromium. As summarized in Table 5, no other calculated (or assumed) trivalent chromium levels were well below Method 1 standards in the soil boring samples.

- Lead: In the five samples submitted for analysis, lead was detected above the S-1 standard of 200 mg/kg in sample B-49 (0-1'), which was collected near the property boundary with 3 Langdon Street (see Figure 5 for reference). [Note: It is our understanding slightly elevated lead levels were also detected in shallow soils at one or more of the three abutting residences at 1, 3, and 5 Langdon Street during their separate study, which may be attributed to lead paint from the residences rather than from the former tannery operations.] In the other four samples, lead was not detected above the S-1 standard of 200 mg/kg.
- Other MCP Metals: In the five samples submitted for analysis, the other MCP metals (i.e., besides arsenic, chromium, and lead) were all detected below Method 1 standards. In addition, selenium and thallium were each not detected above laboratory reporting limits.
- PCBs: In the two samples submitted for analysis, PCBs were not detected above laboratory reporting limits.
- VOCs: In sample B-37 (4-8'), acetone was detected at 0.442 mg/kg, well below the S-1 standard of 50 mg/kg. In this sample, 2-butanone was also detected at a trace concentration of 0.0556 mg/kg, well below the S-1 standard of 50 mg/kg.
- Total Cyanide: In the two soil boring samples submitted for analysis, total cyanide was not detected above laboratory reporting limits.

4.2 Groundwater Results

As part of IRA assessment activities described herein, groundwater samples were collected from the four newly installed monitoring wells at the site. The groundwater results are summarized in Table 6. Within the summary table, groundwater results are compared to Method 1 standards for the applicable GW-3 groundwater category, and to Method 3 UCLs. Further discussion on the site's applicable groundwater categories is provided below in Section 5.

As summarized in Table 6:

- EPH with target PAHs: In well MW-4, no EPH carbon range of target PAH was detected above laboratory reporting limits.
- Dissolved Arsenic: Dissolved arsenic was detected at 20.1 micrograms per liter (µg/L) in well MW-3, well below the GW-3 standard of 900 µg/L. In the other three wells, dissolved arsenic was not detected above laboratory reporting limits.
- Dissolved Chromium (and Hexavalent Chromium): Dissolved chromium was not detected above laboratory reporting limits in the four wells. In well MW-4, hexavalent chromium was also not detected above laboratory reporting limits.

- Dissolved Lead: In well MW-2, dissolved lead was detected at 1.9 µg/L, below the GW-3 standard of 10 µg/L. In the other three wells, dissolved lead was not detected above laboratory reporting limits.
- Other MCP Metals (Dissolved): In well MW-4, dissolved cadmium was detected at 1.2 µg/L, below the GW-3 standard of 4 µg/L. In the other three wells, dissolved cadmium was not detected above laboratory reporting limits. No other MCP metal was detected above laboratory reporting limits in the four wells.
- Total Cyanide: In well MW-4, total cyanide was not detected above laboratory reporting limits.

4.3 Further Review of Extent of Soil Contamination

Using the soil results from the earlier investigations and the IRA investigations described herein, Figure 8 and Figure 9 (in Appendix A) were developed depicting the approximate limits of where elevated levels of arsenic were detected in the top three feet BSG and from approximately 3 to 6-feet BSG, respectively. On each figure, the approximate limits of where arsenic were detected in soils at concentrations greater than 500 mg/kg (i.e., Method 3 UCL), greater 100 mg/kg, and greater 20 mg/kg (i.e., Method 1, S-1 standard) are shown.

For developing Figure 8, most of the representative samples used were collected from the 0 to 2-foot interval, and some samples collected from the overlapping 2 to-4-foot interval were also used for developing this figure. As depicted on Figure 8:

- The arsenic >500 mg/kg boundary covers an approximate 28,000 square-foot area of the subject 50 Proctor Street parcel, with a significant portion of the storm drain system that crosses the subject parcel within this boundary. This boundary is also shown to extend up to the property line abutting the 1, 3, and 5 Langdon Street residential properties. Due to the arsenic detection of 603 mg/kg in sample B-33 (2-4'), at least a portion of the basketball court area was included in this boundary. Lastly, due to the arsenic detection of 669 mg/kg in sample B-40 (2-4'), the arsenic >500 mg/kg boundary is also shown to extend up to the southern boundary along a portion of Mansell Parkway.
- The arsenic >100 mg/kg and >20 mg/kg boundaries are shown to extend further up to the property lines to the east along a portion of Proctor Street, to the north along a portion of (and into) Langdon Street*, and to the south along a portion of Mansell Parkway. As shown, the arsenic >20 mg/kg boundary does not extend to the 50 Proctor Street parcel property line to the west, toward (or into) the playground area in the City's right-of-way parcel as discussed above.

It should also be noted that the focus of the soil delineation completed to date was within the property boundaries. There is the potential that elevated arsenic is present within the abutting public sidewalks and/or roadways associated with Langdon Street, Proctor Street, and/or Mansell Parkway based on elevated arsenic being detected near/along the property boundaries in these areas. However, based on the investigations that MassDEP/EPA completed at abutting or nearby residences along Langdon Street and Mansell Parkway, if there are further impacts within public right-of-way areas associated with these two streets, the extent of those impacts should be limited. Also, the former tannery facility "footprint" on the subject site was located off Proctor Street at that time, and therefore significant impacts beneath this roadway are also not anticipated at this time.

For developing Figure 9, some intervals used include samples collected from partially within this 3 to 6-foot BSG interval (e.g., sample collected from 2 to 6-feet BSG, where there was a sample collected from shallow depths at this same location). Also, only test pit or boring locations where arsenic data is available for this interval are shown on Figure 9. As depicted on Figure 9:

- The arsenic >500 mg/kg boundary is mostly confined to the central portion of the subject parcel, over an approximate 5,000 square-foot area. Due to the arsenic detection of 2,140 mg/kg in sample B-39 (0-2'), this boundary is shown to extend to the property line adjacent to the residential property at 5 Langdon Street.
- The arsenic >100 mg/kg and >20 mg/kg boundaries are also shown to be significantly smaller in total area than in the 0 to 3-foot zone. Due to the arsenic detections of 77.7 mg/kg and 31.5 mg/kg in samples B-44 (2-4') and TP-9 (3-5'), respectively, a separate arsenic >20 mg/kg boundary is also shown on the eastern portion of the site.

Note: Figure 9 does not show boring B-33/basketball court area within the arsenic >500 mg/kg boundary. This is because, although sample B-33 (2-4') had arsenic detection of 603 mg/kg, sample B-33 (4-6') had an arsenic detection of only 13.1 mg/kg which suggests that arsenic decreases significantly at depths beginning close to three feet BSG.

As part of our investigations, only a limited number of samples were collected exclusively from depths below six feet BSG. However, it should be noted that samples collected from depth intervals within the 3 to 6-foot interval had arsenic below 20 mg/kg in several areas (see Figure 9 for reference), and on the central portion of the site where arsenic levels were generally highest, the concentrations decreased significantly with depth as represented by samples B-35 (6-8'; arsenic at 6.04 mg/kg) and B-37 (4-8'; arsenic at 99.5 mg/kg). These findings are not unexpected, as the observed fill generally ends within this depth interval (i.e., within the top six feet) and the groundwater table is shallower than six feet BSG in this area.

4.4 Data Validation

All soil and groundwater samples collected by Tighe & Bond were submitted in compliance with Data Quality Enhancement (DQE) protocols of July 2010. The MCP Case Narratives and Analytical Method Report Certification Forms are included in the analytical reports (prepared by ESS) provided in Appendix G. In accordance with the DQE protocols, the laboratory analytical reports were reviewed for compliance with the DQE policy. Presumptive Certainty requirements were met for each laboratory analytical report, except for the following:

- For groundwater sample MW-4 in ESS laboratory report No. 1903343, the hexavalent chromium analysis was completed out of hold time. Therefore, the hexavalent result is reported as an estimated value. However, as reviewed herein, dissolved chromium (i.e., trivalent chromium and hexavalent chromium) was not detected in site groundwater (including in well MW-4) above laboratory reporting limits. Therefore, the "estimated" not-detect value for hexavalent chromium in well MW-4 is not a concern.

Based on a review of the data, field observations, and the laboratory MCP Case Narrative descriptions, the data collected during the site investigations described herein are

commensurate with its intended use and meet the PARCCS criteria, recommended for specifying quality assurance goals by the MassDEP. Details of those criteria are specified below.

Precision: Precision is the degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves. Precision may be quantifiably measured through analysis of duplicates, or as discussed in the Compendium of Analytical Methods (CAM), in lieu of field duplicates, sampling precision related to the non-homogeneity of the impacted matrix may be most appropriately addressed via the analysis of an adequate data set of samples using field screening techniques.

No duplicate samples were collected as part of site investigations. However, a significant volume of soil data was collected from across the disposal site (and beyond) as part of the IRA work and "Phase II CSA" delineation, and the data suggest there is a consistent or distinguishable pattern in the arsenic levels (i.e., the primary contaminant of concern) in site soils, as discussed above in Section 4.3. Furthermore, the limited number of other Method 1, S-1 exceedances in site soils for other COCs is generally confined to areas where there is elevated arsenic.

Accuracy: Accuracy is the degree of agreement of a measurement with an accepted reference or true value. According to the MCP Case Narratives in the laboratory analytical reports, QA/QC performance standards and recommendations, which may affect Data Usability, were achieved except for hexavalent chromium analysis for groundwater sample MW-4 in ESS laboratory report No. 1903343, as discussed above. Although other individual QC performance standards specified in the CAM protocol(s) were also not achieved for some other samples, the analytical deficiencies were generally minor, and it is our opinion that those results do not significantly affect the overall accuracy of the analytical data.

Representativeness: Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variation, or environmental condition. As discussed, the contamination from the former tannery operations is generally confined to fill soils at depths above the groundwater table (i.e., within the top five or six feet BSG), as shown through extensive sampling of soils across the 50 Proctor Street parcel. The groundwater samples collected from four monitoring wells installed across the parcel, including on the downgradient portion of the site, show that the site COCs have not significantly impacted site groundwater. Due to the type of contamination present in soils, it is not expected that there would be significant seasonal fluctuations in contaminant levels in groundwater or significant migration (horizontally or vertically) at the site.

Completeness: Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under normal conditions. All of the samples of environmental media collected by Tighe & Bond, as described herein, are being used to support the Risk Characterization completed for the site in this report submittal. It is our opinion that the sample density and spatial distribution of the samples submitted for laboratory analysis is sufficient to characterize site conditions for RTN 3-35355.

Comparability: Comparability expresses the confidence with which one data set can be compared to another. Data used for this submittal includes laboratory analysis of soil

(and groundwater) samples for MCP metals (via EPA Method 6010B), mercury (via EPA Method 7471A), hexavalent chromium (via EPA Method 7196), VOCs (via EPA Method 8260), EPH/target PAHs (via MassDEP EPH Method), PCBs (via EPA Method 8082B), pesticides (via EPA Method 8081B), and total cyanide (via EPA Method 9014). These analytical methods are the most current methodologies for these analyses and are appropriate for characterization of potential COCs associated with the release at this former tannery site.

Sensitivity: Sensitivity is the ability of the method to detect contaminants of concern at the concentrations of interest. The reporting limits were compared to the Method 1 standards (including S-1 standards) to confirm that the limits were below the applicable standards. For each of the COCs, the reporting limits for soil (and groundwater) samples are below Method 1 standards, with exception of a few target PAHs above S-1 standards in samples TP-3A (2-5.5') and B-43 (2-4'), as shown in Tables 4 and 5 in Appendix B. These limited "elevated" reporting limits is not a significant concern for this investigation or submittal.

Summary: The data used to support this submittal are commensurate with their intended use and meet the PARCCS criteria recommended for specifying quality assurance goals by MassDEP. It is our opinion that the data is both useable and representative of site conditions and is appropriate to support this report submittal.

Section 5
Risk Characterization

5.1 Selection of Risk Characterization Method

The MCP describes two basic approaches (a constituent-specific approach and a cumulative risk approach) and three methods (Method 1, Method 2, and Method 3) for evaluation of risk.

In a Method 1 Risk Characterization, soil and groundwater exposure point concentrations are compared to applicable Method 1 standards, and the risk of harm to safety is also characterized separately [310 CMR 40.0971(5)].

A Method 2 Risk Characterization supplements and modifies the MCP Method 1 Standards with site and constituent-specific information [310 CMR 40.0981]. Method 2 can be used to modify existing Method 1 Standards and/or to derive additional standards for those constituents for which Method 1 Standards have not been promulgated and can also account for site-specific fate and transport mechanisms.

A Method 3 Risk Characterization is a cumulative, site-specific risk approach that includes assessment of the impacts to identified human and ecological receptors, as well as characterizing the risk of harm to safety and public welfare. Subpart I of the MCP (310 CMR 40.0900) describes the procedures, criteria, and standards for the characterization of the risk of harm to human health, safety, public welfare, and the environment.

Since the site contamination is confined to soils, and to a lesser extent, groundwater and since Method 1 standards have been promulgated for all site contaminants of concern, a Method 1 Risk Characterization was used to characterize site risk, as further described in the sections below.

5.2 Contaminants of Concern

An evaluation of the COCs for the site is presented in Table 7 provided in Appendix B. The list of COCs is based on the analyses conducted on soil and groundwater samples collected during site investigations, as summarized herein.

As summarized in Table 7:

- COCs identified for the release site include 12 of the 14 MCP metals, hexavalent chromium, each of the three EPH carbon fractions, 16 of the 17 target PAHs, two VOC analytes, and total cyanide.
- Arsenic in soil is the "primary" COC for the release site, with arsenic detected above the Method 1, S-1 standard of 20 mg/kg in 51 of the 86 soil samples submitted for arsenic analysis.
- Other COCs detected above Method 1 standards for the release site include one EPH carbon (in one soil sample), one target PAH (in one soil sample), barium (in one soil sample), trivalent chromium (in two soil samples), and lead (in one soil sample).

As part of further evaluation for the site COCs:

- Each of the 16 target PAHs detected in site soils were at concentrations below MassDEP identified background levels for "Soil Containing Fill Material," as referenced in MassDEP's Technical Update to Section 2.3 of the Guidance for Disposal Site Risk Characterization document. Apparent coal and/or coal ash was observed in fill soils at the site, and there is history of a smokestack being located at the early 20th century tannery facility (i.e., when coal use was prevalent for heating) on the site. However, as a conservative measure, each of these COCs is being carried through the site risk characterization at this time.
- In accordance with the MCP, "the application of pesticides in a manner consistent with their labelling" is not a release condition. It is our opinion that the very low to trace levels of pesticides detected in shallow site soils in these grass-covered areas can be attributed to historical application of pesticides at the park site, and therefore are not considered COCs for the site release.

5.3 Current and Foreseeable Site Use

As indicated herein, the subject 50 Proctor Street parcel portion of Gallows Hill Park (and the abutting right-of-way park parcel) is currently fenced off and closed to the public, and no renovation plans are currently scheduled for this portion of the park. t.

5.4 Identification of Receptors

5.4.1 Human Receptors

Prior to the discovery of the IH condition, human receptors at the site included park users. With the subject site now being fenced off and monitored under the IRA, the human receptors within this area are currently limited to City personnel. As discussed above in Section 3.4, there will be infrequent visits by the City's DPW for mowing the grass area during growing season for the foreseeable future.

5.4.2 Environmental Receptors

The environmental receptors associated with the subject site are limited because, although the site is a park area, the surrounding area is heavily urbanized. Per MassDEP guidance, since the property is considered "disturbed", the release site would not be characterized as an ecological resource area/receptor.

However, as indicated earlier in Section 3.4, there is a concern that there could be potential impacts to "sediments" in the open drainage swale located off-site to the rear (east) of the 37 Proctor Street residential property. However, the potential for site-related impacts (if present) would likely have been through surface water and/or storm water discharge when former tannery operations occurred at the subject site circa late 1800s/early 1900s (i.e., when there was a stream channel and/or pond on the subject site). It should be also noted that that there could be other potential sources of impacts (if present) in this limited environmental resource area from other historical operations in the site area (i.e., other tanneries) and/or from the stormwater culvert system's other "upstream" contributions.

5.5 Determination of Applicable Standards

For purposes of evaluating site risk, soil data collected from the site are compared to MCP Method 1 Risk Characterization Standards. This section provides a basis for the selection of site soil (and groundwater) classifications. Within an individual site, several applicable categories may be present, including one or more soil categories and one or more groundwater categories. The applicable soil and groundwater Risk Characterization Standards for the site include S-1/GW-3, S-2/GW-3, and S-3/GW-3 for soils (and GW-3 for groundwater). The justifications for these standards are described below.

5.5.1 Soil Classification

Three soil classifications for use in risk characterizations have been developed by MassDEP based on the following characteristics of exposure potential: soil accessibility, frequency of exposure to soil, and intensity of exposure to soil. Based on the relative degree of importance of each of these factors, soils are classified as S-1, S-2 or S-3 soils. Category S-1 soils represent the greatest exposure potential while category S-3 soils represent the least.

The exposure potentials are based upon children's and adults' frequency of use of the area (high, low or not present), the intensity of the use (high or low) and the accessibility of the soils (accessible, potentially accessible or isolated). These criteria are listed in 310 CMR 40.0900(4).

Based on current site conditions (or at least when this park area was "open" to the public prior to the IH condition), soils at the site meet the criteria of soil category S-1 for soils 0 to 3 feet below grade and soil category S-2 for soils 3 to 15 feet below grade. A comparison to the conservative S-1 standards is also required to be protective of potential future exposures to all site soils.

5.5.2 Groundwater Classification

Groundwater is classified according to the following potential exposures:

- GW-1: Groundwater which includes potential or current sources of drinking water.
- GW-2: Groundwater which is considered to be a source of oil or hazardous material vapors to indoor air. It includes locations where the average annual depth of the groundwater table is less than 15 feet below grade and where compounds of concern are detected within 30 feet of an occupied building.
- GW-3: Groundwater at all disposal sites, based on the potential for compounds of concern to be a source of discharge to surface water.

Groundwater may be classified as one or more of these categories for a particular site. Since all groundwater has the potential to discharge to surface water, all groundwater is considered to be category GW-3. Criteria for inclusion in GW-1 are listed in 310 CMR 40.0932(4). The site does not meet the criteria for a GW-1 area. The depth to site groundwater is less than 15 feet below grade, but there are no site buildings on the disposal site, and no off-site residences are located within 30 feet of the site monitoring wells. Therefore, the GW-2 criteria is currently not applicable.

5.6 Environmental Fate & Transport Characteristics

The primary COCs for the site are metals, with arsenic being the primary concern. These contaminants typically adsorb to and bioaccumulate in soils and are relatively insoluble but can become soluble in reducing conditions.

The primary media impacted by the disposal site is site soils. The primary migration pathway of site COCs is through erosion. Since the disposal site area is relatively flat and grass covered, erosion is not a concern for the site.

There is also little to no evidence of groundwater impacts.

5.7 Exposure Pathway Evaluation

5.7.1 Soil

Under normal site use as a park (i.e., when this park area was "open"), exposure to accessible soils is anticipated.

Site soil is not currently used (nor will be in the foreseeable future) for growing fruits or vegetables for human consumption.

Future potential exposures to site soils are not restricted by any Activity and Use Limitation (AUL) placed on the site in accordance with the MCP. Therefore, all site soils are considered to be a potential exposure pathway.

5.7.2 Groundwater

The site is not located in a Current or Potential Drinking Water Source Area, and there is no evidence that site groundwater is impacted by the disposal site. Therefore, groundwater can be eliminated from further evaluation as a potential exposure pathway for the site.

5.7.3 Surface Water

As mentioned, no significant impacts to groundwater were identified and there are no surface water bodies at the disposal site. However, as discussed above, there could be impacts to "sediments" in the open drainage swale to the rear (east) of the 37 Proctor Street residential property that may be historically-related to the former tannery operations on the subject site. Therefore, this potential exposure pathway is not being eliminated at this time.

5.7.4 Air

There are no structures on the disposal site, no organic (volatile) contaminants were detected in site soils, and groundwater does not represent a current (or future) exposure pathway to indoor air. Therefore, indoor air can be eliminated from further evaluation as a potential exposure pathway for the site.

As mentioned, there was a concern regarding dust control during the test pitting work due to the shallow nature of site contamination, and dust control will be a concern during future remedial work at the site. Under current site conditions, there is grass cover throughout the disposal site (along with an impervious basketball court area). In addition, the condition of the covered former test pit areas (i.e., where the grass cover was

disturbed) is also being monitored as part of the City's weekly inspections under the IRA, as reviewed earlier in Section 3.4.

5.8 Identification of Exposure Point Concentrations

The identification of exposure point concentrations (EPCs) for COCs at the site are reviewed for site soils and groundwater in the following sections.

5.8.1 EPCs in Soil

EPCs for site soils are evaluated for the top three feet (S-1 soils when park is "open") and for the 3 to 15-foot interval (S-2 soils when park is "open").

EPCs were calculated for arsenic via arithmetic averages for these two soil category intervals, and are summarized in Tables 8 and 9, respectively, provided in Appendix B. The boundaries where samples were used for the EPC calculations are based on Figures 8 and 9 in Appendix A, respectively, with only samples collected within the "arsenic >20 mg/kg boundaries" being used in the calculations.

- As summarized in Table 8, the calculated EPC for arsenic in shallow soils is 871 mg/kg which is above the Method 3 UCL of 500 mg/kg. If only samples collected within the "arsenic >500 mg/kg boundary" shown on Figure 8 were used in this EPC calculation, the average arsenic value would be evidently higher.

- As summarized in Table 9, the calculated EPC for arsenic in deeper soils is 1,506 mg/kg which is above the Method 3 UCL of 500 mg/kg. If only samples collected within the "arsenic >500 mg/kg boundary" shown on Figure 9 were used in this EPC calculation, the average arsenic value would be evidently higher.

For the other site COCs, the EPCs were calculated using arithmetic averages and are summarized in Table 8A (EPCs for Shallow Soils for Other COCs) and Table 9A (EPCs for Deeper Soils for Other COCs).

As summarized in Table 8A, the calculated EPC for only one other site COC was above Method 1 standards in shallow soils. The calculated EPC for C_{11}-C_{22} aromatics is above the S-1 standard of 1,000 mg/kg, and is attributed to the detection in soil boring B-43 (2-4'), which could be considered a "hot spot" for petroleum contamination, as similar levels were not identified elsewhere on site and this boring location did not have elevated arsenic levels.

As summarized in Table 9A, the calculated EPC for cadmium was above Method 1 standards. As shown, the high cadmium concentration of 102 mg/kg in sample B-35 (4-5.5'), slightly above the S-2 standard of 100 mg/kg, is considered a "hot spot" for cadmium as similar levels were not identified elsewhere on site. [Note: The arsenic concentration of 10,900 mg/kg in sample B-35 (4-5.5') is also the highest arsenic level in deeper site soils.]

5.8.2 EPCs in Groundwater

EPCs for site groundwater are represented by the maximum concentration for each COC detected in each of the four current exposure points (i.e., each of the site monitoring wells). As summarized earlier in Table 6, no individual concentration was detected above applicable Method 1, GW-3 standards.

5.9 Characterization of Risk of Harm

5.9.1 Risk of Harm to Human Health

As detailed above, the calculated EPCs for site COCs (primarily arsenic) in both shallow and deep soils are above applicable Method 1 standards and/or above S-1 standards protective for unrestricted future use. Therefore, a condition of No Significant Risk does not exist for human health at the site.

5.9.2 Risk of Harm to Environment

Due to concerns relative to potential impacts to "sediments" in the open drainage swale located off-site to the rear (east) of the 37 Proctor Street residential property that remain to be investigated, a condition of No Significant Risk of Harm to the environment cannot yet be concluded for the site.

5.9.3 Risk of Harm to Public Welfare

The assessment of risk of harm to public welfare for the site is evaluated by considering the presence of nuisance conditions (i.e., odors) resulting from the release, loss of active or passive property use(s), and any non-pecuniary effects not otherwise considered in the characterization of risk of harm, safety and the environment which may occur due to the degradation of public resources directly attributable to the release. None of these conditions are applicable to the site release. However, since EPCs for arsenic in site soils are above Method 3 UCLs, a condition of No Significant Risk of Harm to public welfare does not exist at the site.

5.9.4 Risk of Harm to Safety

An evaluation relative to the risk of harm to safety posed by current and foreseeable conditions at the disposal site has been made in accordance with 310 CMR 40.0960. There are no dangerous structures, explosive vapors, uncontained hazardous materials or other unsafe conditions at the site.

Section 6
Imminent Hazard Evaluation and Tier Classification

6.1 Imminent Hazard Evaluation

As reviewed herein, the detections of arsenic in the top 12 inches of soils above the 40 mg/kg "threshold" level that could pose an Imminent Hazard to human health in accordance with 310 CMR 40.0321(2)(b) are present at the site. Temporary chain-link fencing was installed around the park to address the potential IH condition and until such time that cleanup response actions have been completed. The temporary chain-link fencing requires continued "maintenance and monitoring" under the IRA.

Since the initial reporting of the arsenic release, the subsequent fencing of the property, and the subsequent soil data collection, it has been determined that an Imminent Hazard condition does exist as the Excess Lifetime Cancer Risk (ELCR) is greater than one-in-100,000. The Method 3 Risk Assessment Short Form for the evaluation of imminent hazard risk for a park visitor is attached in Appendix C for reference.

6.2 Tier Classification

As stated in 310 CMR 40. 40.0520(2), the Tier I Criteria includes the following:

> *(a) there is evidence of groundwater contamination with oil and/or hazardous material at concentrations equal to or exceeding the applicable RCGW-1 Reportable Concentration set forth in 310 CMR 40.0360, and such groundwater is located within an Interim Wellhead Protection Area, Zone II, or within 500 feet of a Private Water Supply Well;*
>
> *(b) an Imminent Hazard is present;*
>
> *(c) one or more remedial actions are required as part of an Immediate Response Action pursuant to 310 CMR 40.0414(2); or*
>
> *(d) one or more response actions are required as part of an Immediate Response Action to eliminate or mitigate a Critical Exposure Pathway pursuant to 310 CMR 40.0414(3)*.

As described herein, an Imminent Hazard exists at the site, and the IRA condition is still in effect.

Therefore, site RTN 3-35355 is Tier I pursuant to 310 CMR 40.0530. A copy of the Notice of Tier Classification Submittal is provided in Appendix H. The notice will be published in The Salem News publication, and a copy of this notice is being provided to the Mayor of Salem and the Salem Health Department. A copy of that notice is also provided in Appendix H.

Section 7
Preliminary Review of Remedial Alternatives

As indicated earlier, the assessment of the "potential" impacts from the release site were not completed at this time due to the concerns associated with the off-site drainage swale area and soil conditions within the adjacent public roads. It is our opinion that the horizontal and vertical extent of site impacts on the subject 50 Proctor Street parcel have been adequately delineated within the property boundary. However, the potential does exist that elevated arsenic is present within the abutting public roads (Mansell Parkway and Proctor Street). As also indicated earlier, MassDEP/EPA is planning to conduct cleanup of the arsenic impacts on the residential properties at 1, 3, and 5 Langdon Street immediately abutting the subject 50 Proctor Street parcel in the fall of 2019. Based on our discussions with MassDEP/EPA, it is our understanding that that work may extend off those properties to create a "clean corridor" between the park parcel and those property boundaries. Therefore, those cleanup findings may be useful for better understanding subject site cleanup implications in the future.

In any event, at this juncture, a preliminary review of remedial action alternatives (RAAs) that may be implemented for addressing the contaminated soil issue on the 50 Proctor Street parcel is presented below.

7.1 Remedial Action Alternatives (Preliminary) for 50 Proctor Street Parcel

In this initial screening, remedial technologies were reviewed to identify remedial action alternatives for further evaluation which are reasonably likely to be feasible for addressing the soil contamination at the site. For the purposes of this initial screening, RAAs were considered reasonably likely to be feasible if; the technologies to be employed by the alternative are reasonably likely to achieve a future Permanent (or Temporary) Solution, and individuals with the expertise needed to effectively implement available solutions would be available.

As reviewed above, calculated EPCs for shallow and subsurface soils are above Method 1 standards <u>and</u> above Method 3 UCLs in some areas for arsenic (i.e., the primary contaminant of concern) across a significant portion of the subject 50 Proctor Street parcel.

Due to the nature of the contaminants (i.e., inorganic compounds) and since the planned future use of the site is continued use as a park area, we have limited the consideration of RAAs for the site under this preliminary review to the following:

- Soil excavation and off-site disposal
- Soil excavation, stabilization, and off-site disposal
- Placement of a cap or engineered barrier to prohibit contact with impacted soil, and implementation of a deed restriction on the property

In this section, each of the alternatives initially screened are evaluated for their potential feasibility at the site.

- **Soil Excavation for Off-Site Disposal**: This RAA would generally consist of the excavation of contaminated soils for off-site disposal. This open and relatively flat park site is readily accessible for excavation equipment, and the depth of contaminated soil excavation (generally to six feet) is also readily accessible with excavation equipment. Some dewatering would likely be warranted during contaminated soil excavation at "deeper" depths below the groundwater table. Further characterization of the generated soils would be required to determine whether the soils (if untreated) would need to be disposed as a hazardous waste.

  This RAA is considered a feasible remedial alternative for the site and, therefore is retained for future consideration.

- **Soil Excavation, Stabilization, and Off-Site Disposal:** The goal of soil stabilization is to immobilize oil or hazardous materials in soils so that the compounds of concern are not classified as a hazardous waste. Soil stabilization would only be performed on soils selected to be removed from the property and is accomplished by mixing contaminated soils with a material such as Portland cement or proprietary additives that decrease leachability. This technology has been utilized successfully for metals. The stabilization process can be performed in-situ or ex-situ. Once the stabilization process is complete, the stabilized soil can be removed from the property as a non-hazardous waste.

  This RAA is considered a feasible remedial alternative for the site and, therefore, is retained for future consideration.

- **Placement of Engineered Barrier (or Cap) and AUL:** This RAA would generally consist of installation of a capping system over the impacted areas to minimize access to the contaminated soils, and the implementation of an Activity Use Limitation (AUL). The goal of this RAA would be to reduce site risk. Due to EPC exceedances of Method 3 UCLs in site soils, an Engineered Barrier would be warranted in accordance with CMR 40.0996 if exceedances of Method 3 UCLs in site soils were to remain unless EPCs are reduced to below UCL levels. If UCL soil excavation is performed, capping and an AUL would still be required.

  With the physical characteristics of the open, generally flat parcel and the planned continued of this property as a park, this RAA is considered a feasible remedial alternative for the site and, therefore, is retained for future consideration.

7.2 Further Evaluation of RAAs (Preliminary) for 50 Proctor Street Parcel

Three RAAs (or combination thereof) are considered feasible and were selected for further evaluation based on their technical viability for reducing contamination and potential feasibility for implementation.

In performing a detailed evaluation of remedial action alternatives for this release site, the following assumptions or items of interest are considered:

- Based on the approximate limits of arsenic contamination in site soils shown on Figures 8 and 9 and GIS measurements of these areas:
    - Arsenic >20 mg/kg (i.e., the Method 1, S-1 standard) in soils within the 0 to 3-foot interval covers an approximate 51,000 square-foot area, and arsenic > 20 mg/kg in soils within the 3 to 6-foot interval covers an approximate 25,000 square-foot area. Based on these measurements, approximately 8,500 cubic yards of soils are impacted by arsenic >20 mg/kg.
    - Arsenic >500 mg/kg (i.e., the Method 3 UCL) in soils within the 0 to 3-foot interval covers an approximate 28,000 square-foot area, and arsenic > 500 in soils within the 3 to 6-foot interval covers an approximate 5,000 square-foot area. Based on these measurements, approximately 3,700 cubic yards of soils are impacted by arsenic >500 mg/kg. Therefore, over 40% of the arsenic-impacted soils have arsenic levels above the Method 3 UCL value of 500 mg/kg.
- Disposal characterization analysis of the impacted soils has not been completed to date. Due to the very high concentrations of arsenic, at least some portion of the soils could be characterized as hazardous wastes during toxicity characteristic leaching procedure (TCLP) analysis (i.e., TCLP arsenic levels could be detected above the hazardous waste threshold limit of 5 milligrams per liter) once the soils are generated. The cost implications for disposal are significant in that soils requiring disposal as hazardous wastes verses non-hazardous waste can be up to (or greater than) three times greater in costs. Therefore, we recommend an "upfront" disposal characterization program be conducted as further discussed below. [Note: The findings from MassDEP/EPA's off-site cleanup on the abutting residential properties off Langdon Street in the fall of 2019 may also be useful for better understanding subject site cleanup implications (specifically disposal characterization/TCLP analysis) in the future.]
- Backfill materials will be required to replace the volume of contaminated soils removed, if excavation and off-site disposal occurs.

It should also be noted that a significant portion of the culverted storm drain system that crosses the 50 Proctor Street parcel is located within the area where elevated arsenic levels (including above Method 3 UCLs) are present in soils. Therefore, either one or more of the following would need to be implemented as part of (or before) future remedial activities on the 50 Proctor Street parcel:

- Measures would need to be taken to preserve the storm drain system during the contaminated soil excavation activities. For areas where contamination is present below the depth of this line, additional precautions will be warranted to structurally support and preserve this line.
- The storm drain system would be removed and replaced as part site cleanup, or a "new" storm drain system would be installed at the site in an alternative area (e.g., along the southern perimeter of this park parcel or along Mansell Parkway).

Lastly, it should also be mentioned that the current basketball court area will be demolished by the remedial activities that are warranted under any of the three alternatives being reviewed.

- **Soil Excavation for Off-Site Disposal**: In order to clean up the site to "background" and subsequently close out the site release with a Permanent Solution without an AUL (and using a Method 1 Risk Characterization), approximately 8,500 cubic yards of impacted soils would need to be excavated, with the area backfilled after completion.

  Although it is unknown what volume of the soils would be characterized as hazardous waste (if any) at this time, it is still presumed that the costs to remediate this volume of soil under this remedial option is likely infeasible.

- **Soil Excavation, Stabilization, and Off-Site Disposal:** Under this option, some or all of the soils would be stabilized before off-site disposal. Unless only a small portion of the soils are characterized as hazardous waste, it is very likely that the remedial costs under this option would be lower because the on-site stabilization costs per cubic yard are typically lower than direct disposal as hazardous waste through economy of scale. If a significant (or all) of the soils are scheduled to be stabilized, the selected remedial contractor may perform an upfront bench-scale soil stabilization program to better understand the materials and ratio volumes needed before full-scale site remediation occurs.

- **Placement of Engineered Barrier (or Cap) and AUL:** The purpose of a barrier is to help demarcate the soil contamination and, more importantly, to prevent direct contact with that contamination. In general, a barrier could either be constructed of soil, concrete, or pavement. The requirements of an engineered barrier system are specified in 310 CMR 40.0996(5). An engineered barrier cannot include existing cover-type features (e.g., the basketball court) unless it was designed to serve as an engineered barrier.

  For the purpose of this preliminary evaluation, it is assumed that approximately 40,000 square feet of area would be covered (after some consolidation efforts are conducted along the perimeters of the impacted area) to meet site release closure requirements.

  It is very likely that the remedial costs for this option would be less than the other two RAAs. However, in accordance with 310 CMR 40.0996(5)(a)(7), the engineered barrier also shall:

  > *be appropriately monitored and maintained to ensure the long-term integrity and performance in accordance with a monitoring and maintenance plan that shall be submitted to the Department and shall document that one or more financial assurance mechanism(s), detailed in 310 CMR 30.906: Financial Assurance for Post-closure Care, have been established and adequately provide for ongoing future monitoring, maintenance and any necessary replacement of the barrier.*

  Therefore, the long-term costs for proper monitoring and maintenance of the engineered barrier would need to be also factored into the final selection of the remedial plan. If removal of a portion of impacted soils was performed to achieve an EPC less than applicable Method 3 UCLs, a direct contact barrier or cap would still be required, along with an AUL. In this instance, the requirements of an Engineered Barrier are eliminated, including the financial assurance requirement.

7.3 Preliminary Remedial Evaluation Conclusions

Based on the preceding "preliminary" evaluation of RAAs, either targeted soil removal program (with soil stabilization) and/or an engineered barrier or cap (with deed restriction placed on the property) will likely be an effective and/or cost-efficient means to remediate impacts on the 50 Proctor Street parcel in order to achieve a condition of No Significant Risk in the future. Further review and assessment are warranted to complete a Phase III remedial evaluation, as described herein.

Section 8
Conclusions

On behalf of the City of Salem, Tighe & Bond has prepared this Phase I - Tier Classification and IRA Status Report for the Gallows Hill Park site located at 50 Proctor Street in Salem, Massachusetts. This submittal also meets the requirements for an Interim Phase Comprehensive Site Assessment (CSA) per the MCP.

On December 19, 2018, MassDEP issued RTN 3-35355 to the site for a condition that could pose an IH to human health in accordance with MCP. Under an IRA Plan, further mitigation measures were completed to address the IH condition, and further assessment was also completed to delineate the site release. Our findings indicate that the IH condition still exists and requires further maintenance and monitoring, and that cleanup response actions are warranted to achieve a future Permanent (or Temporary) Solution at the site.

8.1 Conceptual Phase II Scope of Work

At this time, additional investigations are being planned for the off-site drainage swale area to the rear of the 37 Proctor Street property, which is tentatively scheduled to include the collection of sediment samples for laboratory analysis of arsenic. Further development of this sampling plan for review by MassDEP/EPA before this sampling event occurs (tentatively scheduled for the fall of 2019) is also planned. Future sampling within the adjacent public ways are also being considered.

In addition, since the "upfront" determination whether or not site soils may be classified as a hazardous waste (once generated) will assist in better understanding the potential cost implications for the remedial alternatives available for the site in the future, the City may collect additional soil samples for TCLP analysis for the primary RCRA 8 metal of concern for the site (i.e., arsenic). These results will further assist in the future completion of a Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives for the site release, per the MCP.

8.2 Public Notification

In accordance with the Public Notification Procedures of the Massachusetts Contingency Plan, 310 CMR 40.1403, a public notification letter has been sent to the Mayor of Salem and the Salem Health Department regarding this submittal. A copy of the public notification letter is included in Appendix H.

Section 9
Limitations

1. This report has been prepared on behalf of and for the exclusive use of the Client (City of Salem) and is subject to and issued in accordance with the Agreement and the provisions thereof. Documents provided on this project shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party without the prior written consent of Tighe & Bond. Reuse of documents by Client or others without Tighe & Bond's written permission and mutual agreement shall be at the user's sole risk, without liability on Tighe & Bond's part and Client agrees to indemnify and hold Tighe & Bond harmless from all claims, damages, and expenses, including attorney's fees, arising out of such unauthorized use or reuse.

2. Tighe & Bond acknowledges and agrees that, subject to the Limitations set forth herein and prior written approval by Tighe & Bond, this report may be provided to specific financial institutions, attorneys, title insurers, lessees and/or governmental agencies identified by Client at or about the time of issuance of the report in connection with the conveyance, mortgaging, leasing, or similar transaction involving the real property which is the subject matter of a report and any work product. Use of this report for any purpose by any persons, firm, entity, or governmental agency shall be deemed acceptance of the restrictions and conditions contained therein, these Limitations and the provisions of Tighe & Bond's Agreement with Client. No warranty, express or implied, is made by way of Tighe & Bond's performance of services or providing an environmental site assessment, including but not limited to any warranty with the contents of a report or with any and all work product.

3. Tighe & Bond performed the subsurface investigation in accordance with our Agreement (including any stated scope and schedule limitations) and used the degree of care and skill ordinarily exercised under similar circumstances by members of the profession practicing in the same or similar locality. The objective of a subsurface investigation is to evaluate the presence or absence of contamination. Where access was denied or conditions obscured, Tighe & Bond provides no opinion or report on such areas. The subsurface investigation may not identify all contaminated media as our scope may be limited to certain locations within a site or due to geologic variability, contamination variability, seasonal conditions, obstructions such as buildings, utilities, or other site features and/or other unknown conditions. Tighe & Bond performed the subsurface investigation using reasonable methods to access and identify the presence of contaminated media. Therefore, additional contaminated media may be present at the site and may be discovered during development and site work, so an appropriate cost contingency should be carried by the Client based on their risk tolerance. Tighe & Bond also makes no opinion or report of contamination that may have migrated off site unless off-site investigations are specifically including in the scope of services.

4. Findings, observations, and conclusions presented in this report, including but not limited to the extent of any subsurface explorations or other tests performed by Tighe & Bond, are limited by the scope of services outlined in the Agreement, which may establish schedule and/or budgetary constraints for an environmental

assessment or phase thereof. Furthermore, while it is anticipated that each assessment will be performed in accordance with generally accepted professional practices and applicable standards (such as ASTM, etc.) and applicable state and Federal regulations, as may be further described in the report and/or the Agreement, Tighe & Bond does not assume responsibility for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of its services.

5. In preparing this report, Tighe & Bond, Inc. may have relied on certain information provided by governmental agencies or personnel as well as information and/or representations provided by other persons, firms, or entities, and on information in the files of governmental agencies made available to Tighe & Bond at the time of the site assessment. To the extent that such information, representations, or files may be inaccurate, missing, incomplete or not provided to Tighe & Bond, Tighe & Bond is not responsible. Although there may be some degree of overlap in the information provided by these various sources, Tighe & Bond does not assume responsibility for independently verifying the accuracy, authenticity, or completeness of any and all information reviewed by or received from others during the course of the site assessment.

6. The assessment presented is based solely upon information obtained or received prior to issuance of the report. If additional environmental or other relevant information is developed at a later date, Client agrees to bring such information to the attention of Tighe & Bond promptly. Upon evaluation of such information, Tighe & Bond reserves the right to recommend modification of this report and its conclusions. In addition, dense forested areas on the site created some visual and access limitations during the site reconnaissance.

7. Emerging contaminants, including per- and poly-fluorinated alkyl substances (PFAS), are hazardous materials or mixtures (including naturally occurring or manmade chemical, microbial, or radiological substances) that are characterized by having a perceived or real threat to human health, public safety, or the environment for which there are no published health standards or guidelines and there is insufficient or limited available toxicological information or toxicity information that is evolving or being re-evaluated; or there is not significant new source, pathway, or detection limit information. The state of these compounds is constantly being updated and therefore, Tighe & Bond cannot be held liable for not including these compounds in the list of analytes that are analyzed when our services are performed. Unless otherwise specified, Tighe & Bond will only analyze for compounds ordinarily included under similar circumstances by members of the profession practicing in the same or similar locality. Tighe & Bond will not be liable for not including these or any other compounds in the list of target analytes if information regarding their use is not made available by current or former operators/owners at the facility being evaluated. We will also not be liable for not analyzing for the presence of an emerging contaminant, even if that compound is detected at a later date.

8. Tighe & Bond makes no guarantee or warranty that this report (if provided to a regulatory agency) will pass a regulatory audit/review. The Licensed Site Professional (LSP), Licensed Environmental Professional (LEP), Professional Geologist (PG), Professional Engineer (PE) or other relevant professional licensure

and the applicable regulatory reviewing agency may have differences of opinion on aspects of (and approaches to) the assessment, remediation, risk evaluation or closure and the regulatory agency may request additional information, sampling data, analysis and/or remediation. Such differences of opinion will not be interpreted to imply that Tighe & Bond's services were not performed competently and in accordance with the standard of care. If additional investigations, response action evaluations, or discussions are needed following a regulatory audit/review, Tighe & Bond can provide these services under a separate Agreement.

9. If an Opinion of Probable Construction Costs (OPCC) is provided, Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the contractor's method of pricing, and that the opinion of probable costs is made on the basis of Tighe & Bond's professional judgment and experience is based on currently available information. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the actual costs of the construction work will not vary from the OPCC.

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Tighe&Bond

APPENDIX A

FIGURE 1
SITE LOCATION

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts
RTN 3-35355

July 2019

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Based on USGS Topographic Map for Salem, MA Revised 1985.
Circles indicate 500-foot and half-mile radii

1:24,000
0 1,000 2,000
Feet

N

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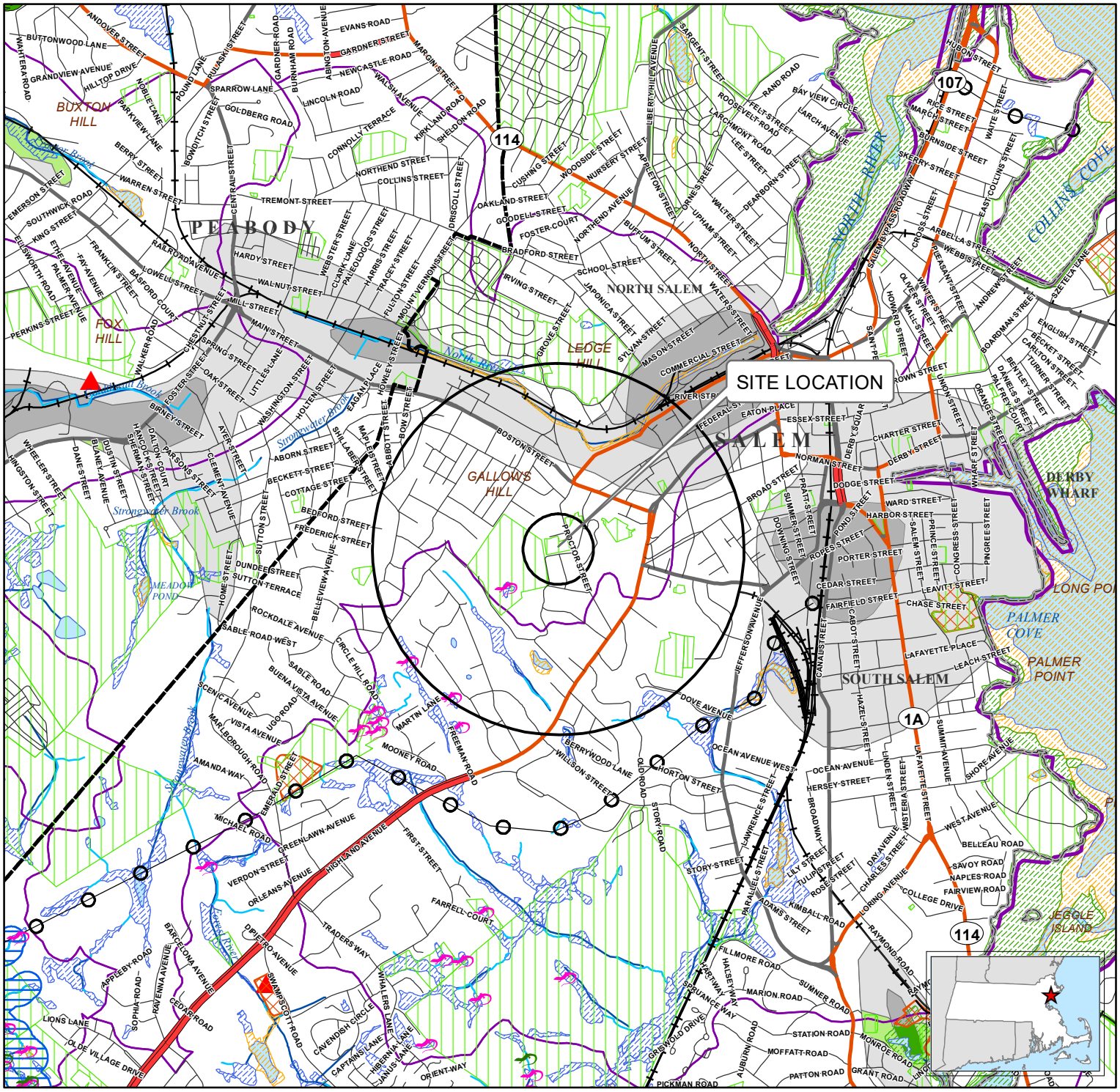
S-5200



Legend

- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- Non-Landfill Solid Waste Sites
- Community Public Water Supply - Surface Water
- Community Public Water Supply - Groundwater
- Non-Community Non-Transient Public Water Supply
- Non-Community Transient Public Water Supply
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Highway
- Major Road - Collector
- Minor Street or Road
- Aqueducts
- Hydrologic Connections
- Stream/Intermittent Stream
- Powerline
- Pipeline
- Track or Trail
- Trains
- Public Surface Water Supply Protection Area (Zone A)
- DEP Approved Wellhead Protection Area (Zone I)
- DEP Approved Wellhead Protection Area (Zone II)
- DEP Interim Wellhead Protection Area (IWPA)
- Protected and Recreational Open Space
- Solid Waste Landfill
- Area of Critical Environmental Concern (ACEC)
- NHESP Priority Habitats for Rare Species
- NHESP Estimated Habitats for Rare Wildlife
- EPA Designated Sole Source Aquifer
- Major Drainage Basin
- Sub Drainage Basin
- MassDEP Open Water
- MassDEP Inland Wetlands
- MassDEP Coastal Wetlands
- MassDEP Not Interpreted Wetlands
- Public Surface Water Supply (PSWS)
- Water Bodies
- Non-Potential Drinking Water Source Area - High Yield
- Non-Potential Drinking Water Source Area - Medium Yield
- Potentially Productive Medium Yield Aquifer
- Potentially Productive High Yield Aquifer
- County Boundary
- Town Boundary

1:24,000

0 1,000 2,000

Feet

N

FIGURE 2
PRIORITY RESOURCE MAP

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts
RTN 3-35355

Data source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology
Circles indicate 500-foot and half-mile radii.
Data valid as of July 2019.

July 2019

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Engineers | Environmental Specialists

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S-5200

Legend

- Sewer Manholes
- Drain Manholes
- Hydrants
- Water Mains
- Sewer Pipes
- Drain Pipes
- Approximate Site Parcel

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Based on MassGIS Color Orthophotography (2013-2014).
Parcels Boundaries (FY 11) are approximate, downloaded from MassGIS. Utility data provided by City of Salem Engineering Dept.

1:2,400
0 100 200
Feet

N

FIGURE 3
ORTHOPHOTOGRAPH

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts
RTN 3-35355

July 2019

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S-5200

FIGURE 4
EARLIER SUBSURFACE INVESTIGATION PLAN

LEGEND

- IRA Boring
- Approximate Hand Boring Locations
- Approximate Drilling Location
- Disposal Site Boundary for RTN 3-35669

See figure 5 for Further Reference

LOCUS MAP

N

0 37.5 75
Feet
1:900

NOTES

1. Based on MassGIS Color Orthophotography (2013).
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept.

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

RTN 3-35355

July 2019

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5200

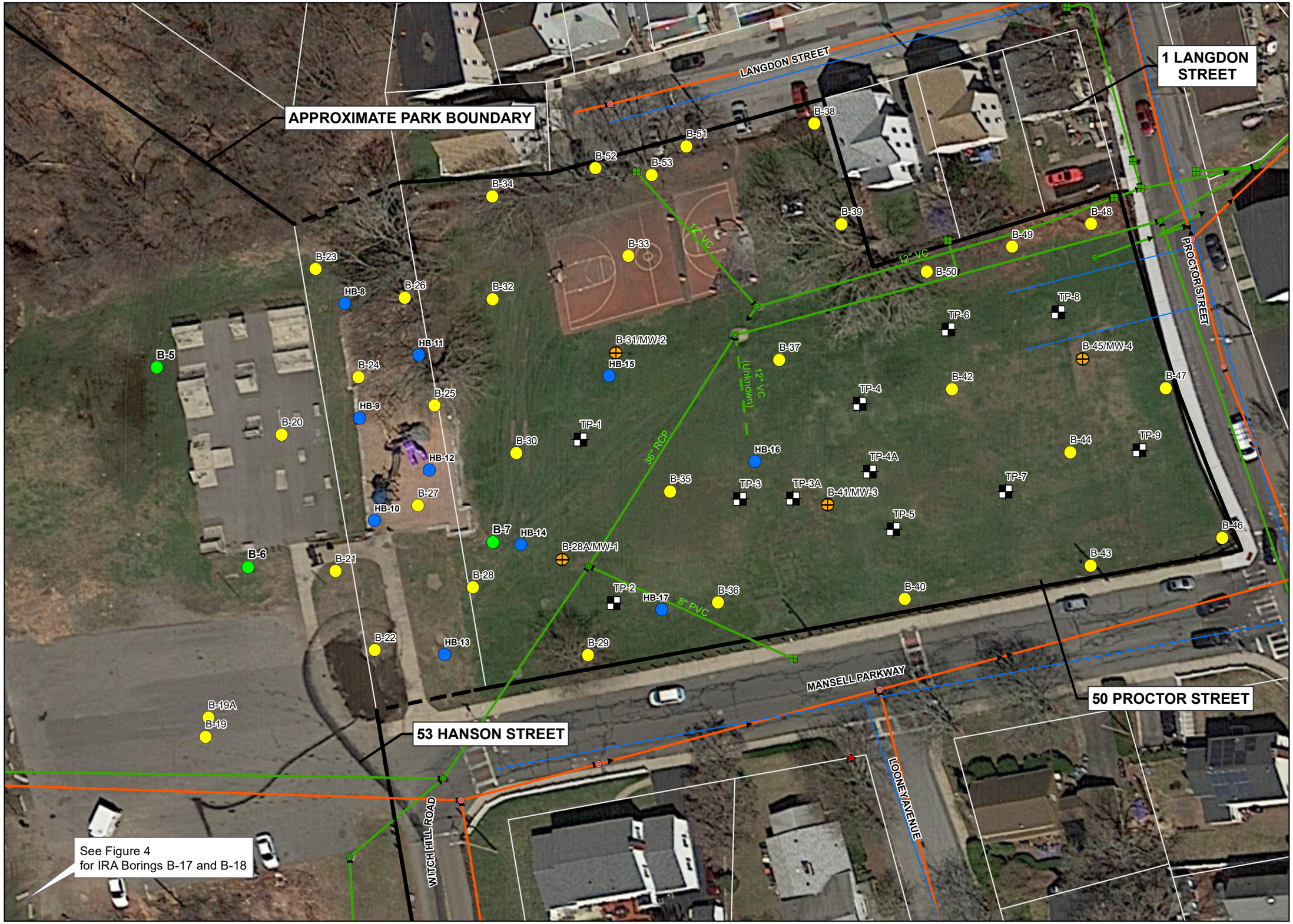

FIGURE 5

IRA SUBSURFACE INVESTIGATION PLAN

LEGEND

- IRA Soil Boring
- IRA Boring Completed as Well
- IRA Test Pit
- Earlier Hand Boring Location (Approximate)
- Earlier Drilling Location (Approximate)
- Approximate Park Boundary

LOCUS MAP

N

0 20 40

Feet

1:480

NOTES

1. Based on Google(C) Imagery (2018)
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept., and supplemented by camera utility line survey completed by city, 2-6-19

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

RTN 3-35355

July 2019

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S-1758

FIGURE 6

GROUNDWATER CONTOUR PLAN

LEGEND

- IRA Boring Completed as Well
- Approximate Park Boundary
- Groundwater Contour
- Inferred Groundwater Contour
- 98 Groundwater Elevation (ft)

LOCUS MAP

N

0 20 40

Feet

1:480

NOTES

1. Based on MassGIS Color Orthophotography (2013).
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept., and supplemented by camera utility line survey completed by city, 2-6-19

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

RTN 3-35355

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FIGURE 7
FENCE INSTALLATION PLAN

LEGEND

Approximate Location of construction chain link fence installation

Disposal Site Boundary Subject RTN 3-35355

See figure 3 for Utility References

LOCUS MAP

N

0 20 40
Feet
1:480

NOTES

1. Based on MassGIS Color Orthophotography (2013).
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept.

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

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S-1758

FIGURE 8
ARSENIC IN SOILS PLAN (0-3')

LEGEND

Estimated Boundaries for Arsenic in Soils 0-3 Feet

- As > 500 mg/kg
- As > 100 mg/kg
- As > 20 mg/kg

1. See other figures for symbol descriptions.
2. Samples collected from depth intervals within (or partially within) the top 3 feet of surface grade with majority of the samples collected in top 2 feet.

LOCUS MAP

N

0 20 40

Feet

1:480

OTHER NOTES

1. Based on Google(C) Imagery (2018)
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept., and supplemented by camera utility line survey completed by City, 2-6-19

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

RTN 3-35355

July 2019

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S-1758

FIGURE 9
ARSENIC IN SOILS PLAN (3-6')

LEGEND

Estimated Boundaries for Arsenic in Soils 3-6 Feet

- As > 500
- As > 100
- As > 20 mg/kg

1. See other figures for symbol descriptions.
2. Samples collected from depth intervals within (or partially within) the 3 to 6 feet of surface grade.
3. Only sample locations where arsenic data collected from within this depth interval are shown.

LOCUS MAP

N

0 20 40
Feet
1:480

OTHER NOTES

1. Based on MassGIS Color Orthophotography (2013).
2. Parcels (FY 2011) downloaded from MassGIS and are approximate.
3. Utility data provided by City of Salem Engineering Dept., and supplemented by camera utility line survey completed by City, 2-6-19

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

RTN 3-35355

July 2019

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APPENDIX B

TABLE 1 - Summary of Soil Results from Earlier Site Investigations
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP	MCP - Method 1 Standards						Method 3	Parcel Location:	53 Hanson Street Parcel*							R.O.W. Parcel					
									Boring No.	B-1	B-2	B-3	B-4	B-5	B-6		B-8	B-9	B-10	B-11	B-12	B-13
									Sample Depth	0.5-2'	0.5-2'	0.5-2'	0.5-2'	0.5-2'	0.5-2'	3-5'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
Analyses	RCS-1	S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	UCLs	Sample Date:	11/05/18	11/05/18	11/05/18	11/05/18	11/05/18	11/05/18	11/05/18	12/10/18	12/10/18	12/10/18	12/10/18	12/10/18	12/10/18
EPH carbon ranges																						
C9-C18 Aliphatics	1,000	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	ND (18.5)	ND (17.6)	ND (16.7)	-	ND (17.4)	-	-	-	-	-	-	-
C11-C22 Aromatics	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	18.7	ND (17.6)	ND (16.7)	-	ND (17.4)	-	-	-	-	-	-	-
C19-C36 Aliphatics	3,000	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	ND (18.5)	ND (17.6)	18.3	-	ND (17.4)	-	-	-	-	-	-	-
Target PAHs																						
Acenaphthene	4	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Acenaphthylene	1	600	10	600	10	600	10	10,000		-	ND (0.25)	ND (0.24)	ND (0.22)	-	ND (0.23)	-	-	-	-	-	-	-
Anthracene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Benz(a)anthracene	7	7	7	40	40	300	300	3,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Benzo(a)pyrene	2	2	2	7	7	30	30	300		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	7	7	40	40	300	300	3,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	70	70	400	400	3,000	3,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Chrysene	70	70	70	400	400	3,000	3,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	0.7	0.7	4	4	30	30	300		-	ND (0.25)	ND (0.24)	ND (0.22)	-	ND (0.23)	-	-	-	-	-	-	-
Fluoranthene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Fluorene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	7	7	40	40	300	300	3,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	80	300	80	500	80	500	5,000		-	ND (0.25)	ND (0.24)	ND (0.22)	-	ND (0.23)	-	-	-	-	-	-	-
Naphthalene	4	20	500	20	1,000	20	3,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Phenanthrene	10	500	500	1,000	1,000	3,000	3,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Pyrene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.49)	ND (0.47)	ND (0.45)	-	ND (0.46)	-	-	-	-	-	-	-
Metals																						
Arsenic	20	20	20	20	20	50	50	500		6.46	-	14.4	4.81	5.43	3.92	5.65	4.93	5.22	ND (3.54)	9.77	2.92	ND (2.21)
Barium	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		40.4	-	48	32.2	33.1	45.5	15.9	-	-	-	-	-	-
Cadmium	70	70	70	100	100	100	100	1,000		ND (0.47)	-	ND (0.52)	ND (1.06)	ND (0.57)	ND (0.56)	ND (0.38)	-	-	-	-	-	-
Chromium (total)	100	100	100	200	200	200	200	2,000		16.8	-	37.9	25.5	18	11.9	9.11	-	-	-	-	-	-
Lead	200	200	200	600	600	600	600	6,000		76	-	50	29.6	37.9	10.9	5.96	-	-	-	-	-	-
Mercury	20	20	20	30	30	30	30	300		0.195	-	0.313	0.116	0.067	0.067	ND (0.28)	-	-	-	-	-	-
Selenium	400	400	400	700	700	700	700	7,000		ND (4.74)	-	ND (5.24)	ND (5.29)	ND (5.72)	ND (5.63)	ND (3.81)	-	-	-	-	-	-
Silver	100	100	100	200	200	200	200	2,000		ND (0.47)	-	ND (0.52)	ND (1.06)	ND (0.57)	ND (0.56)	ND (0.76)	-	-	-	-	-	-
PCBs																						
All PCB Arochlors	1	1	1	2	2	4	4	100		ND (0.07)	-	-	-	ND (0.06)	-	-	-	-	-	-	-	-
VOCs																						
All Analytes	CS	CS	CS	CS	CS	CS	CS	CS		-	-	ND	-	-	-	-	-	-	-	-	-	-
Pesticides[1]																						
4,4´-DDE	6	6	6	30	30	60	60	600		-	ND (0.0030)	-	0.0040	-	-	-	-	-	-	-	-	-
4,4´-DDT	6	6	6	30	30	60	60	600		-	ND (0.0030)	-	0.0048	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	0.7	0.7	0.7	0.8	0.8	0.8	0.8	8		-	ND (0.0030)	-	0.0042	-	-	-	-	-	-	-	-	-

NOTES:

* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.

(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.

(2) Hand boring B-17 on the 50 Proctor Street parcel during the "pre-IRA investigations" has the same ID as the subsequent boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations, as further reviewed in this report.

(3) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.

Bold boxed values indicates exceedance of MCP Reportable Concentrations (RCS-1) and/or Method 1 Standards.

Represents values above MCP Method 3 UCLs

ND indicates that the analyte was not detected above laboratory reporting limits.

\- indicates sample not analyzed for respective analyte.

TABLE 1 - Summary of Soil Results from Earlier Site Investigations
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP	MCP - Method 1 Standards						Method 3	Parcel Location:	50 Proctor Street Parcel							
									Boring No.	B-7	B-14	B-15		B-16		B-17[2]	
									Sample Depth	0.5-2'	0-1'	0-1'	1-2'	0-1'	1-2'	0-1'	1-2'
Analyses	RCS-1	S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	UCLs	Sample Date:	11/05/18	12/10/18	12/10/18	12/10/18	12/10/18	12/10/18	12/10/18	12/10/18
EPH carbon ranges																	
C9-C18 Aliphatics	1,000	1,000	1,000	3,000	3,000	5,000	5,000	20,000		ND (18.2)	-	-	-	-	-	-	-
C11-C22 Aromatics	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (18.2)	-	-	-	-	-	-	-
C19-C36 Aliphatics	3,000	3,000	3,000	5,000	5,000	5,000	5,000	20,000		ND (18.2)	-	-	-	-	-	-	-
Target PAHs																	
Acenaphthene	4	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Acenaphthylene	1	600	10	600	10	600	10	10,000		ND (0.24)	-	-	-	-	-	-	-
Anthracene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Benz(a)anthracene	7	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	-	-	-	-
Benzo(a)pyrene	2	2	2	7	7	30	30	300		ND (0.49)	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	70	70	400	400	3,000	3,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Chrysene	70	70	70	400	400	3,000	3,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.7	0.7	0.7	4	4	30	30	300		ND (0.24)	-	-	-	-	-	-	-
Fluoranthene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Fluorene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	-	-	-	-
2-Methylnaphthalene	0.7	80	300	80	500	80	500	5,000		ND (0.24)	-	-	-	-	-	-	-
Naphthalene	4	20	500	20	1,000	20	3,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Phenanthrene	10	500	500	1,000	1,000	3,000	3,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Pyrene	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	-	-	-	-
Metals																	
Arsenic	20	20	20	20	20	50	50	500		**36**	19.5	**348**	**333**	**221**	**169**	**633**	**504**
Barium	1,000	1,000	1,000	3,000	3,000	5,000	5,000	10,000		34.5	-	-	-	-	-	-	-
Cadmium	70	70	70	100	100	100	100	1,000		0.67	-	-	-	-	-	-	-
Chromium (total)	100	100	100	200	200	200	200	2,000		18.9	-	332[3]	-	82.4	-	227[3]	-
Lead	200	200	200	600	600	600	600	6,000		83.6	-	106	-	86	-	126	-
Mercury	20	20	20	30	30	30	30	300		0.117	-	-	-	-	-	-	-
Selenium	400	400	400	700	700	700	700	7,000		ND (4.34)	-	-	-	-	-	-	-
Silver	100	100	100	200	200	200	200	2,000		ND (0.43)	-	-	-	-	-	-	-
PCBs																	
All PCB Arochlors	1	1	1	2	2	4	4	100		-	-	-	-	-	-	-	-
VOCs																	
All Analytes	CS	CS	CS	CS	CS	CS	CS	CS		ND	-	-	-	-	-	-	-
Pesticides[1]																	
4,4´-DDE	6	6	6	30	30	60	60	600		-	-	-	-	-	-	-	-
4,4´-DDT	6	6	6	30	30	60	60	600		-	-	-	-	-	-	-	-
Hexachlorobenzene	0.7	0.7	0.7	0.8	0.8	0.8	0.8	8		-	-	-	-	-	-	-	-

NOTES:

* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.

(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.

(2) Hand boring B-17 on the 50 Proctor Street parcel during the "pre-IRA investigations" has the same ID as the subsequent boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations, as further reviewed in this report.

(3) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.

Bold boxed values indicates exceedance of MCP Reportable Concentrations (RCS-1) and/or Method 1 Standards.

Represents values above MCP Method 3 UCLs

ND indicates that the analyte was not detected above laboratory reporting limits.

\- indicates sample not analyzed for respective analyte.

TABLE 2 - Summary of Phase II Soil Borings

Gallows Hill Park

50 Proctor Street - Subject of RTN 3-35355

Salem, Massachusetts

Boring ID	Total Depth in feet	Sample Depth /Analysis	General Overview of Boring Findings[2]
53 Hanson Street Parcel*			
B-17[1]	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 5 feet BSG.
B-18	8'	(0-2') / MCP metals	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
B-19	3' (refusal)	-	Due to refusal at shallow depths, boring was moved and re-advanced at B-19A - see below.
B-19A	3' (refusal)	(0-2') / As	Boring refusal occurred again at 3 feet BSG. Apparent native soils sand, gravel and silt to 3 feet BSG.
B-20	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 7 feet BSG.
B-21	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 5 feet BSG.
R.O.W. Parcel			
B-22	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
B-23	7' (refusal)	(0-2') / As	Apparent native soils to 7 feet BSG (boring refusal), with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 5 feet BSG.
B-24	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with playground area mulch followed by sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
B-25	8'	(0-2') / As + Cr (total)	Apparent native soils to 8 feet BSG, with playground area mulch followed by sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
B-26	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with playground area mulch followed by sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
B-27	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with playground area mulch followed by sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
Subject 50 Proctor Street Parcel			
B-28	8' (refusal)	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
B-28A / MW-1	14' (refusal)	(0-2') / As	(see Well Log for reference)
		(2-4') / As	
B-29	8'	(0-2') / As	Apparent fill soils (with trace to some brick pieces) to 4 feet BSG, followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 8 feet BSG.
		(2-4') / As	
		(4-5.5') / MCP metals	
B-30	8'	(0-2') / As	Apparent fill soils (with trace to some brick pieces) to 4 feet BSG, followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 8 feet BSG.
		(2-4') / As	
B-31/ MW-2	14' (refusal)	(0-2') / As	(see Well Log for reference)
		(2-4') / As	
B-32	8'	(0-2') / As	Apparent fill soils to 3 feet BSG, followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
B-33	8'	(0-2') / As	Apparent fill soils to 4 feet BSG (with trace amounts of coal and brick), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
		(2-4') / As	

Gallows Hill Park

50 Proctor Street - Subject of RTN 3-35355

Salem, Massachusetts

Boring ID	Total Depth in feet	Sample Depth /Analysis	General Overview of Boring Findings[2]
B-34	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand to silty-sand and little gravel to EOB Wet soils/GW table at 4 feet BSG.
B-35	8'	(0-2') / As	Apparent fill soils to 6 feet BSG (with trace to mostly ash, brick and coal pieces), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
		(2-4') / As	
		(4-5.5') / EPH, MCP metals	
B-36	8'	(0-2') / As	Apparent fill soils to 5 feet BSG (with trace to little ash, brick and coal pieces), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 4 feet BSG.
		(2-4') / As	
B-37	8'	(0-2') / As	Apparent fill soils to 4 feet BSG (with little ash), followed by native soil consisting mostly of peat to EOB. Wet soils/GW table at 5 feet BSG.
		(2-4') / As	
		(4-8') / As, EPH, VOCs, PCBs	
B-38	8'	(0-2') / As	Apparent native soil to 8 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
B-39	8'	(0-2') / As	Apparent fill soils to 4 feet BSG (with little to some ash, and trace brick and coal pieces), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
B-40	8'	(0-2') / As	Apparent fill soils to 4 feet BSG (with trace ash and brick pieces), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 5 feet BSG.
B-41/ MW-3	15.5' (refusal)	(0-2') / As + Cr (total), PCBs	(see Well Log for reference)
		(2-4') / As, Cyanide	
B-42	16'	(0-2') / As + Cr (total)	Little to no evidence of anthropogenic fill to 16 feet BSG, with sand to silty-sand and little gravel to EOB. Wet soils/GW table at 8 feet BSG.
B-43	8'	(0-2') / As	Apparent fill soils to 4 feet BSG (with trace to mostly ash and brick pieces with trace amounts of coal pieces), followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG, with some petroleum odor.
		(2-4') / MCP metals, EPH	
		(4-8') / As	
B-44	13' (refusal)	(0-2') / As	Apparent fill soils (with trace to some brick pieces) to 8 feet BSG, followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 8 feet BSG.
		(2-4') / As	
B-45/ MW-4	16'	(0-2') / As	(see Well Log for reference)
		(2-4') / As, Cyanide	
		(4-8') / As	
B-46	8'	(0-2') / As	Apparent fill soils (with some ash and trace to little coal and brick pieces) to 4 feet BSG, followed by native sand to silty-sand and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
		(2-4') / As	
B-47	8'	(0-2') / As	Apparent native soils to 8 feet BSG, with sand, silt/clay and little gravel to EOB. Wet soils/GW table at 6 feet BSG.
B-48	2'	(0-1') / As	Apparent fill soil to 2 feet BSG, with sand, silt and gravel.
		(0-2') / As	
B-49	2'	(0-1') / MCP metals	Apparent fill soils with sand, silt and gravel (with trace to little brick and ash) to 2 feet BSG.
		(0-2') / As	
B-50	2'	(0-1') / As	Apparent fill soils with sand, silt and gravel (with trace to little brick and ash) to 2 feet BSG.
		(0-2') / As	

NOTES:

* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.

[1] Boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations was inadvertently named with same ID as the earlier (i.e., "pre-IRA investigations") hand boring B-17 on the 50 Proctor Street parcel, as further reviewed in this report.

[2] This is a general overview of the soil boring findings - further details on site stratigraphy encountered during drilling is provided in the monitoring well logs provided in Appendix E. All referenced depths are considered approximate.

EOB indicates end of boring; GW indicates groundwater table; BSG indicates below surface grade.

TABLE 3 - Summary of Groundwater Elevations
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Well ID	Well Elevation[1]	Gauging Date:	3/14/2019	
			Depth to Water[2]	Calculated Elevation
MW-1	100.47		1.85	98.62
MW-2	100.40		3.90	96.5
MW-3	100.05		1.55	98.5
MW-4	100.34		4.20	96.14

Notes:
[1] Arbitrary baseline elevation of 100' was used for the site, located at the center of the manhole cover for the storm drain system to immediate east/southeast of well MW-1.
[2] Depth to groundwater table (and survyed elevation) was measured from top of PVC.

TABLE 4 - Summary of Test Pit Soil Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	Method 3 UCLs	Test Pit:	TP-1				TP-2			TP-3A			TP-4		TP-5			TP-6		TP-7		
								Sample Depth:	0-2'	3-5'	5'	6.5'	0-2'	5'	6.5'	0-2'	2-5.5'	5.5-6'	0-2'	4-5.5'	0-2'	3-5'	5-6'	0-2'	2-5'	0-2'	2-5'	5-5.5'
								Sample Date:	01/28/19	01/28/19	01/28/19	01/28/19	01/28/19	01/28/19	01/28/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/11/19	02/12/19	02/12/19	02/12/19
EPH carbon ranges																												
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	ND (21.5)	-	-	-	-	-	-	ND (63.2)	-	-	-	-	-	-	-	ND (19.7)	-	ND (18.2)	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (21.5)	-	-	-	-	-	-	145	-	-	-	-	-	-	-	83.1	-	ND (18.2)	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	78.5	-	-	-	-	-	-	150	-	-	-	-	-	-	-	20.2	-	ND (18.2)	-
Target PAHs																												
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.57)	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	0.99	-	ND (0.49)	-
Acenaphthylene	600	10	600	10	600	10	10,000		-	ND (0.29)	-	-	-	-	-	-	ND (0.84)	-	-	-	-	-	-	-	ND (0.26)	-	ND (0.24)	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.57)	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	1.82	-	ND (0.49)	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	1.6	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	3.15	-	ND (0.49)	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	1.57	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	**2.97**	-	ND (0.49)	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	1.76	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	3.23	-	ND (0.49)	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	1.02	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	1.49	-	ND (0.49)	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	0.61	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	1.18	-	ND (0.49)	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	1.64	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	3.2	-	ND (0.49)	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	ND (0.29)	-	-	-	-	-	-	*ND (0.84)*	-	-	-	-	-	-	-	0.48	-	ND (0.24)	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	3.33	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	9.32	-	ND (0.49)	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	ND (0.57)	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	0.96	-	ND (0.49)	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	1.09	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	1.78	-	ND (0.49)	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	ND (0.29)	-	-	-	-	-	-	ND (0.84)	-	-	-	-	-	-	-	0.29	-	ND (0.24)	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	ND (0.57)	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	0.72	-	ND (0.49)	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	2.45	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	1.4	-	ND (0.49)	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	3.20	-	-	-	-	-	-	ND (1.69)	-	-	-	-	-	-	-	11.1	-	ND (0.49)	-
Metals																												
Antimony	20	20	30	30	30	30	300		ND (6.79)	-	ND (4.03)	-	-	-	-	-	-	-	-	ND (5.64)	-	ND (6.8)	ND (5.00)	-	ND (5.41)	-	-	ND (4.42)
Arsenic	20	20	20	20	50	50	500		**549**	-	11.8	7.64	**84**	**35.7**	5.77	**5,150**	-	3.28	**2,330**	**34.9**	**508**	4.1	5.12	**623**	**250**	10.4	3.65	2.66
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		64.5	-	47.9	-	-	-	-	-	-	-	-	60.8	-	38.5	53.9	-	75.1	-	-	35.6
Beryllium	90	90	200	200	200	200	2,000		0.42	-	0.47	-	-	-	-	-	-	-	-	0.64	-	0.7	0.7	-	0.34	-	-	0.48
Cadmium	70	70	100	100	100	100	1,000		5.27	-	0.4	-	-	-	-	-	-	-	-	ND (0.56)	-	ND (0.68)	ND (0.50)	-	2.6	-	-	ND (0.44)
Chromium (Total)	100	100	200	200	200	200	2,000		149	-	25.8	21	62.6	23.7	-	1,820	-	-	-	23	106[3]	24.2	20.8	-	92.9	25.5	-	17
Hexavalent Chromium	100	100	200	200	200	200	2,000		ND (0.5)	-	0.6	-	ND (0.5)	ND (0.6)	-	ND (0.6)	-	-	-	-	-	ND (0.7)	-	-	-	ND (0.5)	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		149	-	25.2	-	62.6	23.7	-	**1,820**	-	-	-	-	-	24.2	-	-	-	25.5	-	-
Lead	200	200	600	600	600	600	6000		107	-	6.32	12.5	60.8	48.5	-	91.7	-	-	-	8.93	51.1	22.4	8.11	-	65.9	-	-	6.25
Mercury	20	20	30	30	30	30	300		0.325	-	ND (0.023)	-	-	-	-	-	-	-	-	0.066	-	0.061	0.034	-	13.5	-	-	0.032
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		13.4	-	15	-	-	-	-	-	-	-	-	18.7	-	15.0	20.0	-	12.6	-	-	13.8
Selenium	400	400	700	700	700	700	7,000		ND (6.79)	-	ND (4.03)	-	-	-	-	-	-	-	-	ND (5.64)	-	ND (6.8)	ND (5.00)	-	ND (5.41)	-	-	ND (4.42)
Silver	100	100	200	200	200	200	2,000		ND (0.68)	-	ND (0.40)	-	-	-	-	-	-	-	-	ND (0.56)	-	ND (0.68)	ND (0.50)	-	ND (0.54)	-	-	ND (0.44)
Thallium	8	8	60	60	80	80	800		ND (6.79)	-	ND (4.03)	-	-	-	-	-	-	-	-	ND (5.64)	-	ND (6.8)	ND (5.00)	-	ND (5.41)	-	-	ND (4.42)
Vanadium	400	400	700	700	700	700	7,000		37.8	-	25.2	-	-	-	-	-	-	-	-	54.8	-	54.6	39.3	-	29.3	-	-	31.6
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		196	-	48.4	-	-	-	-	-	-	-	-	80.7	-	56.4	68.5	-	114	-	-	51
PCBs																												
All PCB Arochlors	1	1	2	2	4	4	100		ND (0.07)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.04)	-	-	ND (0.03)	-	-	-
VOCs[1]																												
Acetone	50	400	50	400	50	400	10,000		-	-	0.0465	-				-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide																												
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	1.11	-	-	-	-	-	-	-	-	-	-	ND (1.68)	-	-	-	-	-	-
Pesticides[1]																												
4,4'-DDE	6	6	30	30	60	60	600		0.0075	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.045)	-	-	-	-	-	-
4,4'-DDT	6	6	30	30	60	60	600		0.0051	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.045)	-	-	-	-	-	-
Hexachlorobenzene	0.7	0.7	0.8	0.8	0.8	0.8	8		ND (0.035)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.045)	-	-	-	-	-	-

NOTES:
(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.
(2) Cyanide expressed as physiologically available cyanide (PAC). In the absence of measured physiologically available cyanide, the standard is applicable to total cyanide per the MCP.
(3) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.

Bold boxed values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs
ND indicates that the analyte was not detected above laboratory reporting limits.
ND indicates that the laboratory reporting limit is above a Method 1 standard.
- indicates sample not analyzed for respective analyte.

TABLE 4 - Summary of Test Pit Soil Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP - Method 1 Standards						Method 3	Test Pit:	TP-8		TP-9		
								Sample Depth:	0-2'	2-6'	0-2'	2-3'	3-5'
Analyses	**S-1/GW-2**	**S-1/GW-3**	**S-2/GW-2**	**S-2/GW-3**	**S-3/GW-2**	**S-3/GW-3**	**UCLs**	Sample Date:	02/12/19	02/12/19	02/12/19	02/12/19	02/12/19
EPH carbon ranges													
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	-	-	ND (18.6)	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (18.6)	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	-	-	ND (18.6)	-
Target PAHs													
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Acenaphthylene	600	10	600	10	600	10	10,000		-	-	-	ND (0.25)	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	-	-	ND (0.5)	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	-	-	ND (0.5)	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	-	-	ND (0.5)	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	-	-	ND (0.5)	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	-	-	ND (0.5)	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	-	-	ND (0.25)	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	-	-	ND (0.5)	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	-	-	ND (0.25)	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	-	-	ND (0.5)	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	-	-	ND (0.5)	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	ND (0.5)	-
Metals													
Antimony	20	20	30	30	30	30	300		-	-	-	ND (5.03)	-
Arsenic	20	20	20	20	50	50	500		**132**	18.4	**62.7**	6.94	**31.5**
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	54.9	-
Beryllium	90	90	200	200	200	200	2,000		-	-	-	0.57	-
Cadmium	70	70	100	100	100	100	1,000		-	-	-	ND (0.50)	-
Chromium (Total)	100	100	200	200	200	200	2,000		-	44.6	302	46.6	-
Hexavalent Chromium	100	100	200	200	200	200	2,000		-	-	ND (0.6)	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	302	-	-
Lead	200	200	600	600	600	600	6000		-	12.8	-	31.4	-
Mercury	20	20	30	30	30	30	300		-	-	-	0.046	-
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		-	-	-	16	-
Selenium	400	400	700	700	700	700	7,000		-	-	-	ND (5.03)	-
Silver	100	100	200	200	200	200	2,000		-	-	-	ND (0.50)	-
Thallium	8	8	60	60	80	80	800		-	-	-	ND (5.03)	-
Vanadium	400	400	700	700	700	700	7,000		-	-	-	29.8	-
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		-	-	-	88.4	-
PCBs													
All PCB Arochlors	1	1	2	2	4	4	100		-	-	-	ND (0.03)	-
VOCs[1]													
Acetone	50	400	50	400	50	400	10,000		-	-	ND (0.0141)	-	-
Cyanide													
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	-	-
Pesticides[1]													
4,4'-DDE	6	6	30	30	60	60	600		-	-	-	-	-
4,4'-DDT	6	6	30	30	60	60	600		-	-	-	-	-
Hexachlorobenzene	0.7	0.7	0.8	0.8	0.8	0.8	8		-	-	-	-	-

NOTES:
(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.
(2) Cyanide expressed as physiologically available cyanide (PAC). In the absence of measured physiologically available cyanide, the standard is applicable to total cyanide per the MCP.
(3) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.

Bold boxed values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs
ND indicates that the analyte was not detected above laboratory reporting limits.
ND indicates that the laboratory reporting limit is above a Method 1 standard.
- indicates sample not analyzed for respective analyte.

TABLE 5 - Summary of Phase II Soil Boring Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP - Method 1 Standards						Method 3	Soil Boring:	53 Hanson Street Parcel*					R.O.W. Parcel																			
									B-17[3]	B-18	B-19A	B-20	B-21	B-22	B-23	B-24		B-25		B-26		B-27		B-28	B-28A /MW-1		B-29			B-30	
								Sample Depth:	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	0-2'	2-4'	0-2'	2-4'	4-5.5'	0-2'	2-4'
Analyses	S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	UCLs	Sample Date:	02/25/19	02/25/19	02/25/19	02/25/19	02/25/19	02/25/19	02/25/19	02/25/19		02/25/19		02/25/19		02/25/19		02/25/19	02/25/19		02/25/19			02/25/19	
EPH carbon ranges																																	
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Target PAHs																																	
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	600	10	600	10	600	10	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																																	
Antimony	20	20	30	30	30	30	300		-	ND (5.12)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.54)	-	-
Arsenic	20	20	20	20	50	50	500		**21**	19.5	2.69	ND (2.54)	3.71	5.15	4.16	5.12	ND (2.5)	5.32	4.37	5.99	5.2	8.6	2.77	12.9	17	8.63	**32**	8.89	5.02	15.4	6.9
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	68.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.4	-	-
Beryllium	90	90	200	200	200	200	2,000		-	0.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.46	-	-
Cadmium	70	70	100	100	100	100	1,000		-	ND (0.51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.65)	-	-
Chromium (Total)	100	100	200	200	200	200	2,000		-	34.2	-	-	-	-	-	-	-	26.6	-	-	-	-	-	-	-	-	-	-	12.8	-	-
Hexavalent Chromium	100	100	200	200	200	200	2,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	200	200	600	600	600	600	6000		-	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.7	-	-
Mercury	20	20	30	30	30	30	300		-	0.039	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.025)	-	-
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		-	24.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.58	-	-
Selenium	400	400	700	700	700	700	7,000		-	ND (5.12)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.54)	-	-
Silver	100	100	200	200	200	200	2,000		-	ND (0.51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.65)	-	-
Thallium	8	8	60	60	80	80	800		-	ND (5.12)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.54)	-	-
Vanadium	400	400	700	700	700	700	7,000		-	32.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.1	-	-
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		-	60.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43.2	-	-
PCBs																																	
All PCB Arochlors	1	1	2	2	4	4	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOCs[1]																																	
Acetone	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide																																	
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:
* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.
(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.
(2) Cyanide expressed as physiologically available cyanide (PAC). In the absence of measured physiologically available cyanide, the standard is applicable to total cyanide per the MCP.
(3) Boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations was inadvertently named with same ID as the earlier (i.e., "pre-IRA investigations") hand boring B-17 on the 50 Proctor Street parcel, as further reviewed in this report.
(4) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.

Bold boxed values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
\- indicates sample not analyzed for respective analyte.

TABLE 5 - Summary of Phase II Soil Boring Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	Method 3 UCLs	Soil Boring:	50 Proctor Street Parcel B-31 / MW-2		B-32		B-33			B-34		B-35				B-36		B-37			B-38	B-39			B-40		B-41/MW-3	
								Sample Depth:	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	4-6'	0-2'	2-4'	0-2'	2-4'	4-5.5'	6-8'	0-2'	2-4'	0-2'	2-4'	4-8'	0-2'	0-2'	2-4'	4-6'	0-2'	2-4'	0-2'	2-4'
								Sample Date:	02/25/19		02/26/19		02/26/19			02/26/19		02/26/19				02/26/19		02/26/19			02/26/19	02/26/19			02/26/19		02/26/19	
EPH carbon ranges																																		
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	-	-	-	-	-	-	-	-	-	-	ND (27.7)	-	-	-	-	-	ND (22.6)	-	-	-	-	-	-	-	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	56.1	-	-	-	-	-	ND (22.6)	-	-	-	-	-	-	-	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	-	-	-	-	-	-	-	-	-	-	ND (27.7)	-	-	-	-	-	ND (22.6)	-	-	-	-	-	-	-	-
Target PAHs																																		
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.74)	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Acenaphthylene	600	10	600	10	600	10	10,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.37)	-	-	-	-	-	ND (0.30)	-	-	-	-	-	-	-	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	0.97	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	2.03	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	-	-	-	-	-	-	-	-	-	-	1.75	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	2.32	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	0.94	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.74)	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	1.82	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	-	-	-	-	-	-	-	-	-	-	ND (0.37)	-	-	-	-	-	ND (0.30)	-	-	-	-	-	-	-	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	4.27	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.74)	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	-	-	-	-	-	-	-	-	-	-	1.13	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.37)	-	-	-	-	-	ND (0.30)	-	-	-	-	-	-	-	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	0.85	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	-	-	-	-	-	-	-	-	-	-	4.13	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	3.82	-	-	-	-	-	ND (0.60)	-	-	-	-	-	-	-	-
Metals																																		
Antimony	20	20	30	30	30	30	300		-	-	-	-	-	-	-	-	-	-	-	7.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	20	20	20	20	50	50	500		**102**	12.2	8.33	7.85	8.02	**603**	13.1	11.6	5.4	**1,510**	**12,300**	**10,900**	6.04	**345**	**419**	**1,260**	**1,700**	**99.5**	**41.1**	**2,140**	**62.9**	**3,190**	**145**	**669**	**2,150**	**179**
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	97.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	90	90	200	200	200	200	2,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.17)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	70	70	100	100	100	100	1,000		-	-	-	-	-	-	-	-	-	-	-	**102**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Total)	100	100	200	200	200	200	2,000		-	-	-	-	-	-	-	-	-	-	-	428	-	-	-	-	-	-	-	-	-	-	-	-	185	-	-
Hexavalent Chromium	100	100	200	200	200	200	2,000		-	-	-	-	-	-	-	-	-	-	-	ND (0.8)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.6)	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	185	-	-
Lead	200	200	600	600	600	600	6000		-	-	-	-	-	-	-	-	-	-	-	70.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	20	20	30	30	30	30	300		-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		-	-	-	-	-	-	-	-	-	-	-	ND (3.94)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	400	400	700	700	700	700	7,000		-	-	-	-	-	-	-	-	-	-	-	ND (7.87)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	100	100	200	200	200	200	2,000		-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	8	8	60	60	80	80	800		-	-	-	-	-	-	-	-	-	-	-	ND (7.87)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	400	400	700	700	700	700	7,000		-	-	-	-	-	-	-	-	-	-	-	5.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	-	-	-	-	-	-	-	69.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																																		
All PCB Arochlors	1	1	2	2	4	4	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.08)	-	-	-	-	-	-	ND (0.08)	-
VOCs[1]																																		
Acetone	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.442	-	-	-	-	-	-	-	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0556	-	-	-	-	-	-	-	-
Cyanide																																		
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.66)

NOTES:
* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.
(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.
(2) Cyanide expressed as physiologically available cyanide (PAC). In the absence of measured physiologically available cyanide, the standard is applicable to total cyanide per the MCP.
(3) Boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations was inadvertently named with same ID as the earlier (i.e., "pre-IRA investigations") hand boring B-17 on the 50 Proctor Street parcel, as further reviewed in this report.
(4) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.
Bold boxed values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
\- indicates sample not analyzed for respective analyte.

TABLE 5 - Summary of Phase II Soil Boring Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP - Method 1 Standards						Method 3	Soil Boring:	B-42	B-43		B-44		B-45/MW-4			B-46		B-47	B-48		B-49		B-50		B-51	B-52	B-53
								Sample Depth:	0-2'	0-2'	2-4'	4-8'	0-2'	2-4'	0-2'	2-4'	4-8'	0-2'	2-4'	0-2'	0-1'	1-2'	0-1'	1-2'	0-1'	1-2'	0-1'	0-1'	0-1'
Analyses	**S-1/GW-2**	**S-1/GW-3**	**S-2/GW-2**	**S-2/GW-3**	**S-3/GW-2**	**S-3/GW-3**	**UCLs**	Sample Date:	02/26/19	02/26/19		02/26/19		02/26/19				02/26/19		02/26/19	02/26/19		02/26/19		02/26/19		03/13/19		
EPH carbon ranges																													
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	-	94.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	**2,210**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	-	2,050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Target PAHs																													
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	600	10	600	10	600	10	10,000		-	-	ND (1.26)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	-	*ND (2.52)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	-	*ND (1.26)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	-	ND (1.26)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (2.52)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																													
Antimony	20	20	30	30	30	30	300		-	-	ND (5.52)	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Arsenic	20	20	20	20	50	50	500		**81.8**	13.5	6.72	8.92	**189**	**77.7**	**27.7**	12.3	5.82	14.6	13.1	**50.2**	**208**	**203**	**444**	**990**	**344**	**528**	**21.2**	8.78	**91.2**
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	49.3	-	-	-	-	-	-	-	-	-	-	-	**1,060**	-	-	-	-	-	-
Beryllium	90	90	200	200	200	200	2,000		-	-	0.32	-	-	-	-	-	-	-	-	-	-	-	0.31	-	-	-	-	-	-
Cadmium	70	70	100	100	100	100	1,000		-	-	ND (0.55)	-	-	-	-	-	-	-	-	-	-	-	5.42	-	-	-	-	-	-
Chromium (Total)	100	100	200	200	200	200	2,000		399	-	266[4]	-	-	-	-	-	-	-	-	-	-	-	1,030	-	-	-	-	-	-
Hexavalent Chromium	100	100	200	200	200	200	2,000		ND (0.6)	-	-	-	-	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		399	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,021**	-	-	-	-	-	-
Lead	200	200	600	600	600	600	6000		-	-	41.3	-	-	-	-	-	-	-	-	-	-	-	**354**	-	-	-	-	-	-
Mercury	20	20	30	30	30	30	300		-	-	ND (2.02)	-	-	-	-	-	-	-	-	-	-	-	4.2	-	-	-	-	-	-
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		-	-	12.8	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-
Selenium	400	400	700	700	700	700	7,000		-	-	ND (5.52)	-	-	-	-	-	-	-	-	-	-	-	ND (7.81)	-	-	-	-	-	-
Silver	100	100	200	200	200	200	2,000		-	-	ND (1.10)	-	-	-	-	-	-	-	-	-	-	-	0.78	-	-	-	-	-	-
Thallium	8	8	60	60	80	80	800		-	-	ND (5.52)	-	-	-	-	-	-	-	-	-	-	-	ND (7.81)	-	-	-	-	-	-
Vanadium	400	400	700	700	700	700	7,000		-	-	36.9	-	-	-	-	-	-	-	-	-	-	-	41.2	-	-	-	-	-	-
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		-	-	48.6	-	-	-	-	-	-	-	-	-	-	-	696	-	-	-	-	-	-
PCBs																													
All PCB Arochlors	1	1	2	2	4	4	100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOCs[1]																													
Acetone	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide																													
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	-	-	-	-	ND (1.72)	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:
* 53 Hanson Street park parcel was subsequently determined to be subject of separate RTN 3-35669, as further reviewed in this report.
(1) Only analytes detected above laboratory reporting limits in one or more samples are included in the table.
(2) Cyanide expressed as physiologically available cyanide (PAC). In the absence of measured physiologically available cyanide, the standard is applicable to total cyanide per the MCP.
(3) Boring B-17 advanced on the 53 Hanson Street parcel during the IRA investigations was inadvertently named with same ID as the earlier (i.e., "pre-IRA investigations") hand boring B-17 on the 50 Proctor Street parcel, as further reviewed in this report.
(4) Since only trace to non-detect levels of hexavalent chromium were subsequently detected in site soils, it is assumed that the majority (if not all) of this total chromium concentration is trivalent chromium. Therefore, this level is not considered to be above Method 1 standards, as further reviewed in this report.
Bold boxed values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
\- indicates sample not analyzed for respective analyte.

TABLE 6 - Summary of Groundwater Results
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analysis	Method 1 Standards	Method 3 UCLs	Sample Identification:	MW-1	MW-2	MW-3	MW-4
	GW-3		Date Collected:	3/13/2019			
EPH carbon ranges							
C9-C18 Aliphatic	50,000	100,000		-	-	-	ND (93)
C19-C36 Aliphatic	50,000	100,000		-	-	-	ND (93)
C11-C22 Aromatic	5,000	100,000		-	-	-	ND (93)
Target PAHs							
Acenaphthene	10,000	60,000		-	-	-	ND (0.19)
Acenaphthylene	40	100,000		-	-	-	ND (0.19)
Anthracene	30	600		-	-	-	ND (0.19)
Benzo(a)anthracene	1,000	10,000		-	-	-	ND (0.19)
Benzo(a)pyrene	500	5,000		-	-	-	ND (0.19)
Benzo(b)fluoranthene	400	4,000		-	-	-	ND (0.19)
Benzo(g,h,i)perylene	20	500		-	-	-	ND (0.19)
Benzo(k)fluoranthene	100	1,000		-	-	-	ND (0.19)
Chrysene	70	700		-	-	-	ND (0.19)
Dibenzo(a,h)anthracene	40	400		-	-	-	ND (0.19)
Fluoranthene	200	2,000		-	-	-	ND (0.19)
Fluorene	40	400		-	-	-	ND (0.19)
Indeno(1,2,3-cd)pyrene	100	1,000		-	-	-	ND (0.19)
2-Methylnaphthalene	20,000	100,000		-	-	-	ND (0.47)
Naphthalene	20,000	100,000		-	-	-	ND (0.47)
Phenanthrene	10,000	100,000		-	-	-	ND (0.47)
Pyrene	20	800		-	-	-	ND (0.19)
Cyanide							
Total Cyanide	30	2,000		-	-	-	ND (5)
Dissolved Metals							
Arsenic	900	9,000		ND (5.0)	ND (5.0)	20.1	ND (5.0)
Barium	50,000	100,000		ND (50)	ND (50)	ND (50)	101
Cadmium	4	50		ND (1.0)	ND (1.0)	ND (1.0)	1.2
Chromium (total)	300	3,000		ND (10)	ND (10)	ND (10)	ND (10)
Lead	10	150		ND (1.0)	1.9	ND (1.0)	ND (1.0)
Mercury	20	200		ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)
Selenium	100	1,000		ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Silver	7	1,000		ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Hexavalent Chromium (total)							
Hexavalent Chromium	300	3,000		-	-	-	ND (10)

NOTES:
All results are reported in micrograms per liter (µg/L).
ND indicates analyte not detected (laboratory reporting limit).

TABLE 7 - Contaminants of Concern
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	Soils				Groundwater			COCs[2]
	No. of Samples	No. of Detections	> Method 1, S-1	> Method 3 UCL	No. of Samples	No. of Detections	> Method 1,GW-3	
EPH carbon ranges								
C9-C18 Aliphatics	9	1	0	0	1	0	0	Yes
C11-C22 Aromatics	9	4	1	0	1	0	0	Yes
C19-C36 Aliphatics	9	4	0	0	1	0	0	Yes
Target PAHs								
Acenaphthene	9	1	0	0	1	0	0	Yes[3]
Acenaphthylene	9	0	0	0	1	0	0	No
Anthracene	9	2	0	0	1	0	0	Yes[3]
Benz(a)anthracene	9	3	0	0	1	0	0	Yes[3]
Benzo(a)pyrene	9	3	1	0	1	0	0	Yes[3]
Benzo(b)fluoranthene	9	3	0	0	1	0	0	Yes[3]
Benzo(g,h,i)perylene	9	3	0	0	1	0	0	Yes[3]
Benzo(k)fluoranthene	9	2	0	0	1	0	0	Yes[3]
Chrysene	9	3	0	0	1	0	0	Yes[3]
Dibenzo(a,h)anthracene	9	1	0	0	1	0	0	Yes[3]
Fluoranthene	9	3	0	0	1	0	0	Yes[3]
Fluorene	9	1	0	0	1	0	0	Yes[3]
Indeno(1,2,3-cd)pyrene	9	3	0	0	1	0	0	Yes[3]
2-Methylnaphthalene	9	1	0	0	1	0	0	Yes[3]
Naphthalene	9	2	0	0	1	0	0	Yes[3]
Phenanthrene	9	3	0	0	1	0	0	Yes[3]
Pyrene	9	3	0	0	1	0	0	Yes[3]
Metals								
Antimony	12	2	0	0	-	-	-	Yes
Arsenic	86	86	51	18	4	1	0	Yes
Barium	13	13	1	0	4	1	0	Yes
Beryllium	12	11	0	0	-	-	-	Yes
Cadmium	13	6	1	0	4	1	0	Yes
Hexavalent Chromium	12	2	0	0	1	0	0	Yes
Chromium (Total)	26	26	2[1]	0	4	0	0	-
[calculated Cr3]	12	12	2[1]	0	-	-	-	Yes
Lead	22	22	1	0	4	1	0	Yes
Mercury	13	10	0	0	4	0	0	Yes
Nickel	12	11	0	0	-	-	-	Yes
Selenium	13	0	0	0	4	0	0	No
Silver	13	2	0	0	4	0	0	Yes
Thallium	12	0	0	0	-	-	-	No
Vanadium	12	12	0	0	-	-	-	Yes
Zinc	12	12	0	0	-	-	-	Yes
PCBs								
All PCB Arochlors	6	0	0	0	-	-	-	No
VOCs								
Acetone	4	2	0	0	-	-	-	Yes
2-Butanone	4	1	NE	NE	-	-	-	Yes
Cyanide								
Total Cyanide	4	1	0	0	1	0	0	Yes
Pesticide								
4,4´-DDE	2	1	0	0	-	-	-	No[4]
4,4´-DDT	2	1	0	0	-	-	-	No[4]
Hexachlorobenzene	2	0	0	0	-	-	-	No[4]

NOTES:
(1) See notes on Tables 4 and 5 regarding chromium levels above Method 1 standards.
(2) Contaminants of concern (COCs) are only identified for the 50 Proctor Street parcel, within the Disposal Site Boundary, as further reviewed in the report text.
(3) These PAHs detected in site soils are considered to be consistent with background conditions for soils with fill, as further reviewed in the report text.
(4) The trace detections of pesticides in shallow site soils are attributed to application of pesticides in a manner consistent with their labelling, as further reviewed in the report text.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
\- indicates not analyzed for respective analyte.

TABLE 8 - EPCS for Shallow Soils for Arsenic
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards						Method 3 UCLs	Area:																				
	S-1/ GW-2	S-1/ GW-3	S-2/ GW-2	S-2/ GW-3	S-3/ GW-2	S-3/ GW-3		Soil Boring:	B-7	B-14	B-15	B-15	B-16	B-16	B-17	B-17	TP-1	TP-2	TP-3A	TP-4	TP-5	TP-6	TP-8	TP-9	TP-9	B-29
								Sample Depth:	0.5-2'	0-1'	0-1'	1-2'	0-1'	1-2'	0-1'	1-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	2-3'	0-2'
Arsenic	20	20	20	20	50	50	500		**36**	19.5	**348**	**333**	**221**	**169**	**633**	**504**	**549**	**84**	**5,150**	**2,330**	**508**	**623**	**132**	**62.7**	6.94	**32**

NOTES:
Bold values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs

TABLE 8 - EPCS for Shallow Soils for Arsenic
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards						Method 3 UCLs	Area:	Area of Concern (shallow soils)																														Highest Detection
	S-1/ GW-2	S-1/ GW-3	S-2/ GW-2	S-2/ GW-3	S-3/ GW-2	S-3/ GW-3		Soil Boring:	B-31 / MW-2	B-33	B-33	B-35	B-35	B-36	B-36	B-37	B-37	B-38	B-39	B-40	B-40	B-41/MW-3	B-42	B-44	B-45/MW-4	B-47	B-48	B-48	B-49	B-49	B-50	B-50	B-51	B-53	
								Sample Depth:	0-2'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	2-4'	0-2'	0-2'	0-2'	2-4'	0-2'	0-2'	0-2'	0-2'	0-2'	0-1'	1-2'	0-1'	1-2'	0-1'	1-2'	0-1'	0-1'	0-1'	
Arsenic	20	20	20	20	50	50	500		**102**	8.02	**603**	**1,510**	**12,300**	**345**	**419**	**1,260**	**1,700**	**41.1**	**2,140**	**145**	**669**	**2,150**	**81.8**	**189**	**27.7**	**50.2**	**208**	**203**	**444**	**990**	**344**	**528**	**21.2**	**91.2**	**12,300**

NOTES:
Bold values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs

TABLE 8 - EPCS for Shallow Soils for Arsenic
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards						Method 3 UCLs	Area:	Calculated EPC	Outside of the AOC (shallow soils				
	S-1/ GW-2	S-1/ GW-3	S-2/ GW-2	S-2/ GW-3	S-3/ GW-2	S-3/ GW-3		Soil Boring:		B-34	B-32	B-30	B-52	B-46
								Sample Depth:		0-2'	0-2'	0-2'	0-1'	0-2'
Arsenic	20	20	20	20	50	50	500		**871**	11.6	8.33	15.4	8.78	14.6

NOTES:
Bold values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs

TABLE 8A - EPCS for Shallow Soils for Other Site COCs
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	UCLs	Sample Location:	B-7	B-41	B-41	B-42	B-43	B-45	B-49	TP-1	TP-2	TP-3A	TP-3A	TP-5	TP-7	TP-8	TP-9	TP-9
								Sample Depth:	0.5-2'	0-2'	2-4'	0-2'	2-4'	2-4'	0-1'	0-2'	0-2'	0-2'	2-5.5'	0-2'	0-2'	2-6'	0-2'	2-3'
EPH carbon ranges																								
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		ND (18.2)	-	-	-	94.5	-	-	-	-	-	ND (63.2)	-	-	-	-	ND (18.6)
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (18.2)	-	-	-	**2,210**	-	-	-	-	-	145	-	-	-	-	ND (18.6)
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		ND (18.2)	-	-	-	2,050	-	-	-	-	-	150	-	-	-	-	ND (18.6)
Target PAHs																								
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Benz(a)anthracene	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Benzo(a)pyrene	2	2	7	7	30	30	300		ND (0.49)	-	-	-	*ND (2.52)*	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Chrysene	70	70	400	400	3,000	3,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		ND (0.24)	-	-	-	*ND (1.26)*	-	-	-	-	-	*ND (0.84)*	-	-	-	-	ND (0.25)
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
2-Methylnaphthalene	80	300	80	500	80	500	5,000		ND (0.24)	-	-	-	ND (1.26)	-	-	-	-	-	ND (0.84)	-	-	-	-	ND (0.25)
Naphthalene	20	500	20	1,000	20	3,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.49)	-	-	-	ND (2.52)	-	-	-	-	-	ND (1.69)	-	-	-	-	ND (0.5)
Metals																								
Antimony	20	20	30	30	30	30	300		-	-	-	-	ND (5.52)	-	3	ND (6.79)	-	-	-	-	-	-	-	ND (5.03)
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		34.5	-	-	-	49.3	-	**1,060**	64.5	-	-	-	-	-	-	-	54.9
Beryllium	90	90	200	200	200	200	2,000		0.67	-	-	-	0.32	-	0.31	0.42	-	-	-	-	-	-	-	0.57
Cadmium	70	70	100	100	100	100	1,000		18.9	-	-	-	ND (0.55)	-	5.42	5.27	-	-	-	-	-	-	-	ND (0.50)
Hexavalent Chromium	100	100	200	200	200	200	2,000		-	ND (0.6)	-	ND (0.6)	-	-	9.3	ND (0.5)	ND (0.5)	ND (0.6)	-	-	ND (0.5)	-	ND (0.6)	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	185	-	399	-	-	**1,021**	149	62.6	**1,820**	-	-	25.5	-	302	-
Lead	200	200	600	600	600	600	6000		83.6	-	-	-	41.3	-	**354**	107	60.8	91.7	-	51.1	-	12.8	-	31.4
Mercury	20	20	30	30	30	30	300		0.117	-	-	-	ND (2.02)	-	4.2	0.325	-	-	-	-	-	-	-	0.046
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		ND (4.34)	-	-	-	12.8	-	18	13.4	-	-	-	-	-	-	-	16
Selenium	400	400	700	700	700	700	7,000		ND (0.43)	-	-	-	ND (5.52)	-	ND (7.81)	ND (6.79)	-	-	-	-	-	-	-	ND (5.03)
Silver	100	100	200	200	200	200	2,000		-	-	-	-	ND (1.10)	-	0.78	ND (0.68)	-	-	-	-	-	-	-	ND (0.50)
Vanadium	400	400	700	700	700	700	7,000		-	-	-	-	36.9	-	41.2	ND (6.79)	-	-	-	-	-	-	-	ND (5.03)
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		-	-	-	-	48.6	-	696	196	-	-	-	-	-	-	-	88.4
VOCs																								
Acetone	50	400	50	400	50	400	10,000		ND	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0141)	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		ND	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0141)	-
Cyanide																								
Total Cyanide	30	30	100	100	500	500	5,000		-	-	ND (1.66)	-	-	ND (1.72)	-	-	-	-	-	-	-	-	-	-

NOTES:
(1) Exposure Point Concentrations were calculated via arithmetic average using only detections above laboratory reporting limits, as further discussed in this report.
Bold boxed values indicates exceedance of Method 1 standard.
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
- indicates sample not analyzed for respective analyte.

TABLE 8A - EPCS for Shallow Soils for Other Site COCs
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	S-1/GW-2	S-1/GW-3	S-2/GW-2	S-2/GW-3	S-3/GW-2	S-3/GW-3	UCLs	Sample Location: Sample Depth:	Highest Concentration	Calculated EPCs[1]
EPH carbon ranges										
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		94.5	94.5
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		**2,210**	**1,178**
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		2,050	1,100
Target PAHs										
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		ND	-
Benzo(a)pyrene	2	2	7	7	30	30	300		ND	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		ND	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		ND	-
Chrysene	70	70	400	400	3,000	3,000	10,000		ND	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		ND	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		ND	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		ND	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		ND	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		ND	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND	-
Metals										
Antimony	20	20	30	30	30	30	300		3	3
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		**1,060**	302
Beryllium	90	90	200	200	200	200	2,000		0.67	0.46
Cadmium	70	70	100	100	100	100	1,000		18.9	9.86
Hexavalent Chromium	100	100	200	200	200	200	2,000		9.3	9.3
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		**1,820**	496
Lead	200	200	600	600	600	600	6000		**354**	93
Mercury	20	20	30	30	30	30	300		4.2	1.2
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		18	15.1
Selenium	400	400	700	700	700	700	7,000		ND	-
Silver	100	100	200	200	200	200	2,000		0.78	0.78
Vanadium	400	400	700	700	700	700	7,000		41.2	39.1
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		696	257
VOCs										
Acetone	50	400	50	400	50	400	10,000		ND	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		ND	-
Cyanide										
Total Cyanide	30	30	100	100	500	500	5,000		ND	-

NOTES:
[1] Exposure Point Concentrations were calculated via arithmetic average using only detections above laboratory reporting limits, as further discussed in this report.
Bold boxed values indicates exceedance of Method 1 standard.
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
- indicates sample not analyzed for respective analyte.

TABLE 9 - EPCS for Deeper Soils for Arsenic
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards						Method 3 UCLs	Area:	Area of Concern (deeper soils)											Highest Detection	Calculated EPC
	S-1/2	GW-S-1/3	GW-S-2/2	GW-S-2/3	GW-S-3/2	GW-S-3/3		Soil Boring:	TP-2	TP-4	TP-6	B-35	B-37	B-37	B-39	B-39	B-41/MW-3	TP-9	B-44		
								Sample Depth:	5'	4-5.5'	2-5'	4-5.5'	2-4'	4-8'	2-4'	4-6'	2-4'	3-5'	2-4'		
Arsenic	20	20	20	20	50	50	500		**35.7**	**34.9**	**250**	**10,900**	**1,700**	**99.5**	**62.9**	**3,190**	**179**	**31.5**	**77.7**	**10,900**	**1,506**

NOTES:
* These samples were collected within the arsenic >20 mg/kg boundary, but at depths considered below where elevated arsenic contamination is present.
Bold values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs

TABLE 9 - EPCS for Deeper Soils for Arsenic
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

Analyses	MCP - Method 1 Standards						Method 3 UCLs	Area:	Outside of AOC (deeper soils)																						
	S-1/ 2	GW-S-1/ 3	S-2/ 2	GW-S-2/ 3	S-3/ 2	GW-S-3/ 3		Soil Boring:	TP-1	TP-1	TP-2	TP-3A*	TP-5	TP-5	TP-7	TP-7	TP-8	B-29	B-29	B-30	B-31 / MW-2	B-32	B-33	B-34	B-35*	B-43	B-43	B-45/MW-4	B-45/MW-4	B-46
								Sample Depth:	5'	6.5'	6.5'	5.5-6'	3-5'	5-6'	2-5'	5-5.5'	2-6'	2-4'	4-5.5'	2-4'	2-4'	2-4'	4-6'	2-4'	6-8'	2-4'	4-8'	2-4'	4-8'	2-4'
Arsenic	20	20	20	20	50	50	500		11.8	7.64	5.77	3.28	4.1	5.12	3.65	2.66	18.4	8.89	5.02	6.9	12.2	7.85	13.1	5.4	6.04	6.72	8.92	12.3	5.82	13.1

NOTES:
* These samples were collected within the arsenic >20 mg/kg boundary, but at depths considered below where elevated arsenic cont
Bold values indicates exceedance of Method 1 standard.
Represents values above MCP Method 3 UCLs

TABLE 9A - EPCs for Deeper Soils for Other Site COCs
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP - Method 1 Standards						Method 3	Area:	Area of Concern (deeper soils)							Highest Concentration	Calculated EPCs[1]
								Sample Location:	B-35	B-37	TP-2	TP-3A	TP-4	TP-5	TP-5		
								Sample Depth:	4-5.5'	4-8'	5'	2-5.5'	4-5.5'	3-5'	5-6'		
Analyses	**S-1/GW-2**	**S-1/GW-3**	**S-2/GW-2**	**S-2/GW-3**	**S-3/GW-2**	**S-3/GW-3**	**UCLs**										
EPH carbon ranges																	
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		ND (27.7)	ND (22.6)	-	ND (63.2)	-	-	-	ND	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		56.1	ND (22.6)	-	145	-	-	-	145	101
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		ND (27.7)	ND (22.6)	-	150	-	-	-	150	150
Target PAHs																	
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.74)	ND (0.60)	-	ND (1.69)	-	-	-	ND	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		0.97	ND (0.60)	-	ND (1.69)	-	-	-	0.97	0.97
Benz(a)anthracene	7	7	40	40	300	300	3,000		2.03	ND (0.60)	-	ND (1.69)	-	-	-	2.03	1.8
Benzo(a)pyrene	2	2	7	7	30	30	300		1.75	ND (0.60)	-	ND (1.69)	-	-	-	1.75	1.7
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		2.32	ND (0.60)	-	ND (1.69)	-	-	-	2.32	2.0
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		0.94	ND (0.60)	-	ND (1.69)	-	-	-	0.94	1.0
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		ND (0.74)	ND (0.60)	-	ND (1.69)	-	-	-	ND	0.61
Chrysene	70	70	400	400	3,000	3,000	10,000		1.82	ND (0.60)	-	ND (1.69)	-	-	-	1.82	1.82
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		ND (0.37)	ND (0.30)	-	*ND (0.84)*	-	-	-	ND	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		4.27	ND (0.60)	-	ND (1.69)	-	-	-	4.27	4.27
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		ND (0.74)	ND (0.60)	-	ND (1.69)	-	-	-	ND	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		1.13	ND (0.60)	-	ND (1.69)	-	-	-	1.13	1.13
2-Methylnaphthalene	80	300	80	500	80	500	5,000		ND (0.37)	ND (0.30)	-	ND (0.84)	-	-	-	ND	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		0.85	ND (0.60)	-	ND (1.69)	-	-	-	0.85	0.85
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		4.13	ND (0.60)	-	ND (1.69)	-	-	-	4.13	4.13
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		3.82	ND (0.60)	-	ND (1.69)	-	-	-	3.82	3.82
Metals																	
Antimony	20	20	30	30	30	30	300		7.18	-	-	-	ND (5.64)	ND (6.8)	ND (5.00)	7.18	7.18
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		97.4	-	-	-	60.8	38.5	53.9	97.4	62.65
Beryllium	90	90	200	200	200	200	2,000		ND (0.17)	-	-	-	0.64	0.7	0.7	0.7	0.68
Cadmium	70	70	100	100	100	100	1,000		**102**	-	-	-	ND (0.56)	ND (0.68)	ND (0.50)	**102**	**102**
Hexavalent Chromium	100	100	200	200	200	200	2,000		ND (0.8)	-	ND (0.6)	-	-	ND (0.7)	-	ND	ND
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		428	-	23.7	-	23	24.2	20.8	428	104
Lead	200	200	600	600	600	600	6000		70.6	-	48.5	-	8.93	22.4	8.11	70.6	32
Mercury	20	20	30	30	30	30	300		1.2	-	-	-	0.066	0.061	0.034	1.2	0.3
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		ND (3.94)	-	-	-	18.7	15.0	20.0	20	18
Selenium	400	400	700	700	700	700	7,000		ND (7.87)	-	-	-	ND (5.64)	ND (6.8)	ND (5.00)	ND	-
Silver	100	100	200	200	200	200	2,000		1.5	-	-	-	ND (0.56)	ND (0.68)	ND (0.50)	1.5	1.5
Vanadium	400	400	700	700	700	700	7,000		5.73	-	-	-	54.8	54.6	39.3	54.8	38.6
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		69.1	-	-	-	80.7	56.4	68.5	80.7	68.7
VOCs[1]																	
Acetone	50	400	50	400	50	400	10,000		-	0.442	-	-	-	-	-	0.442	0.442
2-Butanone (MEK)	50	400	50	400	50	400	10,000		-	0.0556	-	-	-	-	-	0.0556	0.0556
Cyanide																	
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	-	-	ND (1.68)	-	ND	ND

NOTES:
(1) Exposure Point Concentrations were calculated via arithmetic average using only detections above laboratory reporting limits, as further discussed in this report.
Bold boxed values indicates exceedance of Method 1 standard.
ND indicates that the analyte was not detected above laboratory reporting limits.
NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.
\- indicates sample not analyzed for respective analyte.

TABLE 9A - EPCs for Deeper Soils for Other Site COCs
Gallows Hill Park
50 Proctor Street - Subject of RTN 3-35355
Salem, Massachusetts

	MCP - Method 1 Standards						Method 3	Area:	Outside of AOC (deeper soils)						
								Sample Location:	B-29	B-33	TP-1	TP-1	TP-1	TP-7	TP-7
								Sample Depth:	4-5.5'	4-6'	3-5'	5'	6.5'	2-5'	5-5.5'
Analyses	**S-1/GW-2**	**S-1/GW-3**	**S-2/GW-2**	**S-2/GW-3**	**S-3/GW-2**	**S-3/GW-3**	**UCLs**								
EPH carbon ranges															
C9-C18 Aliphatics	1,000	1,000	3,000	3,000	5,000	5,000	20,000		-	-	ND (21.5)	-	-	ND (18.2)	-
C11-C22 Aromatics	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (21.5)	-	-	ND (18.2)	-
C19-C36 Aliphatics	3,000	3,000	5,000	5,000	5,000	5,000	20,000		-	-	78.5	-	-	ND (18.2)	-
Target PAHs															
Acenaphthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (0.57)	-	-	ND (0.49)	-
Anthracene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (0.57)	-	-	ND (0.49)	-
Benz(a)anthracene	7	7	40	40	300	300	3,000		-	-	1.6	-	-	ND (0.49)	-
Benzo(a)pyrene	2	2	7	7	30	30	300		-	-	1.57	-	-	ND (0.49)	-
Benzo(b)fluoranthene	7	7	40	40	300	300	3,000		-	-	1.76	-	-	ND (0.49)	-
Benzo(g,h,i)perylene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	1.02	-	-	ND (0.49)	-
Benzo(k)fluoranthene	70	70	400	400	3,000	3,000	10,000		-	-	0.61	-	-	ND (0.49)	-
Chrysene	70	70	400	400	3,000	3,000	10,000		-	-	1.64	-	-	ND (0.49)	-
Dibenzo(a,h)anthracene	0.7	0.7	4	4	30	30	300		-	-	ND (0.29)	-	-	ND (0.24)	-
Fluoranthene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	3.33	-	-	ND (0.49)	-
Fluorene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	ND (0.57)	-	-	ND (0.49)	-
Indeno(1,2,3-cd)pyrene	7	7	40	40	300	300	3,000		-	-	1.09	-	-	ND (0.49)	-
2-Methylnaphthalene	80	300	80	500	80	500	5,000		-	-	ND (0.29)	-	-	ND (0.24)	-
Naphthalene	20	500	20	1,000	20	3,000	10,000		-	-	ND (0.57)	-	-	ND (0.49)	-
Phenanthrene	500	500	1,000	1,000	3,000	3,000	10,000		-	-	2.45	-	-	ND (0.49)	-
Pyrene	1,000	1,000	3,000	3,000	5,000	5,000	10,000		-	-	3.20	-	-	ND (0.49)	-
Metals															
Antimony	20	20	30	30	30	30	300		ND (6.54)	-	-	ND (4.03)	-	-	ND (4.42)
Barium	1,000	1,000	3,000	3,000	5,000	5,000	10,000		26.4	-	-	47.9	-	-	35.6
Beryllium	90	90	200	200	200	200	2,000		0.46	-	-	0.47	-	-	0.48
Cadmium	70	70	100	100	100	100	1,000		ND (0.65)	-	-	0.4	-	-	ND (0.44)
Hexavalent Chromium	100	100	200	200	200	200	2,000		-	-	-	0.6	-	-	-
[calculated Cr3]	1,000	1,000	3,000	3,000	5,000	5,000	10,000		12.8	-	-	25.2	-	-	-
Lead	200	200	600	600	600	600	6000		12.7	-	-	6.32	12.5	-	6.25
Mercury	20	20	30	30	30	30	300		ND (0.025)	-	-	ND (0.023)	-	-	0.032
Nickel	600	600	1,000	1,000	1,000	1,000	10,000		9.58	-	-	15	-	-	13.8
Selenium	400	400	700	700	700	700	7,000		ND (6.54)	-	-	ND (4.03)	-	-	ND (4.42)
Silver	100	100	200	200	200	200	2,000		ND (0.65)	-	-	ND (0.40)	-	-	ND (0.44)
Vanadium	400	400	700	700	700	700	7,000		22.1	-	-	25.2	-	-	31.6
Zinc	1000	1000	3,000	3,000	5,000	5,000	10,000		43.2	-	-	48.4	-	-	51
VOCs[1]															
Acetone	50	400	50	400	50	400	10,000		-	-	-	0.0465	-	-	-
2-Butanone (MEK)	50	400	50	400	50	400	10,000		-	-	-	ND	-	-	-
Cyanide															
Total Cyanide[2]	30	30	100	100	500	500	5,000		-	-	-	1.11	-	-	-

NOTES:

[1] Exposure Point Concentrations were calculated via arithmetic average using only detections above laboratory reporting limits, as further discussed in this report.

Bold boxed values indicates exceedance of Method 1 standard.

ND indicates that the analyte was not detected above laboratory reporting limits.

NE indicates no Method 1 standard (or Method 3 UCL) established for this compound.

- indicates sample not analyzed for respective analyte.

Tighe&Bond

APPENDIX C

SOVEREIGN CONSULTING INC.

February 11, 2019

Todd Kirton, LSP
Tighe & Bond
446 Main Street
Worcester, Massachusetts 01608

RE: Calculation Air Action Levels
Gallows Hill Park
50 Proctor Street, Salem, Massachusetts
RTN 3-0035355

Dear Mr. Kirton:

As requested, Sovereign Consulting Inc. has developed action levels (ALs) for inhalable soil particles (i.e., particles with an aerodynamic-equivalent diameter of 10 microns or less; PM_{10}) containing elevated concentrations of arsenic and other metals. The ALs are based on sampling data for soil collected from the park, as provided by Tighe & Bond. The PM_{10} ALs are protective of residential and construction/utility worker exposure and are intended to be used to monitor air PM_{10} concentrations during soil removal activities. This letter describes the PM_{10} action level calculations and discusses their use.

Calculation of Action Levels

To calculate action levels, risk assessment calculations were first performed estimating the potential health risks to construction/utility workers and off-site residents posed by inhalation and ingestion of soil particles during soil removal activities. A limited suite of constituents detected at elevated concentrations were assessed: arsenic, chromium (total) and lead. From this assessment, it was identified that arsenic provided nearly 100% of the non-carcinogenic health hazards and carcinogenic risks from the site. Therefore, the AL is based on exposure to arsenic alone.

An assumed PM_{10} concentration of 60 micrograms per cubic meter ($\mu g/m^3$) is used as a place-holder to establish the relationship between arsenic concentrations in soil and risk levels. Once this relationship has been established, the equation is rearranged to calculate a maximum acceptable PM_{10} concentration associated with a target acceptable risk or hazard level.

It is assumed that soil excavation will result in PM_{10} concentrations that construction/utility workers and off-site residents are exposed to for 8 hours per day, 5 days per week, for a 6-month exposure period. Based on a MassDEP-adopted exposure model, construction/utility workers are assumed to have an inhalation rate of 60 liters per minute (L/min; 86.4 m^3/day), representing elevated activity. When performed for off-site residents, a typical resting inhalation rate of 14 L/min (20 m^3/day) was applied. All other exposure factors for the two receptor groups remained the same.

The concentration of arsenic on PM_{10} was assumed to be the same as arsenic concentrations in soil; in other words, it was not assumed that smaller inhalable particles of PM_{10} contained higher or lower concentrations of arsenic than bulk soil samples. Specifically, PM_{10} was assumed to contain the maximum detected concentration of arsenic in soil, a concentration of 633 mg/kg.

Potential non-carcinogenic health hazards and excess lifetime cancer risks were quantified for both inhalation pathways using MassDEP-adopted toxicity values for arsenic.

Risk characterization calculations for construction/utility workers are presented in **Appendix A**; results are summarized below:

RISK CHARACTERIZATION SUMMARY CONSTRUCTION/UTILITY WORKERS			
EXPOSURE PATHWAY	**Non-Carcinogenic Hazard Index [1]**		**Excess Lifetime Cancer Risk**
	All COCs [2]	**Arsenic Alone**	**Arsenic [3]**
Inhalation of entrained soil particles (assumed PM_{10})	1.0	0.97	4×10^{-7}
Ingestion of inhaled, entrained soil particles	0.04	0.03	1×10^{-7}
Total (Both Pathways)	**1.0**	**1.0**	**5×10^{-7}**
Maximum Acceptable Level (for all constituents)	**1**		**1×10^{-6}**

[1] HIs are expanded out beyond the recommend one significant figure for informational purposes.
[2] Includes arsenic, chromium (total) and lead.
[3] Arsenic is the only carcinogen among the constituents assessed.

For the non-carcinogenic endpoint above, arsenic and the soil particle inhalation pathway constituted 97% of the total HI and the soil particle ingestion pathway constituted 3% of the total HI. For the cancer endpoint, the soil particle and inhalation and ingestion pathways constitute 80 and 20 percent, respectively of the total risk.

Note that the total hazard Index (HI) and cancer risk do not include consideration of other exposure pathways the workers may be subject to, such as soil ingestion or dermal contact, since they are not subject to ALs. Since other pathways and constituents may "add" to the overall risk/hazards, a "target" HI of 0.2 was conservatively adopted to derive a PM_{10} AL for the non-carcinogenic endpoint and a conservative "target" cancer risk of 1×10^{-6} was adopted to derive a PM_{10} AL for the carcinogenic endpoint. If the other exposure pathways are adequately managed and other constituents continue to remain below concentrations of concern compared to arsenic, then the more conventional "acceptable risk" endpoints of HI = 1.0 and cancer risk = 1×10^{-5} could be applied as target values.

Calculated PM_{10} concentrations in air for both sets of "acceptable risk" levels are shown below.

CALCULATED PM_{10} ACTION LEVELS PROTECTIVE OF CONSTRUCTION/UTILITY WORKER EXPOSURE TO ARSENIC			
TOXICITY ENDPOINT AND RISK/HAZARD LEVEL	**CONSERVATIVE CALCULATED ASSOCIATED PM_{10} CONCENTRATION ($\mu g/m^3$)**	**TOXICITY ENDPOINT AND RISK/HAZARD LEVEL**	**ALTERNATE CALCULATED ASSOCIATED PM_{10} CONCENTRATION ($\mu g/m^3$)**
Hazard Index = 0.2	12	Hazard Index = 1.0	60
Excess Lifetime Cancer Risk = $1x10^{-6}$	114	Excess Lifetime Cancer Risk = $1x10^{-5}$	1,145

$\mu g/m^3$ Micrograms per cubic meter.

As is apparent, the non-carcinogenic endpoint results in a lower maximum acceptable PM_{10} concentration than the cancer endpoint, so the lower of the two calculated values, a PM_{10} concentration of 12 $\mu g/m^3$, is adopted as the conservative PM_{10} Action Level. Again, if other pathways are controlled and arsenic continues to be the risk driver, then the alternate AL of 60 $\mu g/m^3$ could be applied.

The hazard/risk calculations for off-site residents is summarized below:

RISK CHARACTERIZATION SUMMARY OFF-SITE RESIDENTS			
EXPOSURE PATHWAY	**Non-Carcinogenic Hazard Index [1]**		**Excess Lifetime Cancer Risk**
	All COCs [2]	**Arsenic Alone**	**Arsenic [3]**
Inhalation of entrained soil particles (assumed PM_{10})	0.24	0.23	1×10^{-7}
Ingestion of inhaled, entrained soil particles	0.0084	0.0077	2×10^{-8}
Total (Both Pathways)	**0.24**	**0.23**	**1×10^{-7}**
Maximum Acceptable Level (for all constituents)	**1**		**1×10^{-6}**

[1]. HIs are expanded out beyond the recommend one significant figure for informational purposes.
[2]. Includes arsenic, chromium (total) and lead.
[3]. Arsenic is the only carcinogen among the constituents assessed.

As can be seen, the risk/hazards posed to off-site residents through these two pathways are below maximum acceptable risk/hazard levels and are less than that experienced by construction/utility workers. This means that the action levels calculated to protect construction/utility workers will also protect off-site residents.

If you have any questions, or require additional information, please do not hesitate to contact the undersigned at (401) 323-9571.

Regards,

SOVEREIGN CONSULTING INC.

Cynthia Fuller
Health Risk Assessor

Attachments:
Appendix A Risk and Action Level Calculations – Construction/Utility Workers
Appendix B Risk Calculations – Off-site Residents

APPENDIX A
Risk and Action Level Calculations
Construction/Utility Workers

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

PM_{10} Action Level Summary (Based on Arsenic Exposure)

Non-cancer Endpoint

Exposure pathway	Assumed Particulate Matter (PM_{10}) Air Concentration [1] µg/m^3	Calculated HQ at Assumed PM_{10} Concentration [1] (unitless)	Percent of Total HI	Total Target HI	Pathway-Specific Target HI	Target PM_{10} [2] µg/m^3	Conservative Target PM_{10} mg/m^3	Total Target HI	Pathway-Specific Target HI	Target PM_{10} [2] µg/m^3	Target PM_{10} mg/m^3
Inhalation of Entrained Soil Particles	60	1.0	97%	0.2	0.193	12	**0.012**	1.0	0.967	60	0.060
Ingestion of Inhaled, Entrained Soil Particles	60	0.03	3%	0.2	0.007	12		1.0	0.033	60	
Total Hazard Index		**1.0**									

Cancer Endpoint

Exposure pathway	Assumed Particulate Matter (PM_{10}) Air Concentration [1] µg/m^3	Calculated Risk at Assumed PM_{10} Concentration [1] (unitless)	Percent of Total Risk Level	Target Cancer Risk	Pathway-Specific Target Risk	Target PM_{10} [2] µg/m^3	Conservative Target PM_{10} mg/m^3	Target Cancer Risk	Pathway-Specific Target Risk	Target PM_{10} [2] µg/m^3	Target PM_{10} mg/m^3
Inhalation of Entrained Soil Particles	60	4.2E-07	80%	1.0E-06	8.0E-07	114	0.11	1.0E-05	8.0E-06	1,145	1.14
Ingestion of Inhaled, Entrained Soil Particles	60	1.1E-07	20%	1.0E-06	2.0E-07	114		1.0E-05	2.0E-06	1,145	
Total Risk		**5.2E-07**									

Selected PM_{10} Action Level	**0.012**	**mg/m^3**

µg/m^3 Micrograms per cubic meter
mg/m^3 Milligrams per cubic meter
1. From the associated risk calculations.
2. [Pathway-specific Target HQ or Risk x Assumed PM_{10}]/Calculated HQ or Risk

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

Risk Characterization Summary

Exposure Pathway	Non-Carcinogenic Hazard Index	Excess Lifetime Cancer Risk
Inhalation of Entrained Soil Particles	1.0	4E-07
Ingestion of Inhaled, Entrained Soil Particles	0.04	1E-07
Total (All Pathways)	**1.0**	**5E-07**

Percent contribution by arsenic	96%	100%

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

Inhalation of Entrained Soil Particles

$$ADE = \frac{C_{soil} \times FI \times PM_{10} \times IH_W \times RAFi \times EF \times ED \times EP \times CF1 \times CF2}{AP \times IH_A}$$

HQ = ADE(nc) / RfCs
HI = Sum [HQ]
Risk = ADE(ca) x IUR

ADE = Average daily exposure (mg/m^3) (nc = noncarcinogen; ca = carcinogen)
C_{soil} = Constituent concentration in soil (mg/kg)
FI = Fraction inhaled that is retained in lungs (unitless)
PM_{10} = Particulate matter concentration in air (</= 10 microns) (ug/m^3)
IH_W = Worker inhalation rate (L/min)
RAFi = Inhalation Relative absorption fraction (unitless)
EF = Exposure frequency (events/yr)
ED = Exposure duration (hr/event)
EP = Exposure period (yr)

CF1 = Unit conversion factor [(min-kg-m^3)/(hr-ug-L)]
CF2 = Unit conversion factor (yr/dy)
IH_A = Assumed inhalation rate (m^3/dy)
AP = Averaging period (dy)
RfCs = Subchronic reference concentration (mg/m^3)
HQ = Non-carcinogenic Hazard Quotient (unitless)
HI = Total Hazard Index (unitless)
Risk = Excess lifetime cancer risk (unitless)
IUR = Cancer inhalation unit risk [(mg/m^3)$^{-1}$]

Constituent	C_{soil} (mg/kg)	FI (unitless)	PM_{10} (ug/m^3)	IH_W (L/min)	RAFi (unitless)	EF (events/yr)	ED (hr/event)	EP (yr)	CF1 (min-kg-m^3)/(hr-ug-L)	CF2 (yr/dy)	IH_A (m^3/dy)	AP (nc) (yr)	ADE (nc) (mg/m^3)	RfCs (mg/m^3)	HQ (unitless)	AP (ca) (yr)	ADE (ca) (mg/m^3)	IUR [(mg/m^3)$^{-1}$]	Risk (unitless)
Arsenic	633	0.5	60	60	1	130	8	1	6.00E-11	2.74E-03	20	0.5	1.95E-05	0.00002	0.97	70	1.39E-07	3	4E-07
Chromium (total)	332	0.5	60	60	1	130	8	1	6.00E-11	2.74E-03	20	0.5	1.02E-05	0.0003	0.03	-	-	-	-
Lead	126	0.5	60	60	1	130	8	1	6.00E-11	2.74E-03	20	0.5	3.88E-06	0.001	0.004	-	-	-	-
Total												**HI =**			**1.0**	**Risk =**			**4E-07**

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

Ingestion of Inhaled, Entrained Soil Particles

$$ADD = \frac{C_{soil} \times FI \times PM_{10} \times IH_W \times RAFo \times EF \times ED \times EP \times CF1 \times CF2}{BW \times AP}$$

HQ = ADD (nc)/RfDs
HI = Sum [HQ]

ADD = Average daily dose (mg/kg-dy) (ca = carcinogens, nc = non-carcinogens)
C_{soil} = Constituent concentration in soil (mg/kg)
FI = Fraction inhaled that is ingested (unitless)
PM_{10} = Particulate matter concentration in air (</= 10 microns) (ug/m^3)
IH_W = Worker inhalation rate (L/min)
RAFo = Relative absorption fraction (unitless)
EF = Exposure frequency (events/yr)
ED = Exposure duration (hr/event)
EP = Exposure period (yr)

CF1 = Unit conversion factor [(min-kg-m^3)/(hr-ug-L)]
CF2 = Unit conversion factor (yr/dy)
BW = Body weight (kg)
AP = Averaging period (yr)
HQ = Non-carcinogenic Hazard Quotient (unitless)
RfDs = Subchronic Reference Dose (mg/kg-dy)
HI = Total Hazard Index (unitless)
Risk = Excess lifetime cancer risk (unitless)
IUR = Cancer inhalation unit risk [(mg/m^3)$^{-1}$]

Constituent	C_{soil} (mg/kg)	FI (unitless)	PM_{10} (ug/m^3)	IH_W (L/min)	RAFo (unitless)	EF (events/yr)	ED (hr/event)	EP (yr)	CF1 [(min-kg-m^3)/(hr-ug-L)]	CF2 (yr/dy)	BW (kg)	AP (nc) (yr)	ADD (nc) (mg/kg-dy)	RfDs (mg/kg-dy)	HQ (unitless)	AP (ca) (yr)	ADD (ca) (mg/kg-dy)	OSF [mg/kg-dy)$^{-1}$]	Risk (unitless)
Arsenic	633	1.5	60	60	0.5	130	8	1	6.00E-11	2.74E-03	58.7	0.5	9.96E-06	0.0003	0.03	70	7.11E-08	1.5	1E-07
Chromium (total)	332	1.5	60	60	1	130	8	1	6.00E-11	2.74E-03	58.7	0.5	1.04E-05	1.5	0.000007	-	-	-	-
Lead	126	1.5	60	60	0.5	130	8	1	6.00E-11	2.74E-03	58.7	0.5	1.98E-06	0.00075	0.003	-	-	-	-
Total												**HI =**			0.04	**Risk =**			**1E-07**

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

Exposure Point Concentration

Constituent	Soil Exposure Point Concentration C_S (mg/kg)
Arsenic	633
Chromium (total)	332
Lead	126

Conveyed by Tom Kirton, Tighe & Bond.

Calculation of PM10 Action Levels for Construction/Utility Workers
Gallows Hill Park, Salem, Massachusetts

Toxicity Values and Relative Absorption Factors

Constituent	Carcinogenic Weight of Evidence Category [1]	Chronic Oral Reference Dose (RfD) (mg/kg-dy)	Subchronic Oral Reference Dose (RfDs) (mg/kg-dy)	Chronic Inhalation Reference Concentration (RfC) (mg/m^3)	Subchronic Inhalation Reference Concentration (RfCs) (mg/m^3)	Oral Cancer Slope Factor (OSF) [$(mg/kg\text{-}dy)^{-1}$]	Inhalation Cancer Unit Risk (IUR) [$(mg/m^3)^{-1}$]	Soil Relative Absorption Factors (RAF) [2] (unitless)	
								Oral	Dermal
Arsenic	A	0.0003 [2]	0.0003 [2]	0.00002 [2]	0.00002 [2]	1.5	3	0.5	0.03
Chromium (total)	D	1.5 [2]	1.5 [2]	0.0001 [2]	0.0003 [2]	-	-	1	0.1
Lead	B2	0.00075 [2]	0.00075 [2]	0.001 [2]	0.001 [2]	-	-	0.5	0.006

2. Obtained from MassDEP(2014) Method 1 Numerical Standards and supporting documentation.

APPENDIX B

Risk Calculations
Off-Site Residents

Risk Characterization of Off-Site Residential Exposure - Inhalation Pathways Only

Gallows Hill Park, Salem, Massachusetts

Risk Characterization Summary

Exposure Pathway	Non-Carcinogenic Hazard Index	Excess Lifetime Cancer Risk
Inhalation of Entrained Soil Particles	0.24	1E-07
Ingestion of Inhaled, Entrained Soil Particles	0.0084	2E-08
Total (All Pathways)	**0.24**	**1E-07**
Percent contribution by arsenic	96%	100%

Risk Characterization of Off-Site Residential Exposure - Inhalation Pathways Only
Gallows Hill Park, Salem, Massachusetts

Inhalation of Entrained Soil Particles

$$ADE = \frac{C_{soil} \times FI \times PM_{10} \times IH_W \times RAFi \times EF \times ED \times EP \times CF1 \times CF2}{AP \times IH_A}$$

HQ = **ADE(nc) / RfCs**
HI = **Sum [HQ]**
Risk = **ADE(ca) x IUR**

ADE = Average daily exposure (mg/m^3) (nc = noncarcinogen; ca = carcinogen)
C_{soil} = Constituent concentration in soil (mg/kg)
FI = Fraction inhaled that is retained in lungs (unitless)
PM_{10} = Particulate matter concentration in air (</= 10 microns) (ug/m^3)
IH_W = Worker inhalation rate (L/min)
RAFi = Inhalation Relative absorption fraction (unitless)
EF = Exposure frequency (events/yr)
ED = Exposure duration (hr/event)
EP = Exposure period (yr)

CF1 = Unit conversion factor [(min-kg-m^3)/(hr-ug-L)]
CF2 = Unit conversion factor (yr/dy)
IH_A = Assumed inhalation rate (m^3/dy)
AP = Averaging period (dy)
RfCs = Subchronic reference concentration (mg/m^3)
HQ = Non-carcinogenic Hazard Quotient (unitless)
HI = Total Hazard Index (unitless)
Risk = Excess lifetime cancer risk (unitless)
IUR = Cancer inhalation unit risk [(mg/m^3)$^{-1}$]

Change

Constituent	C_{soil} (mg/kg)	FI (unitless)	PM_{10} (ug/m^3)	IH_W (L/min)	RAFi (unitless)	EF (events/yr)	ED (hr/event)	EP (yr)	CF1 (min-kg-m^3)/(hr-ug-L)	CF2 (yr/dy)	IH_A (m^3/dy)	AP (nc) (yr)	ADE (nc) (mg/m^3)	RfCs (mg/m^3)	HQ (unitless)	AP (ca) (yr)	ADE (ca) (mg/m^3)	IUR [(mg/m^3)$^{-1}$]	Risk (unitless)
Arsenic	633	0.5	60	14	1	130	8	1	6.00E-11	2.74E-03	20	0.5	4.55E-06	0.00002	0.23	70	3.25E-08	3	1E-07
Chromium (total)	332	0.5	60	14	1	130	8	1	6.00E-11	2.74E-03	20	0.5	2.38E-06	0.0003	0.01	-	-	-	-
Lead	126	0.5	60	14	1	130	8	1	6.00E-11	2.74E-03	20	0.5	9.05E-07	0.001	0.001	-	-	-	-
Total												**HI =**			**0.2**	**Risk =**			**1E-07**

Risk Characterization of Off-Site Residential Exposure - Inhalation Pathways Only
Gallows Hill Park, Salem, Massachusetts

Ingestion of Inhaled, Entrained Soil Particles

$$ADD = \frac{C_{soil} \times FI \times PM_{10} \times IH_W \times RAFo \times EF \times ED \times EP \times CF1 \times CF2}{BW \times AP}$$

HQ = ADD (nc)/RfDs
HI = Sum [HQ]

ADD = Average daily dose (mg/kg-dy) (ca = carcinogens, nc = non-carcinogens)
C_{soil} = Constituent concentration in soil (mg/kg)
FI = Fraction inhaled that is ingested (unitless)
PM_{10} = Particulate matter concentration in air (</= 10 microns) (ug/m^3)
IH_W = Worker inhalation rate (L/min)
RAFo = Relative absorption fraction (unitless)
EF = Exposure frequency (events/yr)
ED = Exposure duration (hr/event)
EP = Exposure period (yr)

CF1 = Unit conversion factor [(min-kg-m^3)/(hr-ug-L)]
CF2 = Unit conversion factor (yr/dy)
BW = Body weight (kg)
AP = Averaging period (yr)
HQ = Non-carcinogenic Hazard Quotient (unitless)
RfDs = Subchronic Reference Dose (mg/kg-dy)
HI = Total Hazard Index (unitless)
Risk = Excess lifetime cancer risk (unitless)
IUR = Cancer inhalation unit risk [(mg/m^3)$^{-1}$]

Constituent	C_{soil} (mg/kg)	FI (unitless)	PM_{10} (ug/m^3)	IH_W (L/min)	RAFo (unitless)	EF (events/yr)	ED (hr/event)	EP (yr)	CF1 [(min-kg-m^3)/(hr-ug-L)]	CF2 (yr/dy)	BW (kg)	AP (nc) (yr)	ADD (nc) (mg/kg-dy)	RfDs (mg/kg-dy)	HQ (unitless)	AP (ca) (yr)	ADD (ca) (mg/kg-dy)	OSF [mg/kg-dy)$^{-1}$]	Risk (unitless)
Arsenic	633	1.5	60	14	0.5	130	8	1	6.00E-11	2.74E-03	58.7	0.5	2.32E-06	0.0003	0.0077	70	1.66E-08	1.5	2E-08
Chromium (total)	332	1.5	60	14	1	130	8	1	6.00E-11	2.74E-03	58.7	0.5	2.44E-06	1.5	0.000002	-	-	-	-
Lead	126	1.5	60	14	0.5	130	8	1	6.00E-11	2.74E-03	58.7	0.5	4.62E-07	0.00075	0.0006	-	-	-	-
Total												**HI =**			0.008	**Risk =**			**2E-08**

Risk Characterization of Off-Site Residential Exposure - Inhalation Pathways Only
Gallows Hill Park, Salem, Massachusetts

Exposure Point Concentration

Constituent	Soil Exposure Point Concentration C_S (mg/kg)
Arsenic	633
Chromium (total)	332
Lead	126

Conveyed by Tom Kirton, Tighe & Bond.

Risk Characterization of Off-Site Residential Exposure - Inhalation Pathways Only

Gallows Hill Park, Salem, Massachusetts

Toxicity Values and Relative Absorption Factors

Constituent	Carcinogenic Weight of Evidence Category [1]	Chronic Oral Reference Dose (RfD) (mg/kg-dy)	Subchronic Oral Reference Dose (RfDs) (mg/kg-dy)	Chronic Inhalation Reference Concentration (RfC) (mg/m^3)	Subchronic Inhalation Reference Concentration (RfCs) (mg/m^3)	Oral Cancer Slope Factor (OSF) [$(mg/kg\text{-}dy)^{-1}$]	Inhalation Cancer Unit Risk (IUR) [$(mg/m^3)^{-1}$]	Soil Relative Absorption Factors (RAF) [2] (unitless)	
								Oral	Dermal
Arsenic	A	0.0003 [2]	0.0003 [2]	0.00002 [2]	0.00002 [2]	1.5	3	0.5	0.03
Chromium (total)	D	1.5 [2]	1.5 [2]	0.0001 [2]	0.0003 [2]	-	-	1	0.1
Lead	B2	0.00075 [2]	0.00075 [2]	0.001 [2]	0.001 [2]	-	-	0.5	0.006

2. Obtained from MassDEP(2014) Method 1 Numerical Standards and supporting documentation.

Park Visitor - Soil Imminent Hazard Evaluation: Table PSIH-1
Exposure Point Concentration (EPC)
Based on Visitor Ages 1-6 (Cancer) and 1-2 (Noncancer)

ShortForm Version 10-12
Vlookup Version v0315

ELCR (all chemicals) = 1.2E-04
Subchronic HI (all chemicals) = 7.8E+00

****Do not insert or delete any rows****
Click on empty cell below and select OHM using arrow.

Oil or Hazardous Material	EPC (mg/kg)	$ELCR_{ingestion}$	$ELCR_{dermal}$	$ELCR_{total}$	Subchronic HQ_{ing}	Subchronic HQ_{derm}	Subchronic HQ_{total}
ARSENIC	8.7E+02	7.9E-05	3.7E-05	1.2E-04	5.8E+00	2.0E+00	7.8E+00

MassDEP ORS
Contact: Lydia Thompson
Lydia.Thompson@state.ma.us
617-556-1165

Tighe&Bond

APPENDIX D

RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™

February 10th, 2019

Mr. Todd D. Kirton, LSP
Senior Hydrogeologist
Tighe & Bond
446 Main Street
Worcester, MA 01608

Via Email: TDKirton@tighebond,com

Re: Utility Detection & Subsurface Investigation
Using GPR, EM-61, EM-31 & EMI
Gallow Hills Park
50 Proctor Street
Salem, Massachusetts

Dear Todd,

In accordance with your authorization, Radar Solutions International (RSI) conducted ground penetrating radar (GPR), EM-61, EM-31, and EM Induction (EMI) survey at the above-referenced site in Salem, Massachusetts on February 5th, 2019 The purpose of this geophysical survey was to determine the location and depth of potential utilities and other subsurface features to avoid in upcoming construction work. RSI's finalized survey results and interpretations are summarized below.

LOCATION AND SURVEY CONTROL

The site was located at the Gallow Hills Park in Salem MA. RSI used EMI, Geonic's EM-61 & EM-41, and Sensor's & Software NOGGIN® portable digital radar system with a 250 MHz antenna to investigate this area. GPR data were collected in lines every 2.5 feet with cross lines every 5 feet. EM-61 data were collected every 2.5 feet across the investigative area. EM-31 lines were collected every 5 feet across the investigative area. EMI was used to sweep the entire area for live, 60 Hz energy, and clamp onto any existing utilities.

METHODOLOGY

EM Induction (EMI)

RSI used an EM Induction tool, in this case a Radio Detection RD8000 (i.e. a sophisticate pipe and cable locator), to detect any live (60-cycle) electrical conduits and those non-electrical utilities to which we can clamp a transmitter. This sophisticated pipe and cable locator has been used with great success at other locations.

The EM induction tool can operate in 4 different modes: ***Receiver only mode***, detecting 60 cycle power (or harmonics thereof), ***Direct Contact/Clamp-on*** mode, where the transmitter hooks the positive lead directly to the pipe or cable while the negative lead is grounded, ***Direct-coupled/ Inductive mode***, where an inductive clamp is place around the pipe or cable, and

Remote Beacon mode, where a transponding beacon is placed on a fiberglass rodder and threaded through non-conductive pipes and traced from the surface using a receiving antenna.

Mode #1 (*Receiver only mode*) only detects active electric lines or anything else that emits a 60-cycle signal. Telephone, cable, fiberoptic, gas, and any other plastic utility with a 60-cycle tracer wire (or tape) can also be detected using this mode. The disadvantage of this mode is that if a utility trends beneath rebar and the rebar matt is not grounded or the soil is conductive, false readings can occur, especially if the receiver's gains are turned up high. **Also, if the electrical cable is located within a heavily reinforced concrete duct bank, or within an oil-filled insulated pipe, it may be shielded, and hence, not detectable.**

Mode #2 (*Direct Contact/Clamp-on*) is the best method for directly tracing pipes, although, its success is contingent upon having a good ground and the pipe's outer surface being conductive enough to induce a signal down it. In some instances, such as gas transmission lines, pipe segments are isolated from each other with insulators so that self-potential (i.e. naturally-occurring energy from the earth's field) does not build up along the pipeline. Also, cast iron, especially when rusty, may not transmit a current well. Also, this mode can not be used for PVC, asbestos concrete, clay, and plastic pipes, as they do not transmit current at all.

Mode #3 (*Direct-coupled/ Inductive mode*) is another reliable way of inducing a current down a pipe. This, like Mode #2, relies on the pipe being conductive enough to induce a signal through it. If a pipe is not accessible, but its trend is known in one location, then it may be possible to induce a current by having the transmitter broadcast a signal. The success of this mode relies on the pipe being sufficiently conductive, and the soil being sufficiently resistive, so signal travels down the pipe and not into the soil.

Mode #4 (*Remote Beacon mode*) is typically used for detecting non-conductive pipes. It can only be used for non-conducting pipes, such as vitrified clay, asbestos concrete, PVC, plastic, and occasionally reinforced concrete. This method only works, however, if there is direct access to one end of the utility, and if it is located no more than 8 feet below grade.

Ground Penetrating Radar (GPR)

The GPR method operates by transmitting low-powered microwave energy into the ground using an ultra-wide band (UWB) transceiver antenna. The GPR signal is then reflected back to the antenna by materials with contrasting electrical impedance, which is primarily determined by dielectric and conductivity properties of the material, its magnetic permeability, and its physical properties. The greater the contrast in the real dielectric permittivity (RDP) of two materials, the greater the reflection amplitude. The highest-amplitude reflections occur where metal and/or reinforced concrete is encountered. High-amplitude reflections also occur at lithologic or mineralogic changes, such as between a concrete slab and gravel fill layer, or where there is a sudden change in water content.

Reflections observed on GPR records can be non-unique, meaning that a similar reflector can be caused by different objects. Objects, such as rebar, utilities, and USTs that have a discrete length and width typically produce hyperbolic reflections that appear similarly on the radargram. By mapping the horizontal continuity of targets, depths, and reflective amplitude, it is possible to differentiate between targets, especially, if depth-slice imaging is performed on the data.

For this survey, RSI used Sensors & Software NOGGIN® portable digital radar system with a

250 MHz antenna. To acquire GPR data, once the antenna is switched on, the antenna and cart with a survey wheel encoder is moved along the ground at a normal walking pace to ensure good coupling of the radar antenna with the ground.

A cross-section of the subsurface is generated wherever the antenna is moved. The horizontal scale on each GPR record is determined by the antenna speed as it is moved by the operator. The vertical scale of these radar "cross-sections" is determined by the recording interval, which was 80 ns for the 250 MHz antenna, which represents the maximum two-way travel time in which data is recorded. This recording interval was selected to be greater than the anticipated maximum two-way travel time during which real GPR reflections might be observed. GPR travel times were converted to approximate depths using an estimated soil velocity and the depths of buried targets plotted.

GPR data were processed by assembling individual lines (files) into a 3D volume and visually inspecting the data, and by using GPR-Slice© to image the 3D volume as plan-view depth slices. This state-of-the-art 2D and 3D GPR imaging software quantifies GPR results by digitizing the amplitude of reflection from each GPR record, looks for horizontal correlation of features across adjacent and nearby parallel lines, assembles them into a 3D image, then contours the data at each time/depth interval specified by the user. Below is a schematic showing how this imaging process works.

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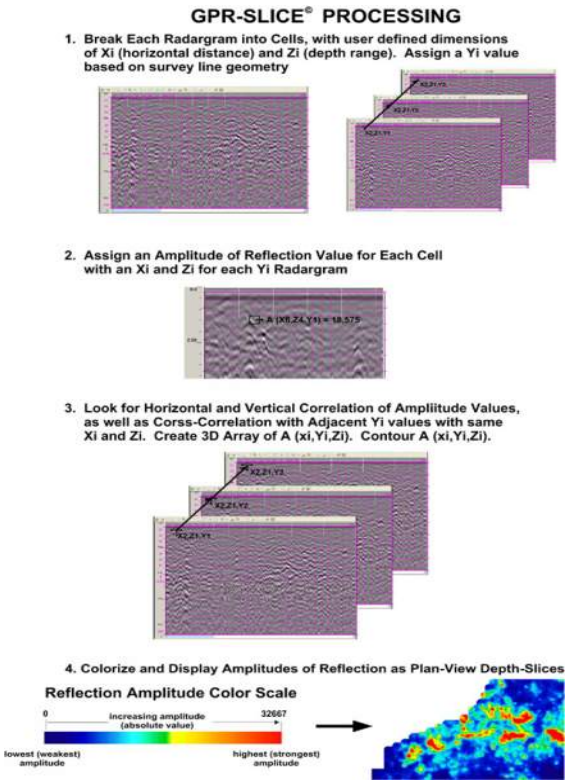

51 Riverview Avenue, Waltham, MA 02453
Telephone: (781) 736-0550 / Fax: (781) 736-0004
www.radar-solutions.com

EM-61

Manufactured by Geonics, Inc., the EM-61 is a time-domain electromagnetic instrument developed to find unexploded ordinances (UXOs) and other buried metal targets in environments where there may be a lot of interference from surface metal and overhead power lines. According to tests conducted by the manufacturer and reports from other geophysical service providers, the EM-61 is has a sensitivity sufficient to detect metal objects as small as a few centimeters.

The EM-61 operates on the principle that the time-decay rate (i.e. transient pulse) of a signal induced in metal decays proportionally to the mass of the metal object. The EM-61 works by generating an EM signal of known frequency and voltage at the transmitter, located in the backpack configuration. In the presence of metal objects, an EM signal is induced when the transmitted signal is applied. When the transmitter is switched off, the induced field decays at a rate specific to the metal mass in which it is induced. The EM-61 top and bottom receiver coils measure the decay voltage at a specific time (i.e. “time gate”) after the transmit pulse has been shut off. The amplitude of the voltage after the transmit pulse has been shut off is proportional to the size of the metal object: the larger the voltage (as measured in millivolts) at the time of the measurement, the larger the metal object. High voltages indicate metal objects. Negative voltages can also indicate both above-ground and buried metal. RSI’s EM-61 Mrk2 measures the voltages at four different time-gates, which helps determine burial depth and size of the target. The larger targets have larger induced voltages at the later time-gates.

The EM-61 operates by pulling or pushing the instrumentation along survey lines spaced 2.5 feet apart. Data can be collected using an encoder or “DMI” - distance measurement instrument, which is built into the EM-61's left wheel, or on a time-basis. A sub-meter accuracy GPS system can also be interfaced with the EM-61, thus eliminating the need and expense to construct a survey grid. The station spacing varies, depending upon the application.

Several different data sets are generated from the two measurements made at top and bottom receiver coils and at the four different time-gates. Differential measurements, obtained from subtracting the bottom receiver coil measurements from the top, help determine whether the anomaly is caused by above or below ground sources. Differential data are also used to minimize the response from at or very near surface (i.e. 1 cm deep or less) metal. Positive voltages in the differential contour map shown in red, magenta, and pink, indicate buried metal. Blue or black filled contours indicate above-ground sources of metal.

EM-31

The terrain conductivity survey was conducted using a Geonics Model EM31-DL Terrain Conductivity Meter. This induction-type instrument measures terrain conductivity without electrodes or direct soil contact. The terrain conductivity method operates on the principle that secondary electric and magnetic currents can be induced in metal objects and conductive bodies, such as iron or steel USTs, when an electric field is applied. This instrumentation measures the secondary magnetic field strength relative to the primary magnetic field and converts it directly into a conductivity value, measured in millimhos per meter (mmhos/m) and a resolution of 1 mmho/m.

The EM-31 also records the amount of phase-shift occurring between primary and secondary magnetic fields. The in-phase component measures that portion of the secondary magnetic field that is aligned with the primary field. Because metal objects are almost perfect conductors, there is sometimes no phase shift between primary and secondary magnetic fields. Hence, metal objects are detectable using the in-phase component (measured in parts per thousand or ppt). Additionally, in the presence of metal, conductivity values are often negative ("polarity reversals") and highly irregular.

The transmitting and receiving coils in the EM31-DL have a fixed separation of 3 meters, and when used in its normal operating mode (vertical dipole mode), the EM-31 achieves a depth of penetration of about 6 meters. The instrument response is more affected by near-surface than by deeper material, especially when used in the vertical dipole mode. Conductivity and in-phase data were digitally stored and transferred to computer, where they were contoured.

RESULTS

Figure 1 is the general investigative area with utilities marked out real time in the field detected by the EMI. Figures 2a-2b shows contoured results from the EM-61 and EM-31 respectively, images show buried metal anomalies within investigative area as well as conductive soil. Figures 3A-3J are GPR depth slice images, a computer generated plan view of specific thickness of soil volume showing features of similar density (i.e. utilities, UST, and buried RCP). Figure 4 is the visual inspection of GPR data, which shows the results of significant GPR anomalies detected throughout the surveyed area. Figure 5 are the combined results from all 4 techniques (EMI, GPR Depth Slice Imaging, and Visual Inspection). Figure 6 are all of the features shown on figure 5 with the sanborn map georeferenced. Please note that EM-61and EM-31 data does not have the capabilities of determining depth of features.

- Figure 1 general area of investigation shows the storm drain lines detected by the use of the EMI and by opening up manholes. These utilities were already known and mapped from previous surveys. No other utilities were detected live in the field using EMI, however multiple other features were detected using the other three (3) methods.

- Figure 2a, contoured EM-61 data, detected multiple buried metal anomalies within the investigative area. EM-61 confirmed the location of the storm drain lines detected by the EMI. Please note not all lines associated with the storm drain system were detected by the EM-61, because some of the other lines are made of plastic (Figure 2).

- Located at (300E,50N) is a large metal mass area coincident with the location of the former tannery building (Figure 2). Trending off of former tannery building at (300E,50N) is a possible utility that extends to (175E,80N) to another utility extending across the investigative area from (195E,20N) to (200E,220N). Located near the test pit at (90E,120N) is a large flat metal structure, possible buried septic tank or vault. We suspect this feature is related to the drainage system due to the utility that extends from this metal structure at (90E,120N) to the storm drain line at (130E,135N) (Figure 2). Note that the areas that showed some response (colored green-red) located throughout the surveyed area is buried metal scrap.

- Contoured EM-31 results (Figure 2b) confirm the location of the metal anomalies detected by the EM-61. Additionally, it appears a high conductive area centered at (200E,100N) was detected North of the metal tannery anomaly (300E,50N) (Figure 2). This large conductive area could be where a former section of the building was located, or an area in which the soil contains a high amount of contaminates.

- GPR depth slice images confirmed a conductive area coincident with the EM-31 high conductivity zone (200E,100N) , we suspect this area is worth test pitting to confirm what is present at this location and confirm soil contamination (Figures 3A-3J). Located at (320E,100N) is a buried slab, which is located just North of the metal anomaly detected by the EM-61. Multiple lineaments were detected trending through the investigative area. One lineament outlines the conductive zone (200E,100N) , detected by both GPR-SLICE and EM-31. GPR slice also confirmed the location of the storm drain system and detected the already known line trending through the basketball court. Furthermore, detected by GPR depth slice imaging is a clay pipe extending from (120E,20N) to the catch basing at (175E,160). Located just Northeast of the test pit (90E,120N) is a large reflective zone centered at (120E,130N) that has the same characteristic of compacted soil as a result fo a large structure residing on top of that location.

- The visual inspection of GPR data further confirmed the location and depth of the storm drain system and the clay pipe within the investigative area (Figure 4). Located near the tannery is a large cluster GPR anomalies at (320E,90N) which is coincident with the high reflective zone detected through GPR depth slice imaging (Figure 4). Located within the Northern portion of the grid are multiple lineaments that could be possible utilities, however, none of these features were detected via the other methods. RSI suspects most of these features are debris left in the ground that are creating false positives, however, please dig with caution around these features. Another area of concern is the large flat area at (50E,100N) located approximately 6 feet below grade.

- Figure 5 are the composite geophysical results showing the overlap of the many features detected throughout this site. RSI recommends on focusing your further investigations on areas with high correlation between the multiple methodologies. Please refer to Table 1 below for test pit locations and descriptions.

TABLE 1:

ID.	Location	Description
RS-T1	(290E,55N)	High amount of buried metal and location coincides with tannery (Figure 6).
RS-T2	(317E,100N)	Anomalies detected at this area are consistent with buried slabs and is located near the former Tannery (Figure 6).
RS-T3	(215E,105N)	Area of high conductivity that codices well with buried metal and former tannery location, possible high soil contamination (Figure 6).
RS-T4	(127E,145N)	Compacted soil area near flat GPR structure hit at test pit (Figure 6).
RS-T5	(75E,135N)	Large flat metal anomaly, possible vault or sceptic system, pipe leads from this feature to storm drain line (Figure 6).
RS-T6	(42E,110N)	Cluster of flat GPR targets that have no historical record, feature is 6 feet below grade (Figure 6).

***

Please do not hesitate to call should you have further questions and comments regarding this report, and we look forward to working again with Tighe & Bond in the near future.

Sincerely,

RADAR SOLUTIONS INTERNATIONAL, Inc.

Doria Kutrubes, M.Sc., P.G.
President and Sr. Geophysicist

Cameron Russ
Associate Geophysicist & GIS Analyst

51 Riverview Avenue, Waltham, MA 02453
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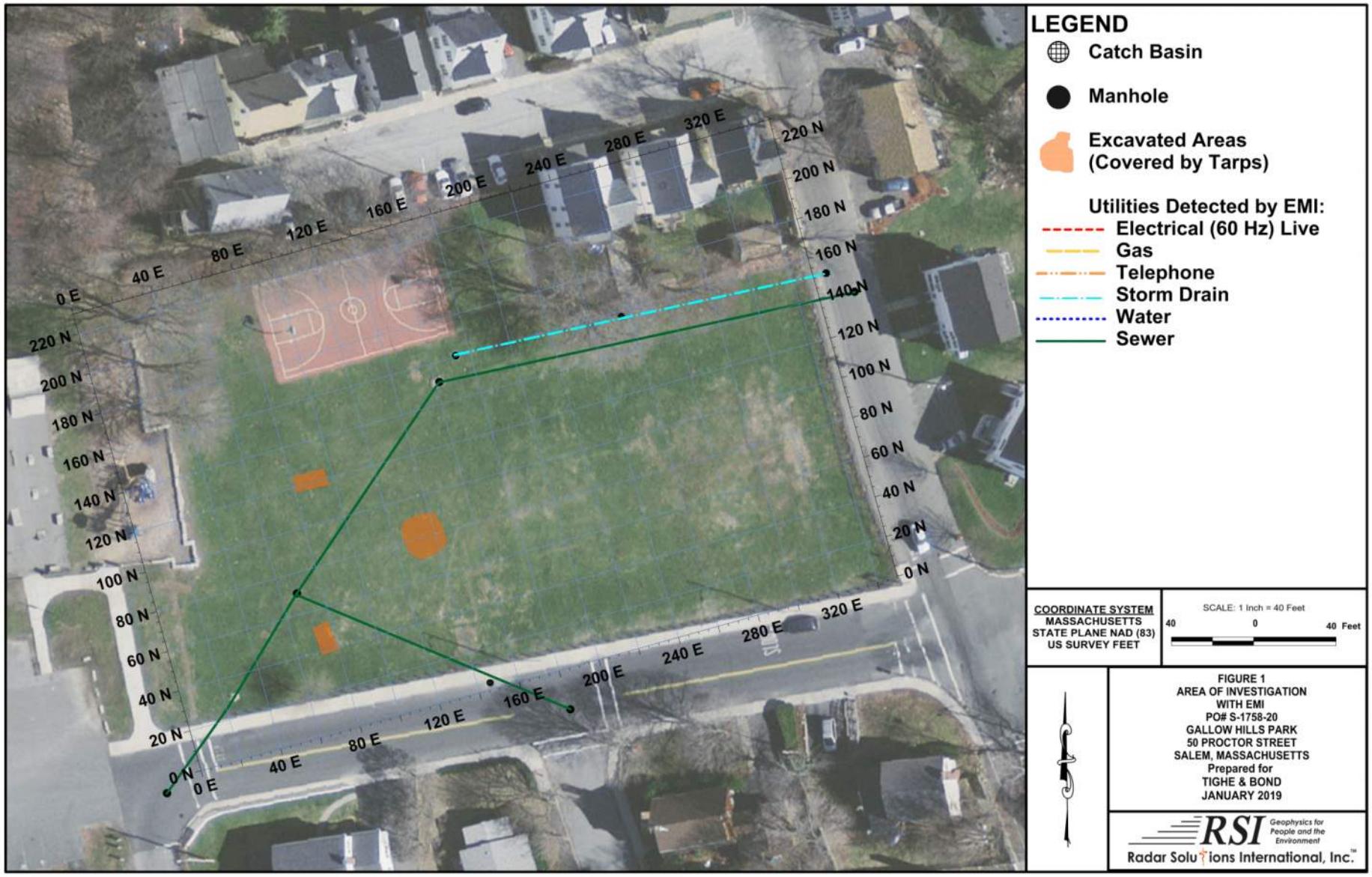
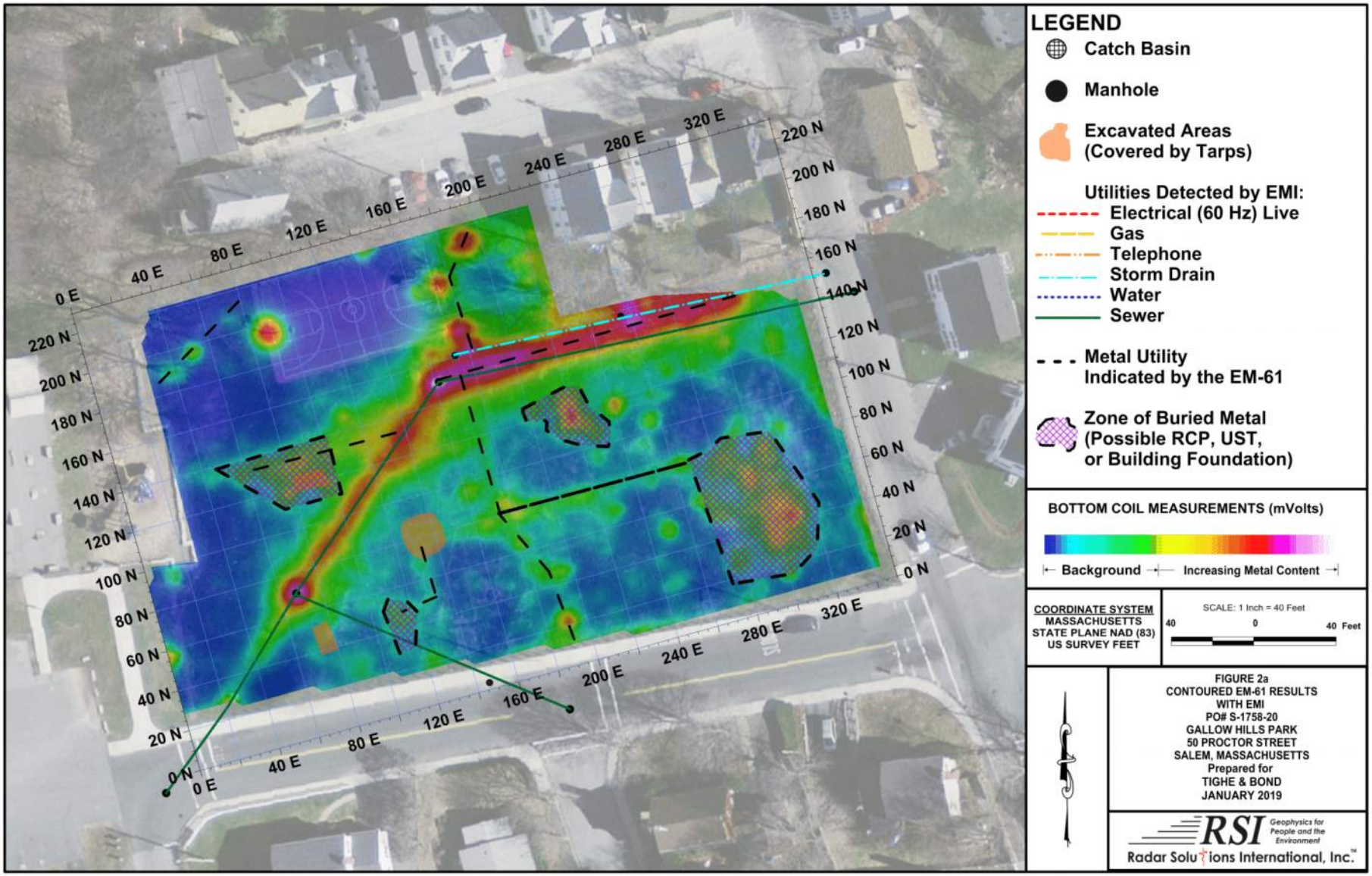
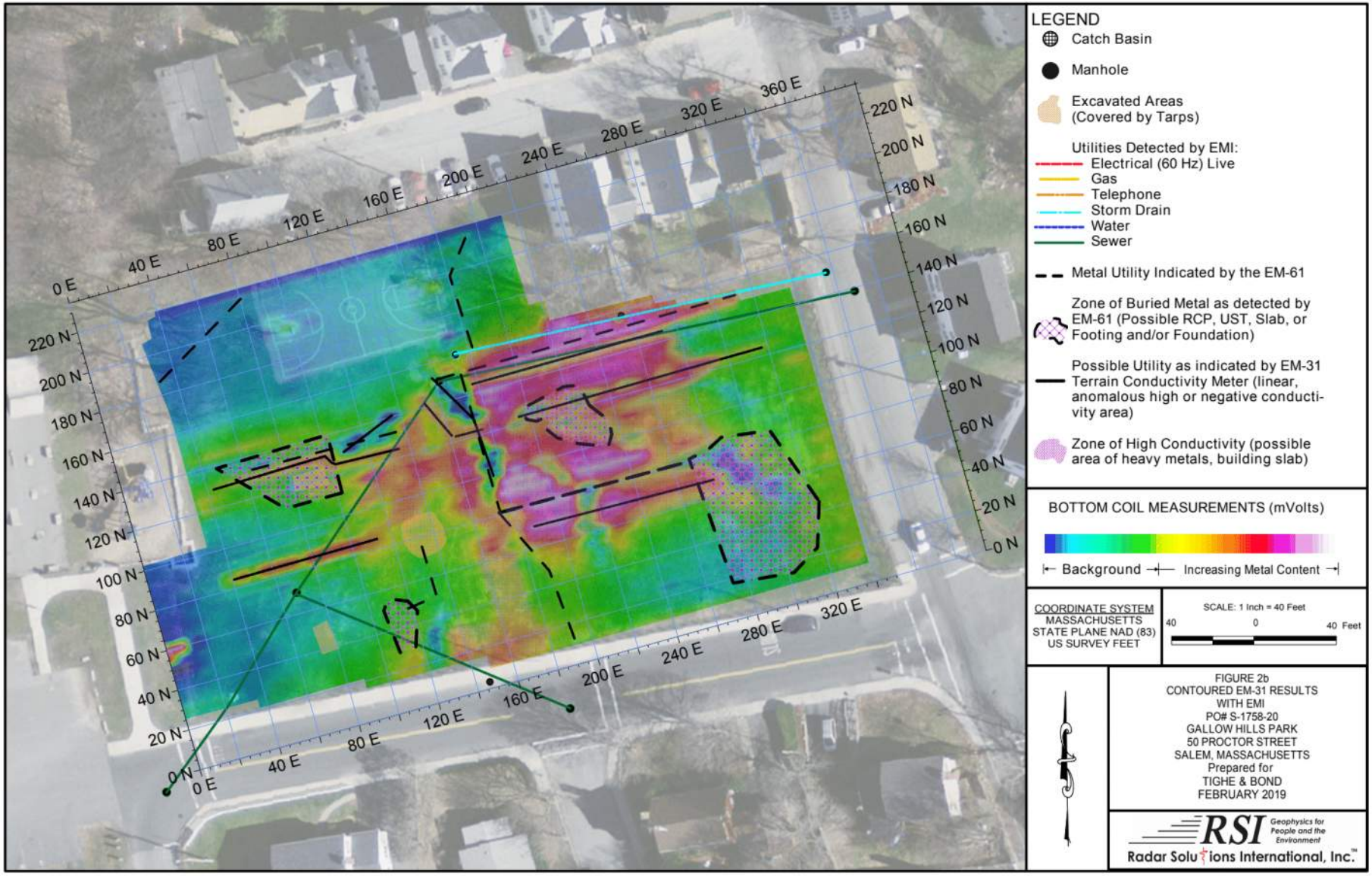
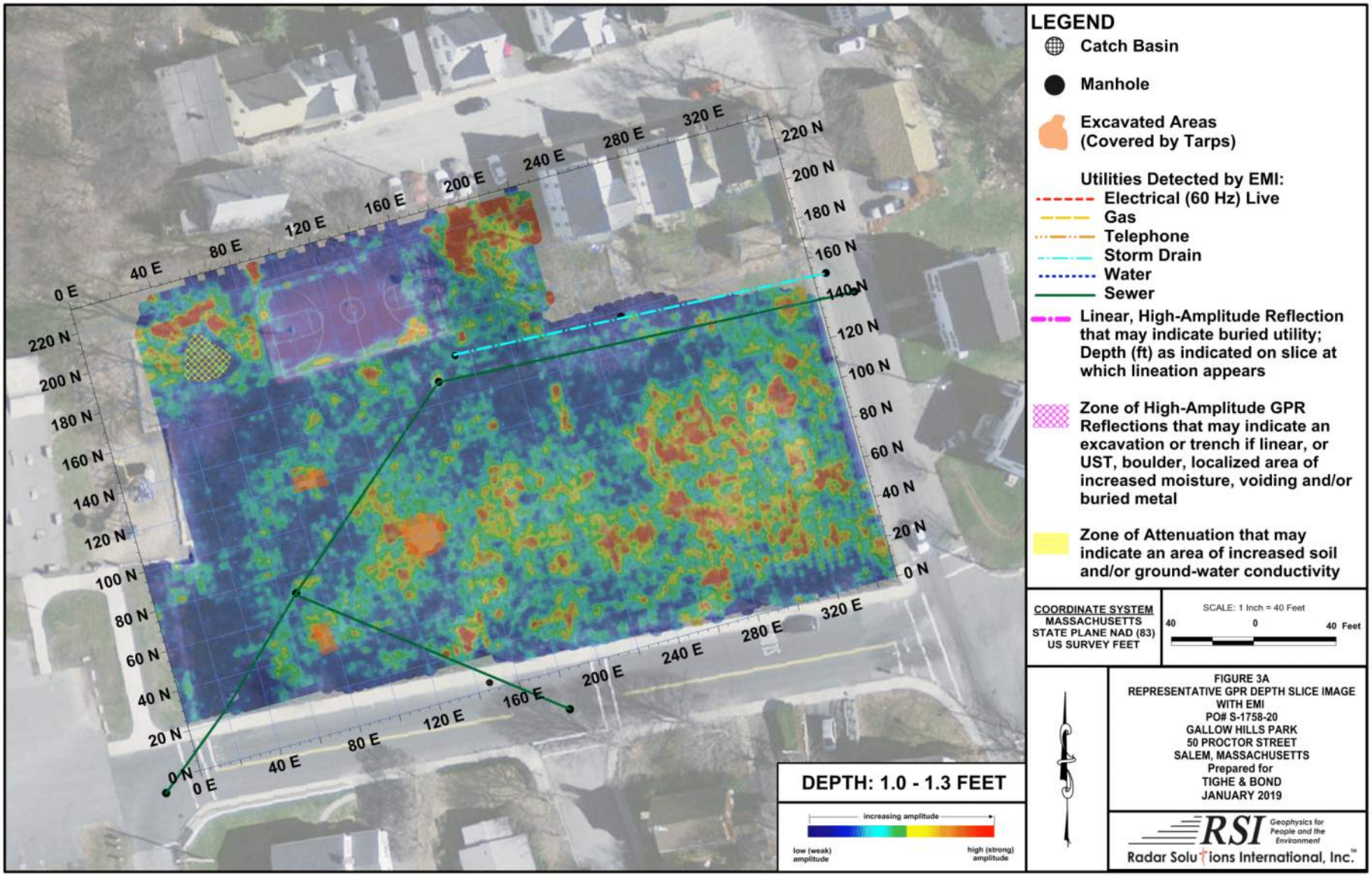
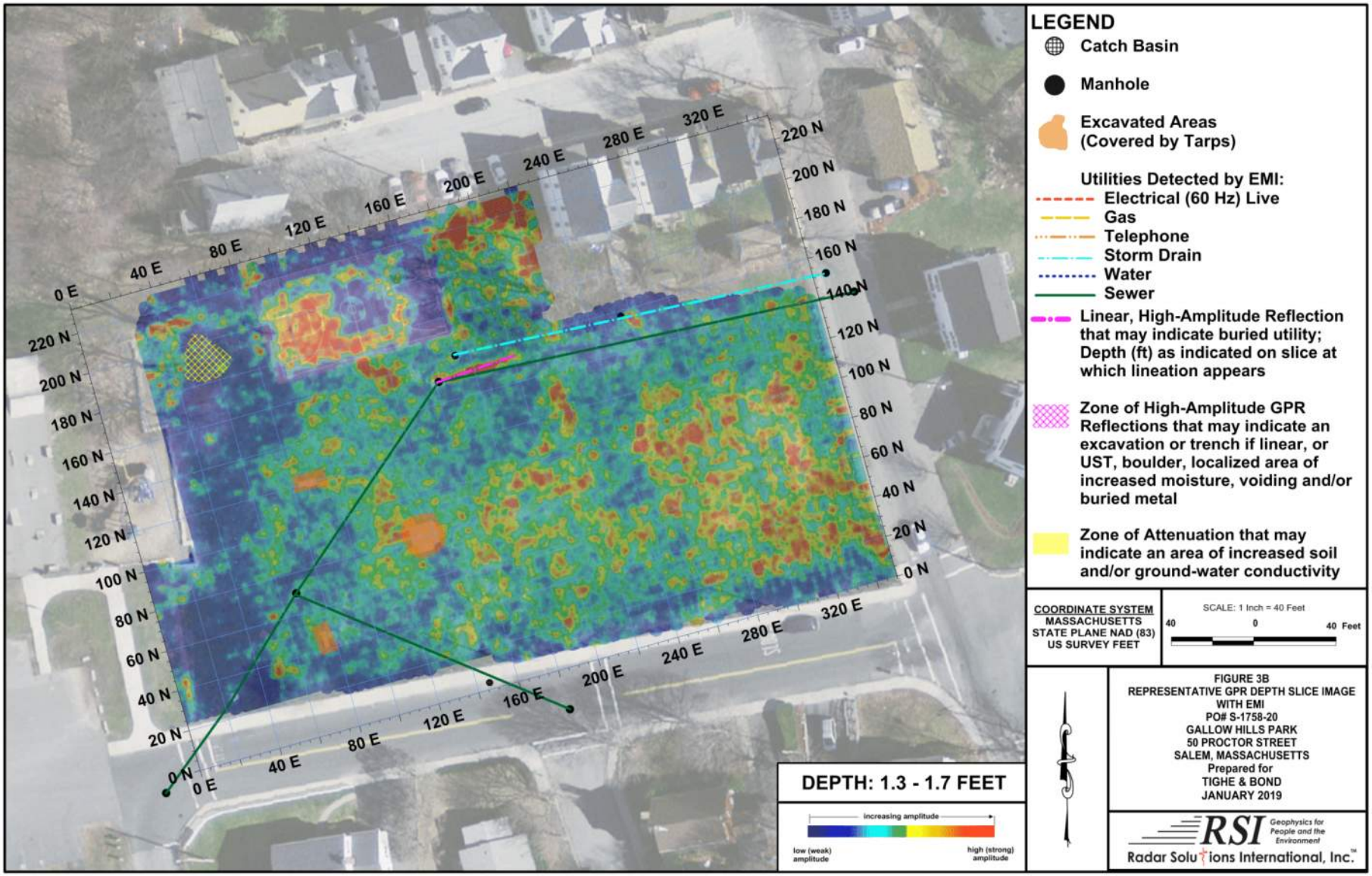

LEGEND
Catch Basin
Manhole
Excavated Areas
(Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
COORDINATE SYSTEM
MASSACHUSETTS
STATE PLANE NAD (83)
US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 1
AREA OF INVESTIGATION
WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

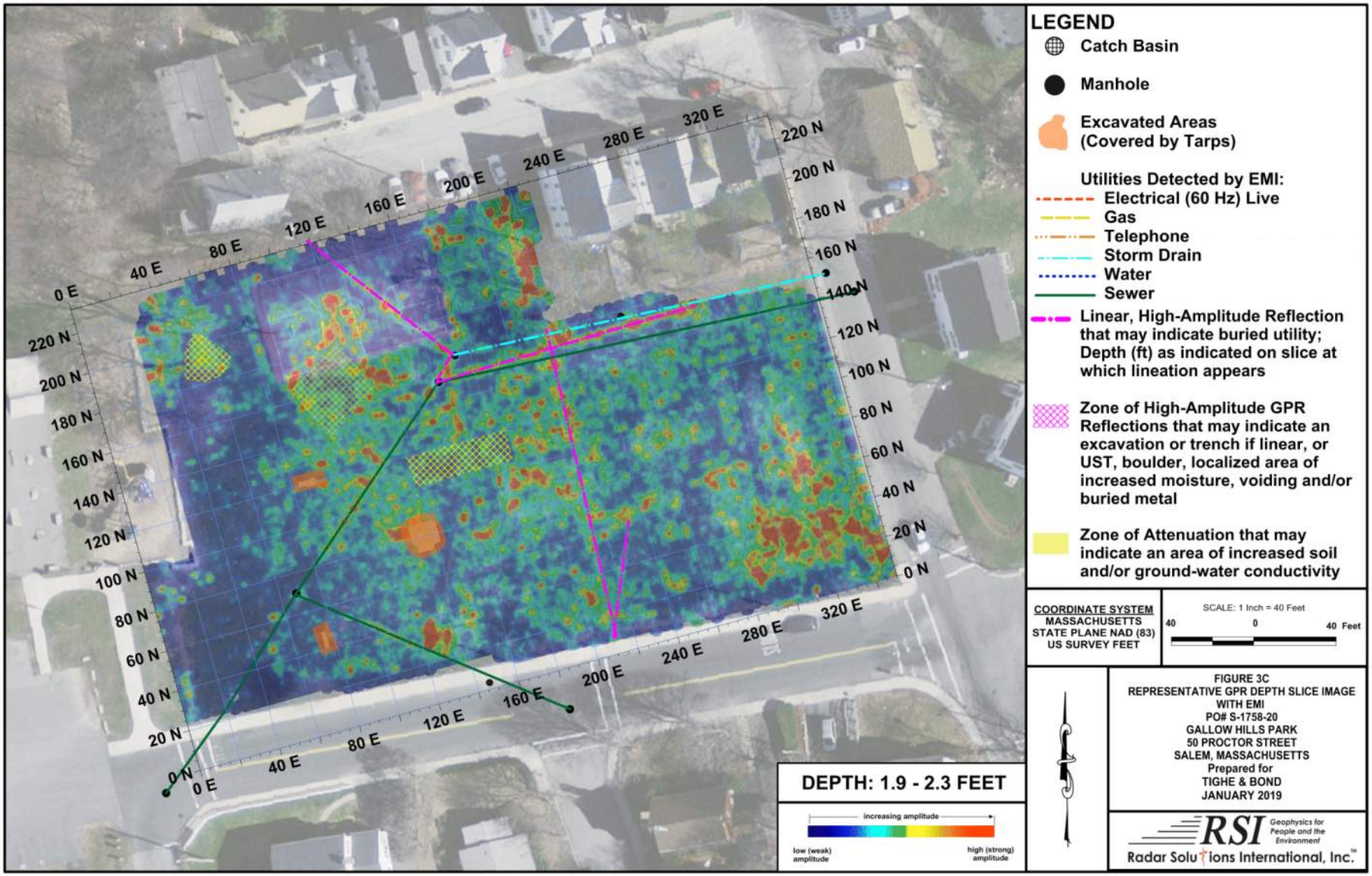

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Metal Utility Indicated by the EM-61
Zone of Buried Metal (Possible RCP, UST, or Building Foundation)
BOTTOM COIL MEASUREMENTS (mVolts)
Background
Increasing Metal Content
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 2a
CONTOURED EM-61 RESULTS WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

1

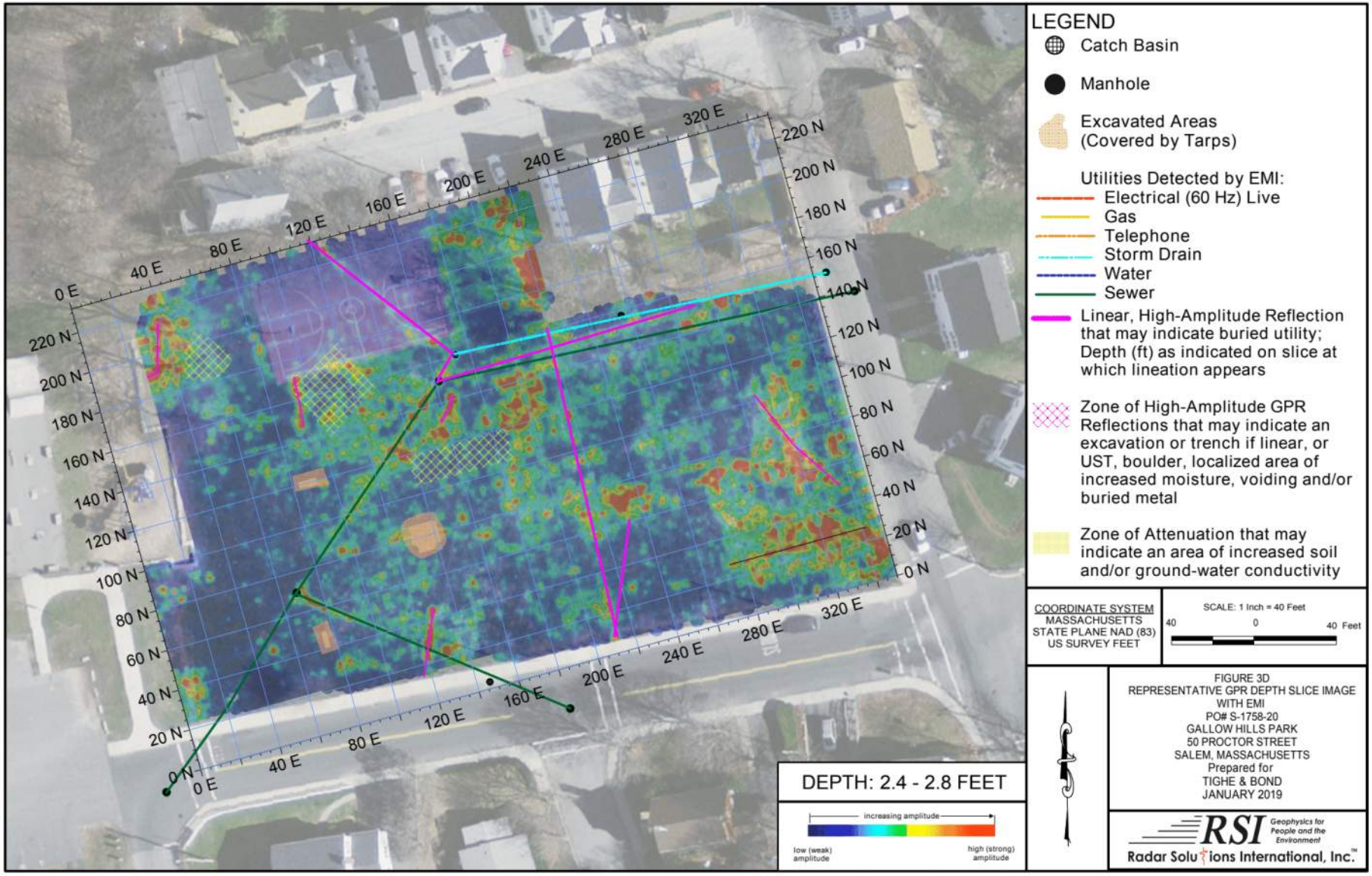

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Metal Utility Indicated by the EM-61
Zone of Buried Metal as detected by EM-61 (Possible RCP, UST, Slab, or Footing and/or Foundation)
Possible Utility as indicated by EM-31 Terrain Conductivity Meter (linear, anomalous high or negative conductivity area)
Zone of High Conductivity (possible area of heavy metals, building slab)
BOTTOM COIL MEASUREMENTS (mVolts)
Background
Increasing Metal Content
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 2b
CONTOURED EM-31 RESULTS WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
FEBRUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
360 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

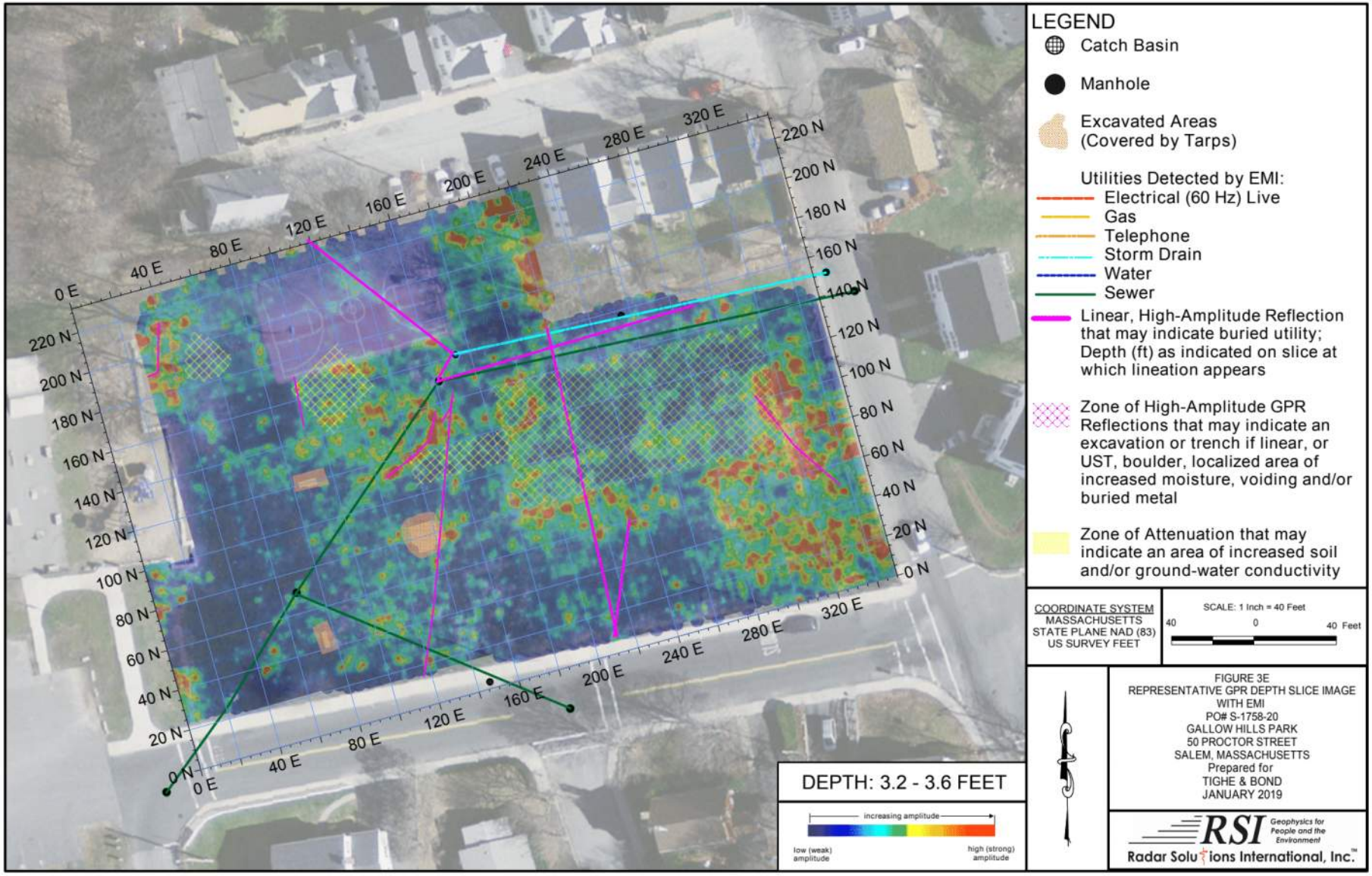

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3A
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 1.0 - 1.3 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

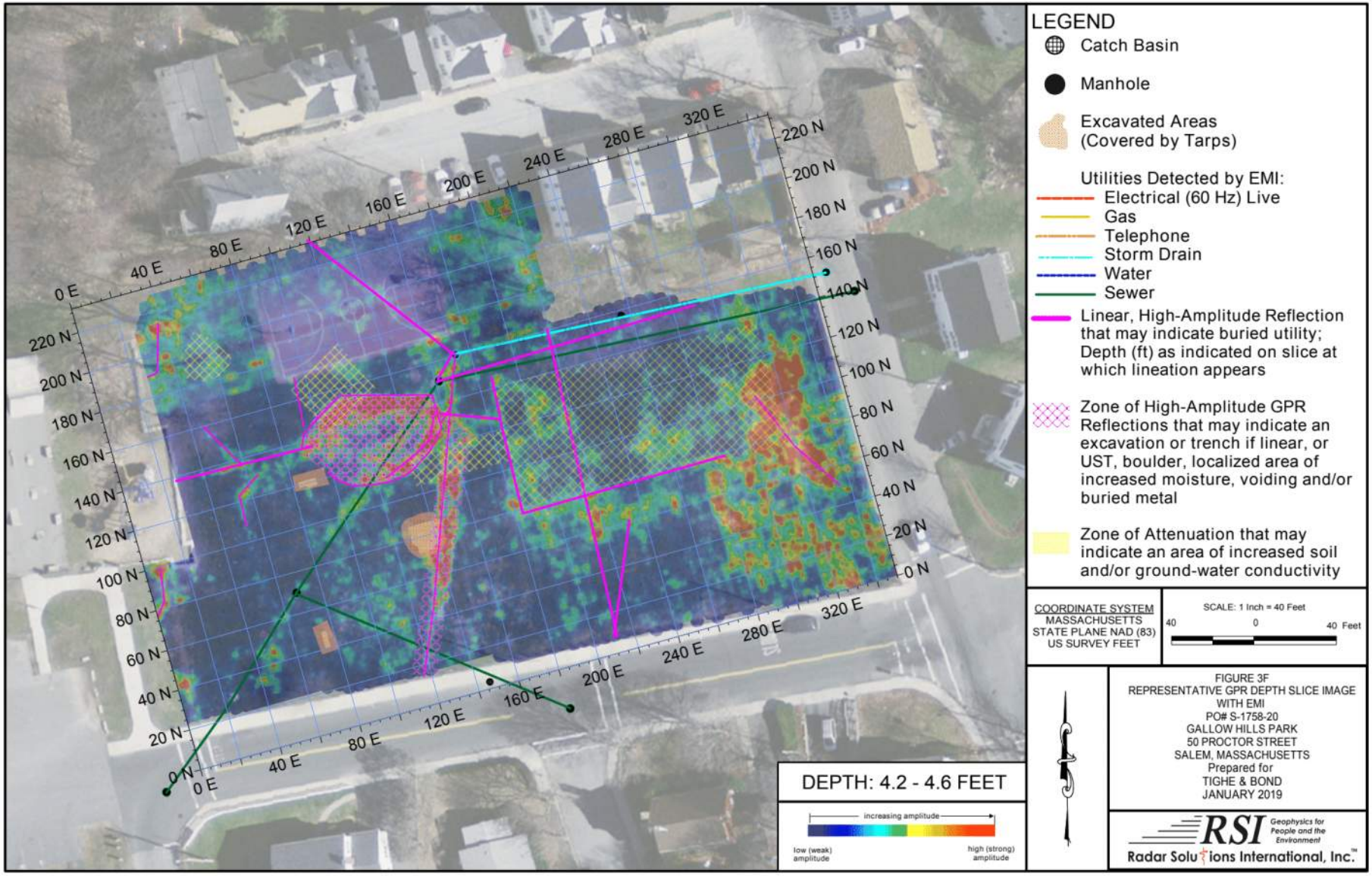

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3B
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 1.3 - 1.7 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

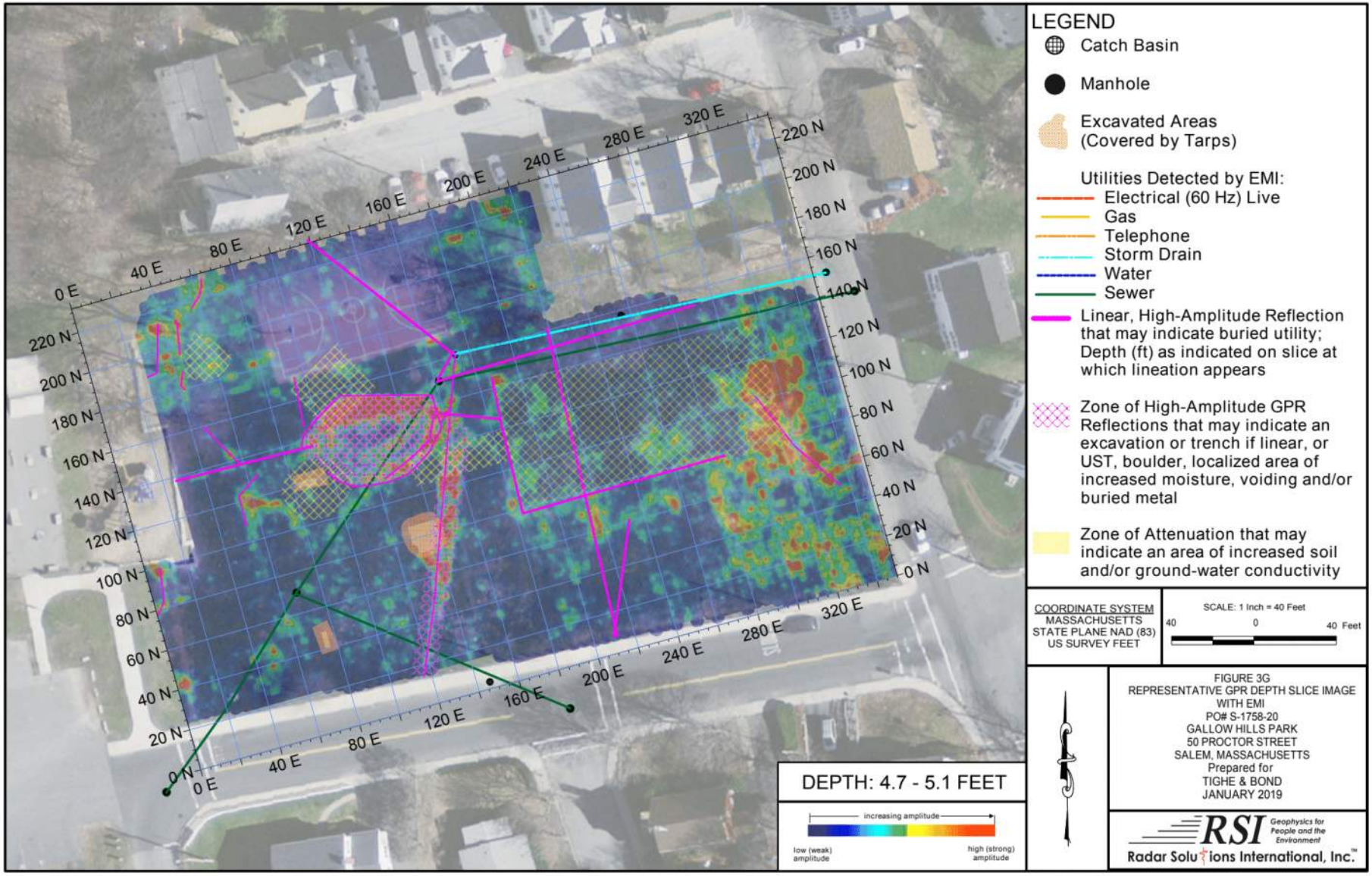

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3C
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 1.9 - 2.3 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N

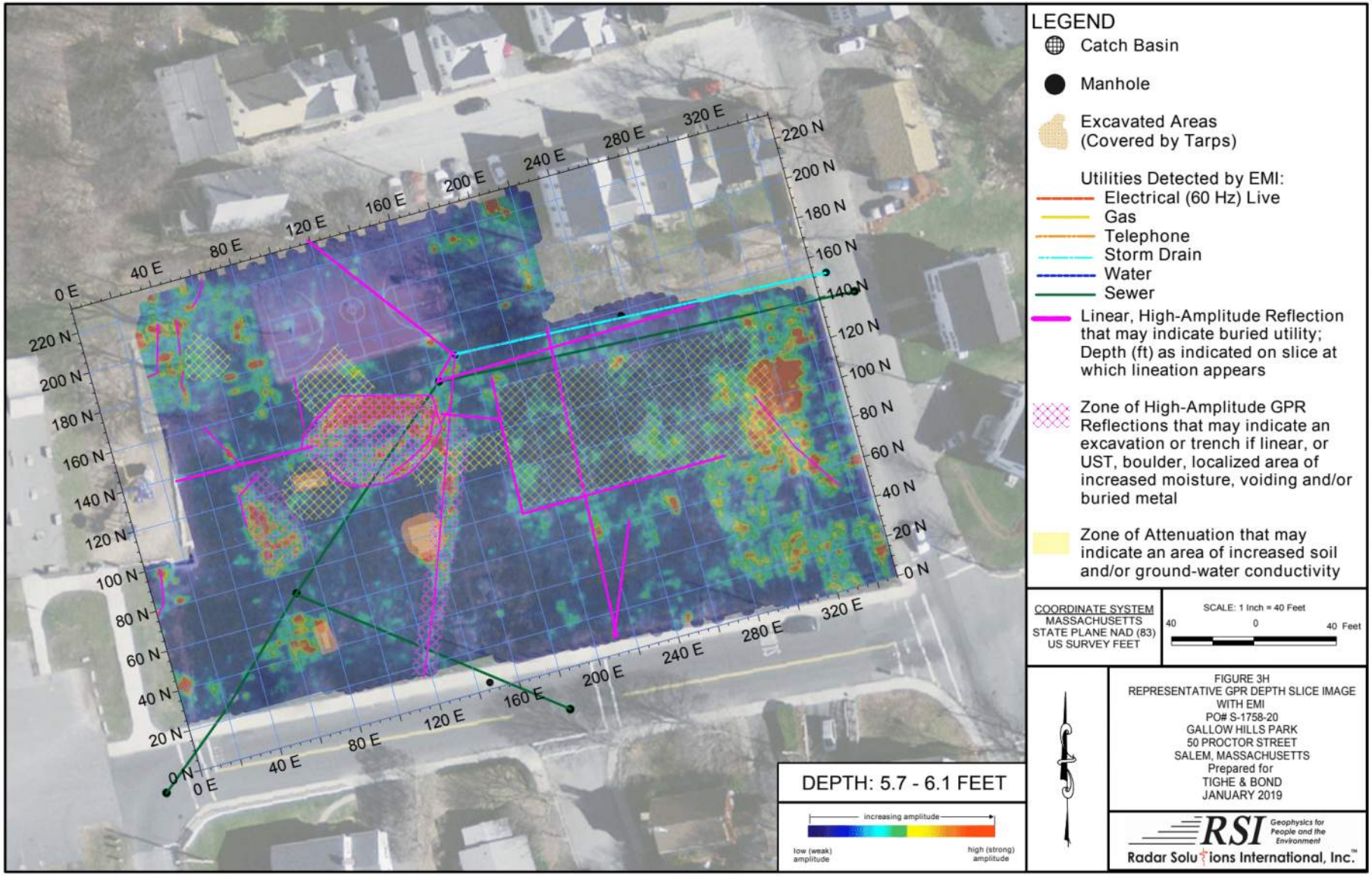
1

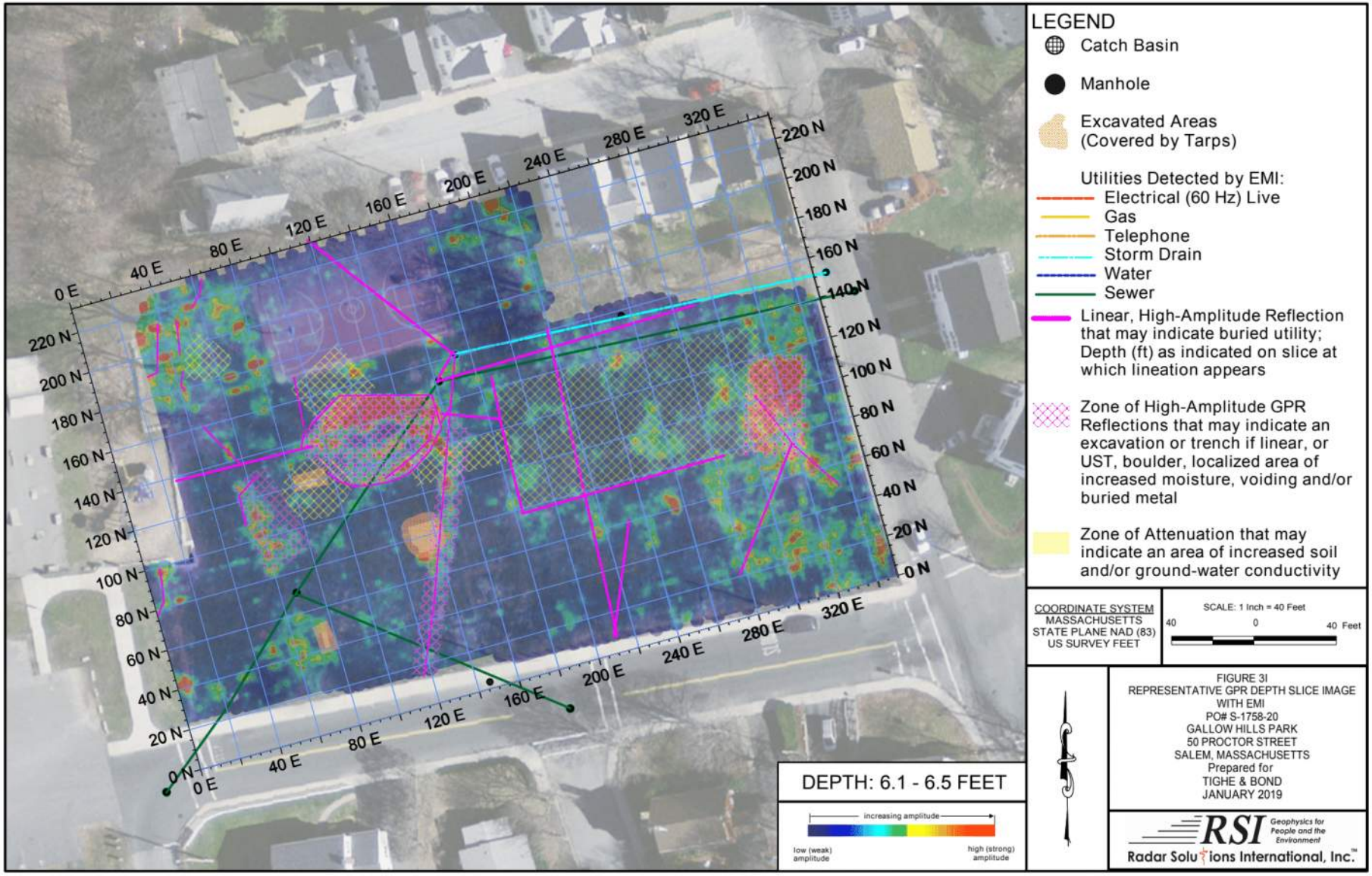

LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3D
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 2.4 - 2.8 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3E
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 3.2 - 3.6 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3F
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 4.2 - 4.6 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3G
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 4.7 - 5.1 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3H
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 5.7 - 6.1 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3I
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
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JANUARY 2019
RSI Geophysics for People and the Environment
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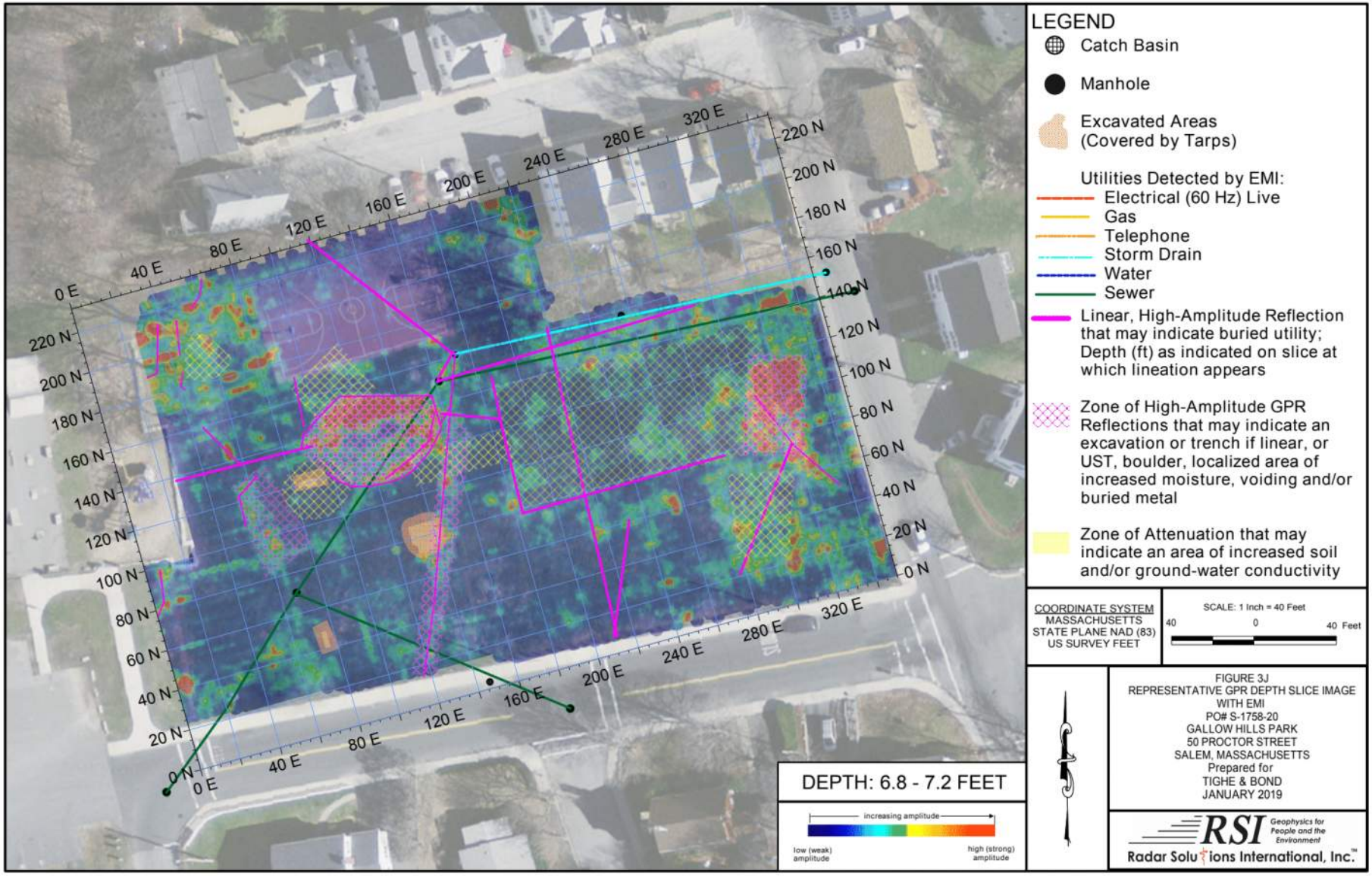
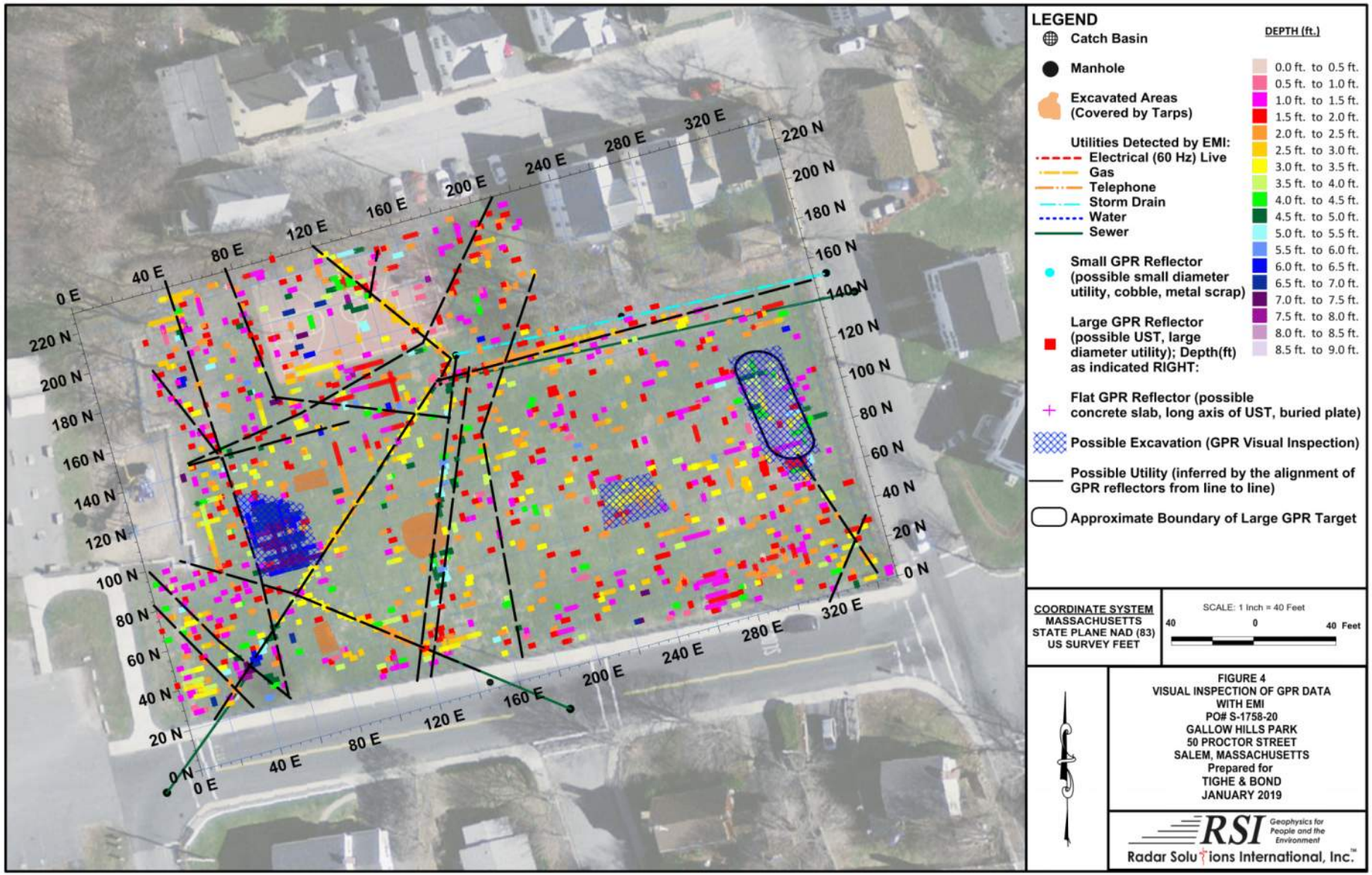
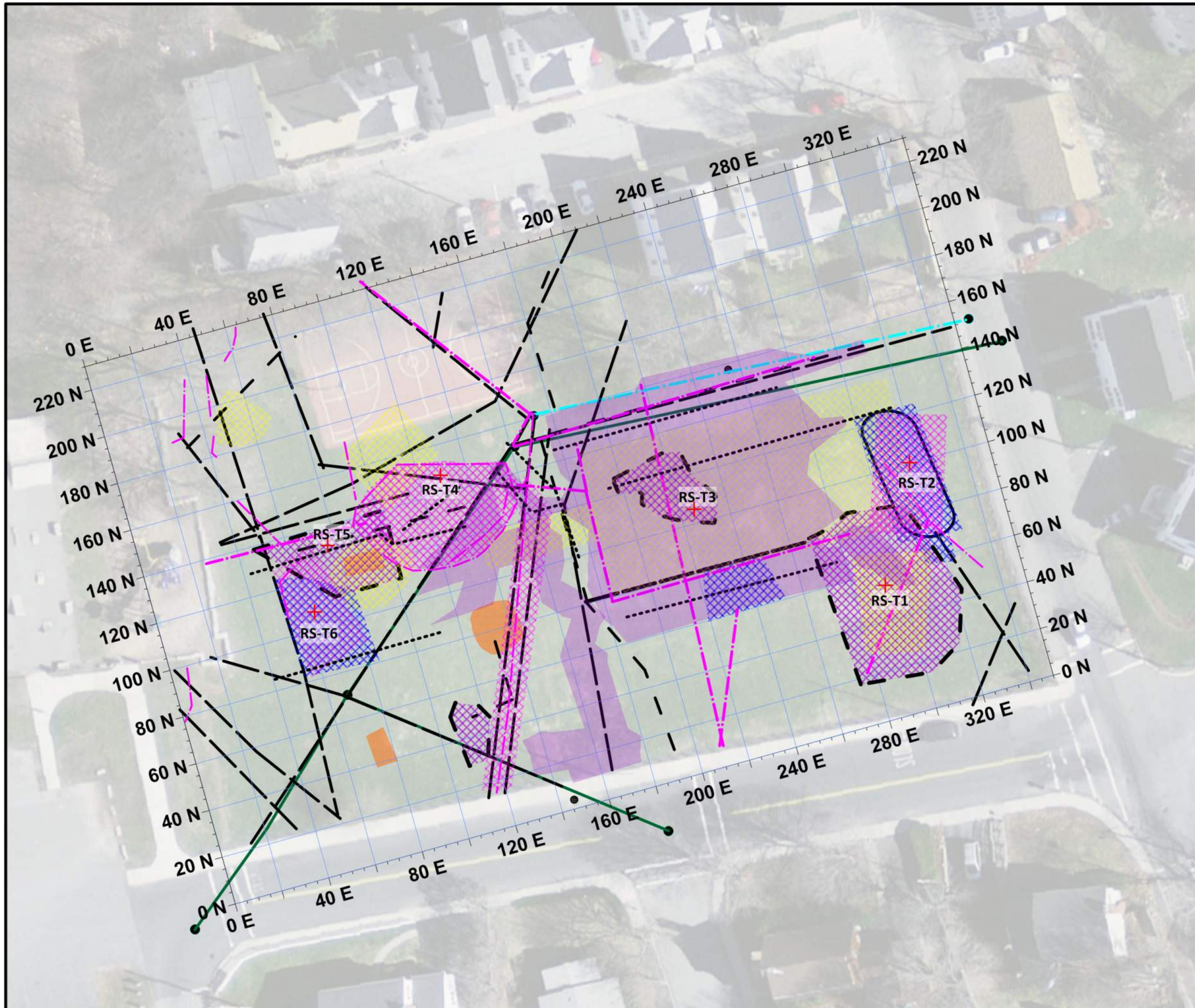
DEPTH: 6.1 - 6.5 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 3J
REPRESENTATIVE GPR DEPTH SLICE IMAGE WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™
DEPTH: 6.8 - 7.2 FEET
increasing amplitude
low (weak) amplitude
high (strong) amplitude
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N


LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Small GPR Reflector (possible small diameter utility, cobble, metal scrap)
Large GPR Reflector (possible UST, large diameter utility); Depth(ft) as indicated RIGHT:
Flat GPR Reflector (possible concrete slab, long axis of UST, buried plate)
Possible Excavation (GPR Visual Inspection)
Possible Utility (inferred by the alignment of GPR reflectors from line to line)
Approximate Boundary of Large GPR Target
DEPTH (ft.)
0.0 ft. to 0.5 ft.
0.5 ft. to 1.0 ft.
1.0 ft. to 1.5 ft.
1.5 ft. to 2.0 ft.
2.0 ft. to 2.5 ft.
2.5 ft. to 3.0 ft.
3.0 ft. to 3.5 ft.
3.5 ft. to 4.0 ft.
4.0 ft. to 4.5 ft.
4.5 ft. to 5.0 ft.
5.0 ft. to 5.5 ft.
5.5 ft. to 6.0 ft.
6.0 ft. to 6.5 ft.
6.5 ft. to 7.0 ft.
7.0 ft. to 7.5 ft.
7.5 ft. to 8.0 ft.
8.0 ft. to 8.5 ft.
8.5 ft. to 9.0 ft.
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 4
VISUAL INSPECTION OF GPR DATA WITH EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.™



LEGEND

- Catch Basin
- Manhole
- Excavated Areas (Covered by Tarps)
- Utilities Detected by EMI:
  - Electrical (60 Hz) Live
  - Gas
  - Telephone
  - Storm Drain
  - Water
  - Sewer
- Small GPR Reflector (possible small diameter utility, cobble, metal scrap)
- Large GPR Reflector (possible UST, large diameter utility); Depth(ft) as indicated RIGHT:
- Flat GPR Reflector (possible concrete slab, long axis of UST, buried plate)
- Possible Excavation (GPR Visual Inspection)
- Possible Utility (inferred by the alignment of GPR reflectors from line to line)
- Approximate Boundary of Large GPR Target
- Metal Utility Indicated by the EM-61
- Zone of Buried Metal (Possible RCP, UST, or Building Foundation)
- Possible Utility as indicated by EM-31 Terrain Conductivity Meter (linear, anomalous high or negative conductivity area)
- Zone of High Conductivity (possible area of heavy metals, building slab)
- Proposed Test Pit Locations (Please refer to Table 1 in the report for descriptions of each location) — RS-T1
- Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
- Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
- Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity

DEPTH (ft.)

- 0.0 ft. to 0.5 ft.
- 0.5 ft. to 1.0 ft.
- 1.0 ft. to 1.5 ft.
- 1.5 ft. to 2.0 ft.
- 2.0 ft. to 2.5 ft.
- 2.5 ft. to 3.0 ft.
- 3.0 ft. to 3.5 ft.
- 3.5 ft. to 4.0 ft.
- 4.0 ft. to 4.5 ft.
- 4.5 ft. to 5.0 ft.
- 5.0 ft. to 5.5 ft.
- 5.5 ft. to 6.0 ft.
- 6.0 ft. to 6.5 ft.
- 6.5 ft. to 7.0 ft.
- 7.0 ft. to 7.5 ft.
- 7.5 ft. to 8.0 ft.
- 8.0 ft. to 8.5 ft.
- 8.5 ft. to 9.0 ft.

COORDINATE SYSTEM
MASSACHUSETTS
STATE PLANE NAD (83)
US SURVEY FEET

SCALE: 1 Inch = 40 Feet
40 0 40 Feet

FIGURE 5
COMPOSITE GEOPHYSICAL RESULTS
GPR, EM-61, EM-31, & EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019

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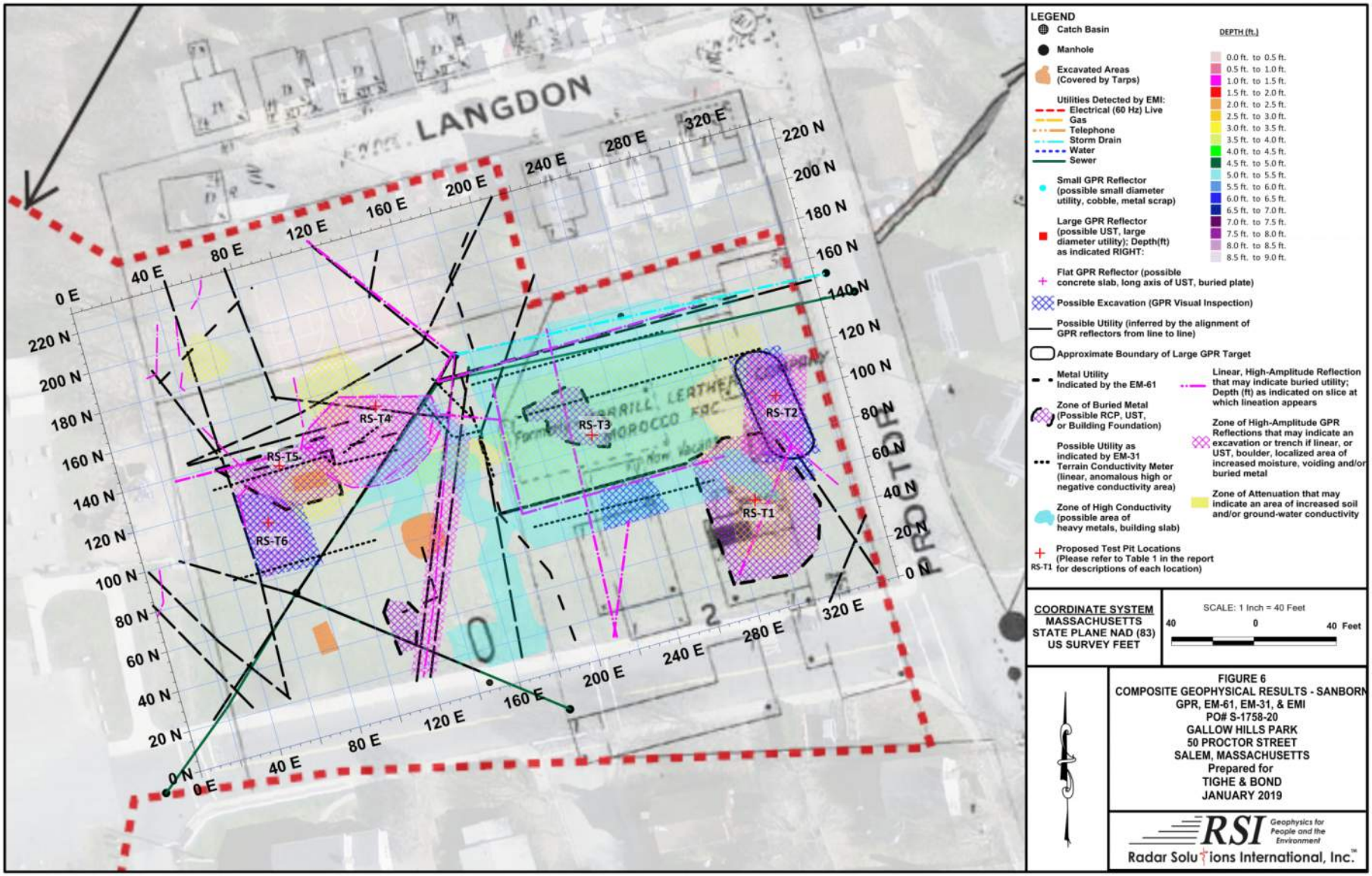
LANGDON
PROCTOR
RS-T1
RS-T2
RS-T3
RS-T4
RS-T5
RS-T6
0 E
40 E
80 E
120 E
160 E
200 E
240 E
280 E
320 E
0 N
20 N
40 N
60 N
80 N
100 N
120 N
140 N
160 N
180 N
200 N
220 N
LEGEND
Catch Basin
Manhole
Excavated Areas (Covered by Tarps)
Utilities Detected by EMI:
Electrical (60 Hz) Live
Gas
Telephone
Storm Drain
Water
Sewer
Small GPR Reflector (possible small diameter utility, cobble, metal scrap)
Large GPR Reflector (possible UST, large diameter utility); Depth(ft) as indicated RIGHT:
Flat GPR Reflector (possible concrete slab, long axis of UST, buried plate)
Possible Excavation (GPR Visual Inspection)
Possible Utility (inferred by the alignment of GPR reflectors from line to line)
Approximate Boundary of Large GPR Target
Metal Utility Indicated by the EM-61
Zone of Buried Metal (Possible RCP, UST, or Building Foundation)
Possible Utility as indicated by EM-31 Terrain Conductivity Meter (linear, anomalous high or negative conductivity area)
Zone of High Conductivity (possible area of heavy metals, building slab)
Proposed Test Pit Locations (Please refer to Table 1 in the report for descriptions of each location)
RS-T1
DEPTH (ft.)
0.0 ft. to 0.5 ft.
0.5 ft. to 1.0 ft.
1.0 ft. to 1.5 ft.
1.5 ft. to 2.0 ft.
2.0 ft. to 2.5 ft.
2.5 ft. to 3.0 ft.
3.0 ft. to 3.5 ft.
3.5 ft. to 4.0 ft.
4.0 ft. to 4.5 ft.
4.5 ft. to 5.0 ft.
5.0 ft. to 5.5 ft.
5.5 ft. to 6.0 ft.
6.0 ft. to 6.5 ft.
6.5 ft. to 7.0 ft.
7.0 ft. to 7.5 ft.
7.5 ft. to 8.0 ft.
8.0 ft. to 8.5 ft.
8.5 ft. to 9.0 ft.
Linear, High-Amplitude Reflection that may indicate buried utility; Depth (ft) as indicated on slice at which lineation appears
Zone of High-Amplitude GPR Reflections that may indicate an excavation or trench if linear, or UST, boulder, localized area of increased moisture, voiding and/or buried metal
Zone of Attenuation that may indicate an area of increased soil and/or ground-water conductivity
COORDINATE SYSTEM
MASSACHUSETTS STATE PLANE NAD (83) US SURVEY FEET
SCALE: 1 Inch = 40 Feet
40 0 40 Feet
FIGURE 6
COMPOSITE GEOPHYSICAL RESULTS - SANBORN
GPR, EM-61, EM-31, & EMI
PO# S-1758-20
GALLOW HILLS PARK
50 PROCTOR STREET
SALEM, MASSACHUSETTS
Prepared for
TIGHE & BOND
JANUARY 2019
RSI Geophysics for People and the Environment
Radar Solutions International, Inc.

1

Tighe&Bond

APPENDIX E

Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-1**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services	Date	01/28/19
		Operator	Donny	Ground Elev.	--
Weather	25° F Cloudy	Make	CAT / Model	Time Started	8:00 AM
		Capacity	/ Reach ft.	Time Completed	8:45 AM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Brown fine to coarse SAND, some Gravel, little Silt.			E	A	
2'				E	A	
3'			0.0	E	A	
4'	ASH, BRICK, COAL (anthropogenic fill material), trace Metal.			E	A	
5'				E	A	1
6'	Blueish/gray, fine to medium SAND and SILT, trace Gravel.			E	A	2
	Brownish red, fine to medium SAND and SILT, trace Gravel, moist.					
7'	End of Exploration at 6.6 feet BSG					
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Little unknown odor observed from 5-6 feet BSG
2.) Groundwater encountered at 6 feet BSG

Test Pit Plan

6 × 3

Volume = 4.4 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
8:30 AM	6 feet BSG

Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-2**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services	Date	01/28/19
		Operator	Donny	Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Time Started	9:00 AM
		Capacity		Time Completed	9:45 AM

Model: Reach: ft.

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Brown, fine to coarse SAND, some Silt,little Gravel, trace Brick.			E	A	
2'				E	A	
3'			0.0	E	A	
4'	Brown, fine to coarse SAND, some Silt, little Gravel, Trace Brick, trace Wood.			E	A	
5'				E	A	
6'	Blueish/gray, fine to medium SAND and SILT.			E	A	1
	Brown, fine to medium SAND and Silt, little Gravel, wet.					
7'	End of Exploration at 6.5 feet BSG					
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 6 feet BSG

Test Pit Plan

6 × 3

Volume = 4.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
9:45 AM	6.5 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-3A**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services			Date	02/11/19
		Operator	Donny			Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model		Time Started	8:00 AM
		Capacity		Reach	ft.	Time Completed	8:30 AM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Brown, fine to medium SAND, some Silt, little Gravel.			M	A	
1'	ASH, BRICK, little Wood, trace Metal (anthropgenic fill material).			E	A	
2'				E	A	
3'	Blackish/brown, PEAT, little Ash.		0.0	E	A	
4'				E	A	
5'				E	A	
6'	Blueish/gray, fine to medium SAND and SILT, trace Gravel.			E	A	
7'	Brown, fine to coarse SAND and SILT, trace Gravel, wet.					1
8'	End of Exploration at 8.5 feet BSG					
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 8 feet BSG

Test Pit Plan

6

3

Volume = 4.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
8:30 AM	6.5 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-4**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services			Date	02/11/19
		Operator	Darwin			Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model		Time Started	9:00 AM
		Capacity		Reach	ft.	Time Completed	9:45 AM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Brown, fine to medium SAND and SILT, trace Gravel.			M	A	
1'	ASH, some Brick, trace Coal, trace Wood, trace SAND (anthropogenic fill material).			E	A	
2'				E	A	
3'	Black PEAT.		0.0	E	A	
4'				E	A	
5'	Blueish/gray, fine to coarse SAND and SILT, some Gravel, trace Fabric.			E	A	
6'	Brown, fine to coarse SAND, some Silt, some Gravel, wet.			E	A	1
7'	End of Exploration at 6.5 feet BSG					
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 6.5 feet BSG

Test Pit Plan

6

3

Volume = 4.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
9:45 AM	6.5 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-5**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services			Date	02/11/19
		Operator	Darwin			Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model		Time Started	10:00 AM
		Capacity		Reach	ft.	Time Completed	10:30 AM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Brown, fine to coarse SAND, some Silt, little Gravel, little Ash, little Brick, trace Fabric, trace Coal, trace Wood (anthropogenic fill material).			E	A	
2'				E	A	1
3'	Reddish/brown, fine to coarse SAND, little Silt, little Gravel.		0.0	E	A	
4'	Black fibrous PEAT.			E	A	
5'				E	A	
6'	Blueish/gray, fine to coarse SAND and SILT, some Gravel, wet.			E	A	2
	Brown, fine to medium SAND and SILT, wet.					
7'	End of Exploration at 6.5 feet BSG					
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Concrete foundation perpendicular to Mansell Parkway was observed at 2.5 feet BSG
2.) Groundwater encountered at 6.5 feet BSG

Test Pit Plan

8

3

Volume = 5.7 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
10:30 AM	6.5 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-6**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services			Date	02/11/19
		Operator	Darwin			Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model		Time Started	10:45 AM
		Capacity		Reach	ft.	Time Completed	11:15 AM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Brown, fine to medium SAND and SILT, trace Gravel.			E	A	
2'				E	A	
3'	Blackish/brown, fine to medium SAND and PEAT, little Slag, litle Ash, trace Brick, trace Gravel (anthropogenic fill material).		0.0	E	A	
4'				E	A	
5'				E	A	1
6'	Blueish/gray, fine to medium SAND and SILT, trace Gravel, wet.					
7'	End of Exploration at 6 feet BSG					
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 6 feet BSG

Test Pit Plan

6

3

Volume = 4 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
#####	6 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-7**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services			Date	02/11/19
		Operator	Darwin			Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model		Time Started	11:30 AM
		Capacity		Reach	ft.	Time Completed	12:00 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Dark brown, fine to coarse SAND, some Gravel, little Silt, trace Brick, trace Coal (anthropogenic fill material).			E	A	
2'				E	A	
3'			0.0	E	A	
4'	Brown, fine to coarse SAND, some Silt, some Gravel.			E	A	
5'				E	A	1
	Blueish/gray, fine to medium SAND and SILT, little Gravel, wet.					
6'	End of Exploration at 5.5 feet BSG					
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 5.5 feet BSG

Test Pit Plan

6

3

Volume = 3.6 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
12:00 PM	5.5 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-8**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services	Date	02/11/19
		Operator	Darwin	Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model	
		Capacity		Reach ft.	
				Time Started	12:15 PM
				Time Completed	12:45 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Dark brown, fine to coarse SAND, some Silt, little Silt, trace Gravel, trace Brick.			M	A	
1'				E	A	
2'				E	A	
3'	Reddish/brown, fine to medium SAND, some Silt, trace Gravel.		0.0	E	A	
4'				E	A	
5'				E	A	
6'				E	A	1
7'	Blueish/gray, fine to medium SAND and SILT, trace Gravel, wet.			E	A	
8'	End of Exploration at 7 feet BSG					
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 7 feet BSG

Test Pit Plan

6

3

Volume = 4.6 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
12:45 PM	7 feet BSG

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Project/Site Information

Gallows Hill Park
50 Proctor Street
Salem, Massachusetts

Test Pit No.	**TP-9**
Page No.	1 of 1
File No.	S-1758-020
Checked By:	

T&B Rep.	Kerri Lewis	Contractor	Technical Drilling Services	Date	02/11/19
		Operator	Darwin	Ground Elev.	--
Weather	25° F Cloudy	Make	CAT	Model	
		Capacity		Reach ft.	
				Time Started	13:00 PM
				Time Completed	13:30 PM

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				M	A	
1'	Black, fine to coarse SAND, some Gravel, little Silt, little Brick, trace Metal, trace Coal, trace Ash.			E	A	
2'				E	A	
3'	Blueish/gray, fine to medium SAND and SILT, trace Gravel.		0.0	E	A	
4'	Light brown, fine to coarse SAND and Silt, trace Gravel, wet.			E	A	1
5'	End of Exploration at 5 feet BSG			E	A	
6'						
7'						
8'						
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1.) Groundwater encountered at 5 feet BSG

Test Pit Plan

6

3

Volume = 3.3 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

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

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
13:30 PM	5 feet BSG

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Boring No. **B-28A/MW-1**
Page 1 of 1
File No.
Checked by:

Project: Gallows Hill Park
Location: 50 Proctor Street, Salem MA
Client: City of Salem

Drilling Co. Technical Drilling Services
Foreman: Kyle Rival
T&B Rep.: Kerri Lewis
Date Start: 02/25/19 End: 2/25/2019
Location See Exploration Location Plan
GS. Elev. Datum:

	Casing	Sampler
Type	N/A	Direct Push
I.D./O.D.	N/A	
Length	N/A	5'
Rig Make/Model	N/A	Geoprobe/6610DT
Other	N/A	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
2/25/2019	9:00	5		

Depth (ft.)	Sample No. / Rec.(in)	Sample Depth (ft.)	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
	S-1/20	0-2	N/A	Brown, fine to medium SAND, some Silt, little Gravel.	SAND	1	RB; NATIVE; BENTONITE; 2" PVC Riser; SAND; 10' Slotted Well Screen
	S-2/8	2-4	N/A	Reddish/brown, fine to coarse SAND, little Silt, trace Gravel.			
5	S-3/30	4-8	N/A	Reddish/brown, fine to coarse SAND, some Silt, trace Gravel.			
	S-4/24	8-12	N/A				
10				Reddish/brown, fine to coarse SAND, some Silt, Trace Gravel.			
	S-5/24	12-14	N/A				
15				Brown, fine to coarse SAND, some Gravel, some Silt.			
				End of exploration at 14 feet BSG due to refusal			
20							
25							
30							

Notes:
1.) Groundwater encountered at 5 feet below ground surface.

Proportions Used

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

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Boring No. **B-31/MW-2**
Page 1 of 1
File No.
Checked by:

Project: Gallows Hill Park
Location: 50 Proctor Street, Salem MA
Client: City of Salem

Drilling Co. Technical Drilling Services
Foreman: Kyle Rival
T&B Rep.: Kerri Lewis
Date Start: 02/26/19 End: 2/26/2019
Location See Exploration Location Plan
GS. Elev. Datum:

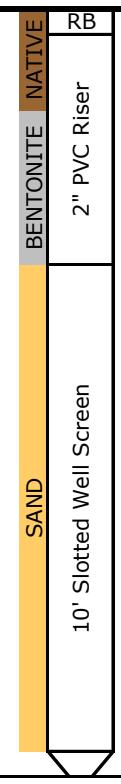
	Casing	Sampler
Type	N/A	Direct Push
I.D./O.D.	N/A	
Length	N/A	5'
Rig Make/Model	N/A	Geoprobe/6610DT
Other	N/A	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
2/26/2019	10:00	4		

Depth (ft.)	Sample No. / Rec.(in)	Sample Depth (ft.)	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes
	S-1/17	0-2	N/A	Reddish/brown, fine to medium SAND and SILT, trace Gravel, trace Brick.	FILL SOILS	1
	S-2/20	2-4	N/A	Brown, fine to coarse SAND and SILT, little Gravel.		2
5	S-3/24	4-8	N/A	Reddish/brown, fine to coarse SAND, some Silt, little Gravel.	SILTY SAND	
	S-4/6	8-12	N/A			
10				Brown, fine to coarse SAND, some Silt, little Gravel.		
	S-5/20	12-14	N/A			
15				Gray Clay	CLAY	
				End of exploration at 14 feet BSG due to refusal		
20						
25						
30						

Well Construction



Notes:
1.) Urban fill material encountered at the above-referenced depth interval, which includes trace amounts of brick.
2.) Groundwater encountered at 4 feet below ground surface.

Proportions Used

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

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Boring No. **B-41/MW-3**
Page 1 of 1
File No.
Checked by:

Project: Gallows Hill Park
Location: 50 Proctor Street, Salem MA
Client: City of Salem

Drilling Co. Technical Drilling Services
Foreman: Kyle Rival
T&B Rep.: Kerri Lewis
Date Start: 02/26/19 End: 2/26/2019
Location See Exploration Location Plan
GS. Elev. Datum:

	Casing	Sampler
Type	N/A	Direct Push
I.D./O.D.	N/A	
Length	N/A	5'
Rig Make/Model	N/A	Geoprobe/6610DT
Other	N/A	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
2/26/2019	12:00	6		

Depth (ft.)	Sample No. / Rec.(in)	Sample Depth (ft.)	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes
	S-1/24	0-2	N/A	Brown, fine to medium SAND, some Ash, some Brick, little Silt, little Gravel.	FILL SOILS	1
	S-2/16	2-4	N/A	Brown, fine to coarse SAND, some Silt, little Gravel, trace Ash, trace Brick.		
	S-3/11	4-5.5	N/A	Brown, fine to medium SAND and SILT, trace Brick, trace Ash, trace Gravel.		
5	S-4/30	5.5-8	N/A			
				Grayish/brown, fine to medium SAND and SILT, trace Brick, trace Gravel.	SILTY SAND	2
	S-4/24	8-12	N/A			
10				Grayish/brown, fine to medium SAND and SILT, trace Gravel.		
	S-5/20	12-15	N/A			
15				Reddish/brown, fine to coarse SAND, some Silt, some Gravel.	SAND	
20				End of exploration at 15 feet BSG		
25						
30						

Well Construction

Notes:
1.) Urban fill material encountered at the above-referenced depth interval, which includes trace to some amounts of ash and brick.
2.)Groundwater encountered at 6 feet below ground surface.

Proportions Used

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

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Boring No. **B-45/MW-4**
Page 1 of 1
File No.
Checked by:

Project: Gallows Hill Park
Location: 50 Proctor Street, Salem MA
Client: City of Salem

Drilling Co. Technical Drilling Services
Foreman: Kyle Rival
T&B Rep.: Kerri Lewis
Date Start: 02/26/19 End: 2/26/2019
Location See Exploration Location Plan
GS. Elev. Datum:

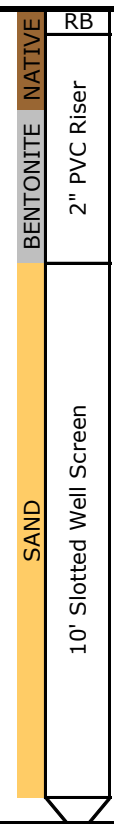
	Casing	Sampler
Type	N/A	Direct Push
I.D./O.D.	N/A	
Length	N/A	5'
Rig Make/Model	N/A	Geoprobe/6610DT
Other	N/A	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
2/26/2019	13:30	5		

Depth (ft.)	Sample No. / Rec.(in)	Sample Depth (ft.)	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes
	S-1/12	0-2	N/A	Brown, fine to coarse SAND, some Silt, some Gravel,trace Brick.	FILL SOILS	1
	S-2/14	2-4	N/A	Reddish/brown, fine to medium SAND and SILT, tace Gravel, trace Brick, trace Ash, trace Glass.		
5	S-3/24	4-8	N/A	Reddish/brown, fine to coarse SAND, some Silt, trace Gravel.	SILTY SAND	2
	S-4/34	8-12	N/A			
10	S-5/24	12-15	N/A	Tan, fine to coarse SAND and SILT, trace Gravel.		
15				Grayish/brown, fine to coarse SAND, some Silt, some Gravel.	SILTY SAND AND GRAVEL	
				End of exploration at 15 feet BSG		
20						
25						
30						

Well Construction



Notes:
1.) Urban fill material encountered at the above-referenced depth interval, which includes trace amounts of ash, brick and glass.
2.)Groundwater encountered at 5 feet below ground surface.

Proportions Used

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

Tighe&Bond

APPENDIX F

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Deutsch Title: Senior Planner

Signature: Date: 5/1/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Deutsch Title: Senior Planner

Signature: Date: 5/8/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Daltor Title: Senior Planner

Signature: Date: 5/16/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Devine Title: Senior Planner

Signature: Date: 5/22/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Deane Title: Senior Planner

Signature: Date: 5/29/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Deane

Title: 6/5/19

Signature:

Date: Senior Planner

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Daoine

Title: Senior Planner

Signature:

Date: 5/13/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Devine Title: Senior Planner

Signature: Date: 6/19/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:
Children observed in playground. Parent notified by inspector. Children vacated fenced area. DPW to repost signs.

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Deane

Title: Senior Planner

Signature:

Date: 6/26/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:
Request in to DPS to repair

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:
DPS to replace missing signs

Inspector Name: Tom Devine Title: Senior Planner

Signature: [illegible] Date: 7/3/19

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? (Yes) / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? (Yes) / No

If yes, describe conditions and corrective actions taken:
DPS to tighten fencing @ Long Jump st
across points.

OTHER OBSERVATIONS

Note any other pertinent site observations:
DPS to replace missing signage

Inspector Name: Tom Derike Title: Senior Planner

Signature: [signature] Date: 7/15/09

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:
DPS to better secure Langdon St fencing and replace missing signs.

Inspector Name: Tom Daniel

Title: Senior Planner

Signature:

Date: 7/24/14

City of Salem Inspection Report
Mansell Field at 50 Proctor Street, Salem, MA

FENCING

Is temporary fencing intact? Yes / No

If no, describe conditions and corrective actions taken:

SITE ACTIVITY

Are there any signs of unauthorized activity within the fenced area? Yes / No

If yes, describe conditions and corrective actions taken:

OTHER OBSERVATIONS

Note any other pertinent site observations:

Inspector Name: Tom Devine

Title: Senior Planner

Signature:

Date: 8/1/19

Tighe&Bond

APPENDIX G

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1901588

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 4:40 pm, Feb 01, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

SAMPLE RECEIPT

The following samples were received on January 28, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Lab Number	Sample Name	Matrix	Analysis
1901588-01	TP-1 0-2ft	Soil	2580, 7196A, 9045
1901588-02	TP-1 5ft	Soil	2580, 7196A, 9045
1901588-03	TP-2 0-2ft	Soil	2580, 7196A, 9045
1901588-04	TP-25ft	Soil	2580, 7196A, 9045

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1901588-01 through 1901588-04**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. 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" 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" 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 (X) No ( )*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes (X) No ( )*

****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: _____ Date: February 01, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 0-2ft
Date Sampled: 01/28/19 09:00
Percent Solids: 73

ESS Laboratory Work Order: 1901588
ESS Laboratory Sample ID: 1901588-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**6.28** (N/A)		9045		1	CCP	01/28/19 19:10	S.U.	CA92820
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.2 ºC.**								
Eh (ORP)	**WL 393** (N/A)		2580		1	CCP	01/28/19 19:10	mv	CA92821
Hexavalent Chromium	ND (0.5)		7196A		1	JLK	01/29/19 15:49	mg/kg dry	CA92932

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 09:45
Percent Solids: 87

ESS Laboratory Work Order: 1901588
ESS Laboratory Sample ID: 1901588-02
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**9.35** (N/A)		9045		1	CCP	01/28/19 19:10	S.U.	CA92820
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.5 ºC.**								
Eh (ORP)	**WL 236** (N/A)		2580		1	CCP	01/28/19 19:10	mv	CA92821
Hexavalent Chromium	**0.6** (0.5)		7196A		1	JLK	01/29/19 15:49	mg/kg dry	CA92932

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-2 0-2ft
Date Sampled: 01/28/19 10:30
Percent Solids: 83

ESS Laboratory Work Order: 1901588
ESS Laboratory Sample ID: 1901588-03
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**6.31** (N/A)		9045		1	CCP	01/28/19 19:10	S.U.	CA92820
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.5 ºC.**								
Eh (ORP)	**WL 336** (N/A)		2580		1	CCP	01/28/19 19:10	mv	CA92821
Hexavalent Chromium	ND (0.5)		7196A		1	JLK	01/29/19 15:49	mg/kg dry	CA92932

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-25ft
Date Sampled: 01/28/19 11:00
Percent Solids: 77

ESS Laboratory Work Order: 1901588
ESS Laboratory Sample ID: 1901588-04
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**6.70** (N/A)		9045		1	CCP	01/28/19 19:10	S.U.	CA92820
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.5 ºC.**								
Eh (ORP)	**WL 284** (N/A)		2580		1	CCP	01/28/19 19:10	mv	CA92821
Hexavalent Chromium	ND (0.6)		7196A		1	JLK	01/29/19 15:49	mg/kg dry	CA92932

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CA92932 - General Preparation										
Blank										
Hexavalent Chromium	ND	0.7	mg/kg wet							
LCS										
Hexavalent Chromium	31.7	0.7	mg/kg wet	33.32		95	80-120			
LCS Dup										
Hexavalent Chromium	32.5	0.7	mg/kg wet	33.32		97	80-120	2	20	
Reference										
Hexavalent Chromium	75.8	2.0	mg/kg wet	71.00		107	20.3-222.5			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

Notes and Definitions

Z-10a	Soil pH measured in water at 20.5 ºC.
Z-10	Soil pH measured in water at 20.2 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901588

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1901588
Date Received: 1/28/2019
Project Due Date: 2/4/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.4 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** (Yes) / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. 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 608.3 Pesticides)
01	312273	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	312272	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	312271	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	312270	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials: ll
Are barcode labels on correct containers? (Yes) / No
Are all necessary stickers attached? (Yes) / No

Completed By: Date & Time: 1/28/19 1602
Reviewed By: Date & Time: 1/28/19 16:42
Delivered By: 1/28/19 16:42

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1901588

Turn Time: Std Rush:

Regulatory State: MA

Reporting Limits: S-1 / S-2 / S-3

Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Electonic Deliverables: ☑ Limit Checker ☐ Excel ☐ Other (Please Specifiy) → PDF

Company Name	Project #	Project Name
Tighe + Bond	S-1757-020	Gallows Hill Park, Salem

Contact Person	Address
Todd Kirton	446 Main St

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
		TDKirton@TigheBond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Hex Cr
1	1/28/19	900	G	S	TP-1 (0-2')	X
2	↓	945	G	S	TP-1 (5')	X
3		1030	G	S	TP-2 (0-2')	X
4	↓	1100	G	S	TP-2 (5')	X

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other* — 1

Number of Containers: 4

Laboratory Use Only

Cooler Present: ✓

Seals Intact: NA

Cooler Temperature: °C ice temp: 0.4

Sampled by: Ken

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
1/28/19 1330	1/28/19 13:09	1/28/19 15:24	1/28/19 1600
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1901617

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 5:34 pm, Feb 27, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

SAMPLE RECEIPT

The following samples were received on January 29, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Low Level VOA vials were frozen by ESS Laboratory on January 29, 2019 at 15:57.

Question I: Samples 1901617-04 thorugh 1901617-07 for Metals were analyzed for a subset of the required MCP list per the client's request.

Revision 1, February 27, 2019: This report has been revised to include Chlordane on the Pesticide list. This compound was analyzed but not reported.

Lab Number	Sample Name	Matrix	Analysis
1901617-01	TP-1 0-2ft	Soil	6010C, 7471B, 8081B, 8082A
1901617-02	TP-1 3-5ft	Soil	EPH8270, MADEP-EPH
1901617-03	TP-1 5ft	Soil	6010C, 7471B, 8260B Low, 9014
1901617-04	TP-1 6.5ft	Soil	6010C
1901617-05	TP-2 0-2ft	Soil	6010C
1901617-06	TP-2 5ft	Soil	6010C
1901617-07	TP-2 6-6.5ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

PROJECT NARRATIVE

5035/8260B Volatile Organic Compounds / Low Level

CA93115-BS1 **Blank Spike recovery is above upper control limit (B+).**
1,4-Dioxane (153% @ 70-130%), 2-Butanone (131% @ 70-130%), 2-Hexanone (134% @ 70-130%), 4-Methyl-2-Pentanone (139% @ 70-130%), Acetone (140% @ 70-130%), Methyl tert-Butyl Ether (131% @ 70-130%), Tetrahydrofuran (145% @ 70-130%)

CA93115-BSD1 **Blank Spike recovery is above upper control limit (B+).**
1,4-Dioxane (133% @ 70-130%)

Total Metals

CA93041-SRM1 **Standard Reference Material is biased low (R-).**
Silver (38% @ 70-130%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1901617-01 through 1901617-07**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. 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" 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" 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: _____ Date: February 05, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 0-2ft
Date Sampled: 01/28/19 09:00
Percent Solids: 70

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (6.79)		6010C		1	KJK	01/31/19 14:07	2.11	100	CA93041
Arsenic	**549** (3.39)		6010C		1	KJK	01/31/19 14:07	2.11	100	CA93041
Barium	**64.5** (3.39)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Beryllium	**0.42** (0.15)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Cadmium	**5.27** (0.68)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Chromium	**149** (1.36)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Lead	**107** (6.79)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Mercury	**0.325** (0.033)		7471B		1	BJV	02/01/19 13:23	0.87	40	CA93042
Nickel	**13.4** (3.39)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Selenium	ND (6.79)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Silver	ND (0.68)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Thallium	ND (6.79)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Vanadium	**37.8** (1.36)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041
Zinc	**196** (3.39)		6010C		1	KJK	01/31/19 0:13	2.11	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 0-2ft
Date Sampled: 01/28/19 09:00
Percent Solids: 70
Initial Volume: 20.4
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 1/31/19 13:41

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
4,4´-DDE	**0.0075** (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
4,4´-DDT	**0.0051** (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Aldrin	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
alpha-BHC	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
alpha-Chlordane	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
beta-BHC	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Chlordane (Total)	ND (0.0281)		8081B		1	02/01/19 21:31	C9B0016	CA93109
delta-BHC	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Dieldrin	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Endosulfan I	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Endosulfan II	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Endosulfan Sulfate	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Endrin	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Endrin Ketone	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
gamma-BHC (Lindane)	ND (0.0021)		8081B		1	02/01/19 21:31	C9B0016	CA93109
gamma-Chlordane	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Heptachlor	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Heptachlor Epoxide	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Hexachlorobenzene	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109
Methoxychlor	ND (0.0035)		8081B		1	02/01/19 21:31	C9B0016	CA93109

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*71 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*79 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*75 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*68 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 0-2ft
Date Sampled: 01/28/19 09:00
Percent Solids: 70
Initial Volume: 19.3
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-01
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 1/30/19 16:22

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1221	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1232	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1242	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1248	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1254	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1260	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1262	ND (0.07)		8082A		1	01/31/19 14:24		CA93002
Aroclor 1268	ND (0.07)		8082A		1	01/31/19 14:24		CA93002

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*70 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*72 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*77 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*81 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 3-5ft
Date Sampled: 01/28/19 09:45
Percent Solids: 71
Initial Volume: 24.6
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-02
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 1/30/19 13:45

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (21.5)		MADEP-EPH		1	CAD	01/31/19 6:01	C9A0476	CA93001
C19-C36 Aliphatics1	ND (21.5)		MADEP-EPH		1	CAD	01/31/19 6:01	C9A0476	CA93001
C11-C22 Unadjusted Aromatics1	**96.8** (21.5)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
C11-C22 Aromatics1,2	**78.5** (21.5)		EPH8270			ZLC	01/31/19 0:18		[CALC]
2-Methylnaphthalene	ND (0.29)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Acenaphthene	ND (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Naphthalene	ND (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Phenanthrene	**2.45** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Acenaphthylene	ND (0.29)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Anthracene	ND (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Benzo(a)anthracene	**1.60** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Benzo(a)pyrene	**1.57** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Benzo(b)fluoranthene	**1.76** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Benzo(g,h,i)perylene	**1.02** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Benzo(k)fluoranthene	**0.61** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Chrysene	**1.64** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Dibenzo(a,h)Anthracene	ND (0.29)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Fluoranthene	**3.33** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Fluorene	ND (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Indeno(1,2,3-cd)Pyrene	**1.09** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001
Pyrene	**3.20** (0.57)		EPH8270		1	ZLC	01/31/19 0:18	C9A0517	CA93001

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*74 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*97 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*95 %*		*40-140*
Surrogate: O-Terphenyl	*85 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 10:00
Percent Solids: 82

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (4.03)		6010C		1	KJK	01/31/19 14:11	3.02	100	CA93041
Arsenic	**11.8** (2.01)		6010C		1	KJK	01/31/19 14:11	3.02	100	CA93041
Barium	**47.9** (2.01)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Beryllium	**0.47** (0.09)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Cadmium	ND (0.40)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Chromium	**25.8** (0.81)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Lead	**6.32** (4.03)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Mercury	ND (0.023)		7471B		1	BJV	02/01/19 13:25	1.03	40	CA93042
Nickel	**15.0** (2.01)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Selenium	ND (4.03)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Silver	ND (0.40)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Thallium	ND (4.03)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Vanadium	**25.2** (0.81)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041
Zinc	**48.4** (2.01)		6010C		1	KJK	01/31/19 0:17	3.02	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 10:00
Percent Solids: 82
Initial Volume: 6.9
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1,1-Trichloroethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1,2,2-Tetrachloroethane	ND (0.0018)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1,2-Trichloroethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1-Dichloroethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1-Dichloroethene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,1-Dichloropropene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2,3-Trichlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2,3-Trichloropropane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2,4-Trichlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2,4-Trimethylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2-Dibromo-3-Chloropropane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2-Dibromoethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2-Dichlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2-Dichloroethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,2-Dichloropropane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,3,5-Trimethylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,3-Dichlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,3-Dichloropropane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,4-Dichlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
1,4-Dioxane	ND (0.0882)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
2,2-Dichloropropane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
2-Butanone	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
2-Chlorotoluene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
2-Hexanone	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
4-Chlorotoluene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
4-Isopropyltoluene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
4-Methyl-2-Pentanone	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Acetone	**0.0465** (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Benzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Bromobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Bromochloromethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 10:00
Percent Solids: 82
Initial Volume: 6.9
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Bromoform	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Bromomethane	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Carbon Disulfide	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Carbon Tetrachloride	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Chlorobenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Chloroethane	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Chloroform	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Chloromethane	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
cis-1,2-Dichloroethene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
cis-1,3-Dichloropropene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Dibromochloromethane	ND (0.0018)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Dibromomethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Dichlorodifluoromethane	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Diethyl Ether	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Di-isopropyl ether	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Ethyl tertiary-butyl ether	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Ethylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Hexachlorobutadiene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Isopropylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Methyl tert-Butyl Ether	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Methylene Chloride	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Naphthalene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
n-Butylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
n-Propylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
sec-Butylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Styrene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
tert-Butylbenzene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Tertiary-amyl methyl ether	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Tetrachloroethene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Tetrahydrofuran	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Toluene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 10:00
Percent Solids: 82
Initial Volume: 6.9
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-03
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
trans-1,3-Dichloropropene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Trichloroethene	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Trichlorofluoromethane	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Vinyl Chloride	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Xylene O	ND (0.0044)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Xylene P,M	ND (0.0088)		8260B Low		1	01/31/19 14:41	C9A0549	CA93115
Xylenes (Total)	ND (0.0088)		8260B Low		1	01/31/19 14:41		[CALC]

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1,2-Dichloroethane-d4	*127 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*94 %*		*70-130*
Surrogate: Dibromofluoromethane	*116 %*		*70-130*
Surrogate: Toluene-d8	*98 %*		*70-130*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 5ft
Date Sampled: 01/28/19 10:00
Percent Solids: 82

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-03
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Total Cyanide	ND (1.11)		9014		1	EEM	01/30/19 11:05	mg/kg dry	CA93012

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-1 6.5ft
Date Sampled: 01/28/19 10:15
Percent Solids: 79

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**7.64** (6.27)		6010C		2	KJK	01/31/19 14:27	2.02	100	CA93041
Chromium	**21.0** (2.51)		6010C		2	KJK	01/31/19 14:27	2.02	100	CA93041
Lead	ND (12.5)		6010C		2	KJK	01/31/19 14:27	2.02	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-2 0-2ft
Date Sampled: 01/28/19 11:00
Percent Solids: 81

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**84.0** (2.67)		6010C		1	KJK	01/31/19 14:31	2.31	100	CA93041
Chromium	**62.6** (1.07)		6010C		1	KJK	01/31/19 0:37	2.31	100	CA93041
Lead	**60.8** (5.35)		6010C		1	KJK	01/31/19 0:37	2.31	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-2 5ft
Date Sampled: 01/28/19 11:15
Percent Solids: 60

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**35.7** (2.63)		6010C		1	KJK	01/31/19 14:35	3.14	100	CA93041
Chromium	**23.7** (1.05)		6010C		1	KJK	01/31/19 0:41	3.14	100	CA93041
Lead	**48.5** (5.27)		6010C		1	KJK	01/31/19 0:41	3.14	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-2 6-6.5ft
Date Sampled: 01/28/19 11:30
Percent Solids: 78

ESS Laboratory Work Order: 1901617
ESS Laboratory Sample ID: 1901617-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.77** (2.34)		6010C		1	KJK	01/31/19 14:38	2.73	100	CA93041

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CA93041 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	42.5	19.6	mg/kg wet	42.40		100	80-120			
Arsenic	134	9.80	mg/kg wet	128.0		105	85-114			
Barium	494	9.80	mg/kg wet	536.0		92	82-118			
Beryllium	206	0.43	mg/kg wet	217.0		95	84-116			
Cadmium	90.1	1.96	mg/kg wet	99.00		91	87-113			
Chromium	110	3.92	mg/kg wet	116.0		95	82-118			
Lead	272	19.6	mg/kg wet	277.0		98	84-116			
Nickel	103	9.80	mg/kg wet	107.0		96	84-117			
Selenium	226	19.6	mg/kg wet	242.0		93	80-120			
Silver	65.2	1.96	mg/kg wet	64.30		101	86-114			
Thallium	178	19.6	mg/kg wet	183.0		97	80-120			
Vanadium	144	3.92	mg/kg wet	146.0		99	86-114			
Zinc	520	9.80	mg/kg wet	561.0		93	86-114			
LCS Dup										
Antimony	43.0	17.5	mg/kg wet	42.40		101	80-120	1	20	
Arsenic	138	8.77	mg/kg wet	128.0		108	85-114	3	20	
Barium	536	8.77	mg/kg wet	536.0		100	82-118	8	20	
Beryllium	211	0.39	mg/kg wet	217.0		97	84-116	2	20	
Cadmium	92.6	1.75	mg/kg wet	99.00		94	87-113	3	20	
Chromium	114	3.51	mg/kg wet	116.0		98	82-118	3	20	
Lead	279	17.5	mg/kg wet	277.0		101	84-116	2	20	
Nickel	99.6	8.77	mg/kg wet	107.0		93	84-117	4	20	
Selenium	235	17.5	mg/kg wet	242.0		97	80-120	4	20	
Silver	66.9	1.75	mg/kg wet	64.30		104	86-114	3	20	
Thallium	182	17.5	mg/kg wet	183.0		100	80-120	2	20	
Vanadium	148	3.51	mg/kg wet	146.0		101	86-114	3	20	
Zinc	534	8.77	mg/kg wet	561.0		95	86-114	3	20	
Reference										
Barium	459	8.62	mg/kg wet	500.0		92	70-130			
Cadmium	398	1.72	mg/kg wet	500.0		80	70-130			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CA93041 - 3050B										
Chromium	462	3.45	mg/kg wet	500.0		92	70-130			
Lead	443	17.2	mg/kg wet	500.0		89	70-130			
Nickel	405	8.62	mg/kg wet	500.0		81	70-130			
Silver	190	1.72	mg/kg wet	500.0		38	70-130			R-
Vanadium	453	3.45	mg/kg wet	500.0		91	70-130			
Zinc	436	8.62	mg/kg wet	500.0		87	70-130			
Batch CA93042 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.57	0.360	mg/kg wet	3.710		96	50-103			
LCS Dup										
Mercury	3.38	0.360	mg/kg wet	3.710		91	50-103	5	20	
Reference										
Mercury	1.00	0.155	mg/kg wet	1000		0.1	0-200			
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
Blank										
1,1,1,2-Tetrachloroethane	ND	0.0050	mg/kg wet							
1,1,1-Trichloroethane	ND	0.0050	mg/kg wet							
1,1,2,2-Tetrachloroethane	ND	0.0020	mg/kg wet							
1,1,2-Trichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethene	ND	0.0050	mg/kg wet							
1,1-Dichloropropene	ND	0.0050	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,3-Trichloropropane	ND	0.0050	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	0.0050	mg/kg wet							
1,2-Dibromoethane	ND	0.0050	mg/kg wet							
1,2-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,2-Dichloroethane	ND	0.0050	mg/kg wet							
1,2-Dichloropropane	ND	0.0050	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,3-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,3-Dichloropropane	ND	0.0050	mg/kg wet							
1,4-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,4-Dioxane	ND	0.100	mg/kg wet							
2,2-Dichloropropane	ND	0.0050	mg/kg wet							
2-Butanone	ND	0.0100	mg/kg wet							
2-Chlorotoluene	ND	0.0050	mg/kg wet							
2-Hexanone	ND	0.0100	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
4-Chlorotoluene	ND	0.0050	mg/kg wet							
4-Isopropyltoluene	ND	0.0050	mg/kg wet							
4-Methyl-2-Pentanone	ND	0.0100	mg/kg wet							
Acetone	ND	0.0100	mg/kg wet							
Benzene	ND	0.0050	mg/kg wet							
Bromobenzene	ND	0.0050	mg/kg wet							
Bromochloromethane	ND	0.0050	mg/kg wet							
Bromodichloromethane	ND	0.0050	mg/kg wet							
Bromoform	ND	0.0050	mg/kg wet							
Bromomethane	ND	0.0100	mg/kg wet							
Carbon Disulfide	ND	0.0050	mg/kg wet							
Carbon Tetrachloride	ND	0.0050	mg/kg wet							
Chlorobenzene	ND	0.0050	mg/kg wet							
Chloroethane	ND	0.0100	mg/kg wet							
Chloroform	ND	0.0050	mg/kg wet							
Chloromethane	ND	0.0100	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Dibromochloromethane	ND	0.0020	mg/kg wet							
Dibromomethane	ND	0.0050	mg/kg wet							
Dichlorodifluoromethane	ND	0.0100	mg/kg wet							
Diethyl Ether	ND	0.0050	mg/kg wet							
Di-isopropyl ether	ND	0.0050	mg/kg wet							
Ethyl tertiary-butyl ether	ND	0.0050	mg/kg wet							
Ethylbenzene	ND	0.0050	mg/kg wet							
Hexachlorobutadiene	ND	0.0050	mg/kg wet							
Isopropylbenzene	ND	0.0050	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.0050	mg/kg wet							
Methylene Chloride	ND	0.0100	mg/kg wet							
Naphthalene	ND	0.0050	mg/kg wet							
n-Butylbenzene	ND	0.0050	mg/kg wet							
n-Propylbenzene	ND	0.0050	mg/kg wet							
sec-Butylbenzene	ND	0.0050	mg/kg wet							
Styrene	ND	0.0050	mg/kg wet							
tert-Butylbenzene	ND	0.0050	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.0050	mg/kg wet							
Tetrachloroethene	ND	0.0050	mg/kg wet							
Tetrahydrofuran	ND	0.0050	mg/kg wet							
Toluene	ND	0.0050	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Trichloroethene	ND	0.0050	mg/kg wet							
Trichlorofluoromethane	ND	0.0050	mg/kg wet							
Vinyl Chloride	ND	0.0100	mg/kg wet							
Xylene O	ND	0.0050	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
Xylene P,M	ND	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0644*		mg/kg wet	*0.05000*		*129*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0457*		mg/kg wet	*0.05000*		*91*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0566*		mg/kg wet	*0.05000*		*113*	*70-130*			
Surrogate: Toluene-d8	*0.0488*		mg/kg wet	*0.05000*		*98*	*70-130*			
LCS										
1,1,1,2-Tetrachloroethane	0.0541	0.0050	mg/kg wet	0.05000		108	70-130			
1,1,1-Trichloroethane	0.0540	0.0050	mg/kg wet	0.05000		108	70-130			
1,1,2,2-Tetrachloroethane	0.0635	0.0020	mg/kg wet	0.05000		127	70-130			
1,1,2-Trichloroethane	0.0587	0.0050	mg/kg wet	0.05000		117	70-130			
1,1-Dichloroethane	0.0519	0.0050	mg/kg wet	0.05000		104	70-130			
1,1-Dichloroethene	0.0577	0.0050	mg/kg wet	0.05000		115	70-130			
1,1-Dichloropropene	0.0570	0.0050	mg/kg wet	0.05000		114	70-130			
1,2,3-Trichlorobenzene	0.0544	0.0050	mg/kg wet	0.05000		109	70-130			
1,2,3-Trichloropropane	0.0646	0.0050	mg/kg wet	0.05000		129	70-130			
1,2,4-Trichlorobenzene	0.0517	0.0050	mg/kg wet	0.05000		103	70-130			
1,2,4-Trimethylbenzene	0.0505	0.0050	mg/kg wet	0.05000		101	70-130			
1,2-Dibromo-3-Chloropropane	0.0622	0.0050	mg/kg wet	0.05000		124	70-130			
1,2-Dibromoethane	0.0613	0.0050	mg/kg wet	0.05000		123	70-130			
1,2-Dichlorobenzene	0.0534	0.0050	mg/kg wet	0.05000		107	70-130			
1,2-Dichloroethane	0.0570	0.0050	mg/kg wet	0.05000		114	70-130			
1,2-Dichloropropane	0.0530	0.0050	mg/kg wet	0.05000		106	70-130			
1,3,5-Trimethylbenzene	0.0546	0.0050	mg/kg wet	0.05000		109	70-130			
1,3-Dichlorobenzene	0.0501	0.0050	mg/kg wet	0.05000		100	70-130			
1,3-Dichloropropane	0.0601	0.0050	mg/kg wet	0.05000		120	70-130			
1,4-Dichlorobenzene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130			
1,4-Dioxane	1.53	0.100	mg/kg wet	1.000		153	70-130			B+
2,2-Dichloropropane	0.0569	0.0050	mg/kg wet	0.05000		114	70-130			
2-Butanone	0.327	0.0100	mg/kg wet	0.2500		131	70-130			B+
2-Chlorotoluene	0.0530	0.0050	mg/kg wet	0.05000		106	70-130			
2-Hexanone	0.336	0.0100	mg/kg wet	0.2500		134	70-130			B+
4-Chlorotoluene	0.0536	0.0050	mg/kg wet	0.05000		107	70-130			
4-Isopropyltoluene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130			
4-Methyl-2-Pentanone	0.349	0.0100	mg/kg wet	0.2500		139	70-130			B+
Acetone	0.349	0.0100	mg/kg wet	0.2500		140	70-130			B+
Benzene	0.0534	0.0050	mg/kg wet	0.05000		107	70-130			
Bromobenzene	0.0533	0.0050	mg/kg wet	0.05000		107	70-130			
Bromochloromethane	0.0555	0.0050	mg/kg wet	0.05000		111	70-130			
Bromodichloromethane	0.0567	0.0050	mg/kg wet	0.05000		113	70-130			
Bromoform	0.0599	0.0050	mg/kg wet	0.05000		120	70-130			
Bromomethane	0.0503	0.0100	mg/kg wet	0.05000		101	70-130			
Carbon Disulfide	0.0592	0.0050	mg/kg wet	0.05000		118	70-130			
Carbon Tetrachloride	0.0546	0.0050	mg/kg wet	0.05000		109	70-130			
Chlorobenzene	0.0516	0.0050	mg/kg wet	0.05000		103	70-130			
Chloroethane	0.0516	0.0100	mg/kg wet	0.05000		103	70-130			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
Chloroform	0.0531	0.0050	mg/kg wet	0.05000		106	70-130			
Chloromethane	0.0475	0.0100	mg/kg wet	0.05000		95	70-130			
cis-1,2-Dichloroethene	0.0557	0.0050	mg/kg wet	0.05000		111	70-130			
cis-1,3-Dichloropropene	0.0506	0.0050	mg/kg wet	0.05000		101	70-130			
Dibromochloromethane	0.0481	0.0020	mg/kg wet	0.05000		96	70-130			
Dibromomethane	0.0596	0.0050	mg/kg wet	0.05000		119	70-130			
Dichlorodifluoromethane	0.0519	0.0100	mg/kg wet	0.05000		104	70-130			
Diethyl Ether	0.0583	0.0050	mg/kg wet	0.05000		117	70-130			
Di-isopropyl ether	0.0528	0.0050	mg/kg wet	0.05000		106	70-130			
Ethyl tertiary-butyl ether	0.0501	0.0050	mg/kg wet	0.05000		100	70-130			
Ethylbenzene	0.0547	0.0050	mg/kg wet	0.05000		109	70-130			
Hexachlorobutadiene	0.0519	0.0050	mg/kg wet	0.05000		104	70-130			
Isopropylbenzene	0.0509	0.0050	mg/kg wet	0.05000		102	70-130			
Methyl tert-Butyl Ether	0.0654	0.0050	mg/kg wet	0.05000		131	70-130			B+
Methylene Chloride	0.0504	0.0100	mg/kg wet	0.05000		101	70-130			
Naphthalene	0.0573	0.0050	mg/kg wet	0.05000		115	70-130			
n-Butylbenzene	0.0519	0.0050	mg/kg wet	0.05000		104	70-130			
n-Propylbenzene	0.0553	0.0050	mg/kg wet	0.05000		111	70-130			
sec-Butylbenzene	0.0536	0.0050	mg/kg wet	0.05000		107	70-130			
Styrene	0.0480	0.0050	mg/kg wet	0.05000		96	70-130			
tert-Butylbenzene	0.0507	0.0050	mg/kg wet	0.05000		101	70-130			
Tertiary-amyl methyl ether	0.0536	0.0050	mg/kg wet	0.05000		107	70-130			
Tetrachloroethene	0.0514	0.0050	mg/kg wet	0.05000		103	70-130			
Tetrahydrofuran	0.0727	0.0050	mg/kg wet	0.05000		145	70-130			B+
Toluene	0.0533	0.0050	mg/kg wet	0.05000		107	70-130			
trans-1,2-Dichloroethene	0.0523	0.0050	mg/kg wet	0.05000		105	70-130			
trans-1,3-Dichloropropene	0.0472	0.0050	mg/kg wet	0.05000		94	70-130			
Trichloroethene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
Trichlorofluoromethane	0.0548	0.0050	mg/kg wet	0.05000		110	70-130			
Vinyl Chloride	0.0518	0.0100	mg/kg wet	0.05000		104	70-130			
Xylene O	0.0504	0.0050	mg/kg wet	0.05000		101	70-130			
Xylene P,M	0.101	0.0100	mg/kg wet	0.1000		101	70-130			
Surrogate: 1,2-Dichloroethane-d4	*0.0542*		mg/kg wet	*0.05000*		*108*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0513*		mg/kg wet	*0.05000*		*103*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0516*		mg/kg wet	*0.05000*		*103*	*70-130*			
Surrogate: Toluene-d8	*0.0499*		mg/kg wet	*0.05000*		*100*	*70-130*			
LCS Dup										
1,1,1,2-Tetrachloroethane	0.0539	0.0050	mg/kg wet	0.05000		108	70-130	0.3	20	
1,1,1-Trichloroethane	0.0526	0.0050	mg/kg wet	0.05000		105	70-130	3	20	
1,1,2,2-Tetrachloroethane	0.0623	0.0020	mg/kg wet	0.05000		125	70-130	2	20	
1,1,2-Trichloroethane	0.0561	0.0050	mg/kg wet	0.05000		112	70-130	5	20	
1,1-Dichloroethane	0.0506	0.0050	mg/kg wet	0.05000		101	70-130	3	20	
1,1-Dichloroethene	0.0564	0.0050	mg/kg wet	0.05000		113	70-130	2	20	
1,1-Dichloropropene	0.0553	0.0050	mg/kg wet	0.05000		111	70-130	3	20	
1,2,3-Trichlorobenzene	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	1	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
1,2,3-Trichloropropane	0.0622	0.0050	mg/kg wet	0.05000		124	70-130	4	20	
1,2,4-Trichlorobenzene	0.0529	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
1,2,4-Trimethylbenzene	0.0515	0.0050	mg/kg wet	0.05000		103	70-130	2	20	
1,2-Dibromo-3-Chloropropane	0.0590	0.0050	mg/kg wet	0.05000		118	70-130	5	20	
1,2-Dibromoethane	0.0596	0.0050	mg/kg wet	0.05000		119	70-130	3	20	
1,2-Dichlorobenzene	0.0549	0.0050	mg/kg wet	0.05000		110	70-130	3	20	
1,2-Dichloroethane	0.0551	0.0050	mg/kg wet	0.05000		110	70-130	3	20	
1,2-Dichloropropane	0.0524	0.0050	mg/kg wet	0.05000		105	70-130	1	20	
1,3,5-Trimethylbenzene	0.0557	0.0050	mg/kg wet	0.05000		111	70-130	2	20	
1,3-Dichlorobenzene	0.0514	0.0050	mg/kg wet	0.05000		103	70-130	3	20	
1,3-Dichloropropane	0.0582	0.0050	mg/kg wet	0.05000		116	70-130	3	20	
1,4-Dichlorobenzene	0.0535	0.0050	mg/kg wet	0.05000		107	70-130	3	20	
1,4-Dioxane	1.33	0.100	mg/kg wet	1.000		133	70-130	14	20	B+
2,2-Dichloropropane	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	3	20	
2-Butanone	0.298	0.0100	mg/kg wet	0.2500		119	70-130	9	20	
2-Chlorotoluene	0.0546	0.0050	mg/kg wet	0.05000		109	70-130	3	20	
2-Hexanone	0.303	0.0100	mg/kg wet	0.2500		121	70-130	10	20	
4-Chlorotoluene	0.0554	0.0050	mg/kg wet	0.05000		111	70-130	3	20	
4-Isopropyltoluene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	2	20	
4-Methyl-2-Pentanone	0.309	0.0100	mg/kg wet	0.2500		124	70-130	12	20	
Acetone	0.301	0.0100	mg/kg wet	0.2500		120	70-130	15	20	
Benzene	0.0525	0.0050	mg/kg wet	0.05000		105	70-130	2	20	
Bromobenzene	0.0551	0.0050	mg/kg wet	0.05000		110	70-130	3	20	
Bromochloromethane	0.0543	0.0050	mg/kg wet	0.05000		109	70-130	2	20	
Bromodichloromethane	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	0.7	20	
Bromoform	0.0592	0.0050	mg/kg wet	0.05000		118	70-130	1	20	
Bromomethane	0.0478	0.0100	mg/kg wet	0.05000		96	70-130	5	20	
Carbon Disulfide	0.0572	0.0050	mg/kg wet	0.05000		114	70-130	4	20	
Carbon Tetrachloride	0.0524	0.0050	mg/kg wet	0.05000		105	70-130	4	20	
Chlorobenzene	0.0516	0.0050	mg/kg wet	0.05000		103	70-130	0.1	20	
Chloroethane	0.0503	0.0100	mg/kg wet	0.05000		101	70-130	2	20	
Chloroform	0.0519	0.0050	mg/kg wet	0.05000		104	70-130	2	20	
Chloromethane	0.0462	0.0100	mg/kg wet	0.05000		92	70-130	3	20	
cis-1,2-Dichloroethene	0.0548	0.0050	mg/kg wet	0.05000		110	70-130	2	20	
cis-1,3-Dichloropropene	0.0503	0.0050	mg/kg wet	0.05000		101	70-130	0.7	20	
Dibromochloromethane	0.0477	0.0020	mg/kg wet	0.05000		95	70-130	0.8	20	
Dibromomethane	0.0576	0.0050	mg/kg wet	0.05000		115	70-130	3	20	
Dichlorodifluoromethane	0.0486	0.0100	mg/kg wet	0.05000		97	70-130	7	20	
Diethyl Ether	0.0569	0.0050	mg/kg wet	0.05000		114	70-130	2	20	
Di-isopropyl ether	0.0524	0.0050	mg/kg wet	0.05000		105	70-130	0.7	20	
Ethyl tertiary-butyl ether	0.0497	0.0050	mg/kg wet	0.05000		99	70-130	0.9	20	
Ethylbenzene	0.0552	0.0050	mg/kg wet	0.05000		110	70-130	0.9	20	
Hexachlorobutadiene	0.0529	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
Isopropylbenzene	0.0523	0.0050	mg/kg wet	0.05000		105	70-130	3	20	
Methyl tert-Butyl Ether	0.0637	0.0050	mg/kg wet	0.05000		127	70-130	3	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CA93115 - 5035										
Methylene Chloride	0.0497	0.0100	mg/kg wet	0.05000		99	70-130	1	20	
Naphthalene	0.0570	0.0050	mg/kg wet	0.05000		114	70-130	0.4	20	
n-Butylbenzene	0.0530	0.0050	mg/kg wet	0.05000		106	70-130	2	20	
n-Propylbenzene	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	2	20	
sec-Butylbenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	2	20	
Styrene	0.0490	0.0050	mg/kg wet	0.05000		98	70-130	2	20	
tert-Butylbenzene	0.0519	0.0050	mg/kg wet	0.05000		104	70-130	2	20	
Tertiary-amyl methyl ether	0.0523	0.0050	mg/kg wet	0.05000		105	70-130	2	20	
Tetrachloroethene	0.0502	0.0050	mg/kg wet	0.05000		100	70-130	2	20	
Tetrahydrofuran	0.0635	0.0050	mg/kg wet	0.05000		127	70-130	14	20	
Toluene	0.0519	0.0050	mg/kg wet	0.05000		104	70-130	3	20	
trans-1,2-Dichloroethene	0.0519	0.0050	mg/kg wet	0.05000		104	70-130	0.7	20	
trans-1,3-Dichloropropene	0.0463	0.0050	mg/kg wet	0.05000		93	70-130	2	20	
Trichloroethene	0.0516	0.0050	mg/kg wet	0.05000		103	70-130	2	20	
Trichlorofluoromethane	0.0522	0.0050	mg/kg wet	0.05000		104	70-130	5	20	
Vinyl Chloride	0.0499	0.0100	mg/kg wet	0.05000		100	70-130	4	20	
Xylene O	0.0504	0.0050	mg/kg wet	0.05000		101	70-130	0.04	20	
Xylene P,M	0.101	0.0100	mg/kg wet	0.1000		101	70-130	0.4	20	
Surrogate: 1,2-Dichloroethane-d4	*0.0505*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0501*		mg/kg wet	*0.05000*		*100*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0497*		mg/kg wet	*0.05000*		*99*	*70-130*			
Surrogate: Toluene-d8	*0.0500*		mg/kg wet	*0.05000*		*100*	*70-130*			
8081B Organochlorine Pesticides										
Batch CA93109 - 3546										
Blank										
4,4´-DDD	ND	0.0025	mg/kg wet							
4,4´-DDD [2C]	ND	0.0025	mg/kg wet							
4,4´-DDE	ND	0.0025	mg/kg wet							
4,4´-DDE [2C]	ND	0.0025	mg/kg wet							
4,4´-DDT	ND	0.0025	mg/kg wet							
4,4´-DDT [2C]	ND	0.0025	mg/kg wet							
Aldrin	ND	0.0025	mg/kg wet							
Aldrin [2C]	ND	0.0025	mg/kg wet							
alpha-BHC	ND	0.0025	mg/kg wet							
alpha-BHC [2C]	ND	0.0025	mg/kg wet							
alpha-Chlordane	ND	0.0025	mg/kg wet							
alpha-Chlordane [2C]	ND	0.0025	mg/kg wet							
beta-BHC	ND	0.0025	mg/kg wet							
beta-BHC [2C]	ND	0.0025	mg/kg wet							
Chlordane (Total)	ND	0.0200	mg/kg wet							
Chlordane (Total) [2C]	ND	0.0200	mg/kg wet							
delta-BHC	ND	0.0025	mg/kg wet							
delta-BHC [2C]	ND	0.0025	mg/kg wet							
Dieldrin	ND	0.0025	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA93109 - 3546										
Dieldrin [2C]	ND	0.0025	mg/kg wet							
Endosulfan I	ND	0.0025	mg/kg wet							
Endosulfan I [2C]	ND	0.0025	mg/kg wet							
Endosulfan II	ND	0.0025	mg/kg wet							
Endosulfan II [2C]	ND	0.0025	mg/kg wet							
Endosulfan Sulfate	ND	0.0025	mg/kg wet							
Endosulfan Sulfate [2C]	ND	0.0025	mg/kg wet							
Endrin	ND	0.0025	mg/kg wet							
Endrin [2C]	ND	0.0025	mg/kg wet							
Endrin Ketone	ND	0.0025	mg/kg wet							
Endrin Ketone [2C]	ND	0.0025	mg/kg wet							
gamma-BHC (Lindane)	ND	0.0015	mg/kg wet							
gamma-BHC (Lindane) [2C]	ND	0.0015	mg/kg wet							
gamma-Chlordane	ND	0.0025	mg/kg wet							
gamma-Chlordane [2C]	ND	0.0025	mg/kg wet							
Heptachlor	ND	0.0025	mg/kg wet							
Heptachlor [2C]	ND	0.0025	mg/kg wet							
Heptachlor Epoxide	ND	0.0025	mg/kg wet							
Heptachlor Epoxide [2C]	ND	0.0025	mg/kg wet							
Hexachlorobenzene	ND	0.0025	mg/kg wet							
Hexachlorobenzene [2C]	ND	0.0025	mg/kg wet							
Methoxychlor	ND	0.0025	mg/kg wet							
Methoxychlor [2C]	ND	0.0025	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0154*		mg/kg wet	*0.01250*		*123*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0144*		mg/kg wet	*0.01250*		*115*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0130*		mg/kg wet	*0.01250*		*104*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0124*		mg/kg wet	*0.01250*		*100*	*30-150*			
LCS										
4,4´-DDD	0.0147	0.0025	mg/kg wet	0.01250		118	40-140			
4,4´-DDD [2C]	0.0135	0.0025	mg/kg wet	0.01250		108	40-140			
4,4´-DDE	0.0143	0.0025	mg/kg wet	0.01250		115	40-140			
4,4´-DDE [2C]	0.0139	0.0025	mg/kg wet	0.01250		111	40-140			
4,4´-DDT	0.0147	0.0025	mg/kg wet	0.01250		117	40-140			
4,4´-DDT [2C]	0.0141	0.0025	mg/kg wet	0.01250		113	40-140			
Aldrin	0.0141	0.0025	mg/kg wet	0.01250		113	40-140			
Aldrin [2C]	0.0137	0.0025	mg/kg wet	0.01250		110	40-140			
alpha-BHC	0.0136	0.0025	mg/kg wet	0.01250		109	40-140			
alpha-BHC [2C]	0.0131	0.0025	mg/kg wet	0.01250		105	40-140			
alpha-Chlordane	0.0134	0.0025	mg/kg wet	0.01250		107	40-140			
alpha-Chlordane [2C]	0.0129	0.0025	mg/kg wet	0.01250		103	40-140			
beta-BHC	0.0129	0.0025	mg/kg wet	0.01250		103	40-140			
beta-BHC [2C]	0.0138	0.0025	mg/kg wet	0.01250		111	40-140			
delta-BHC	0.0111	0.0025	mg/kg wet	0.01250		89	40-140			
delta-BHC [2C]	0.0106	0.0025	mg/kg wet	0.01250		85	40-140			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA93109 - 3546										
Dieldrin	0.0149	0.0025	mg/kg wet	0.01250		119	40-140			
Dieldrin [2C]	0.0143	0.0025	mg/kg wet	0.01250		114	40-140			
Endosulfan I	0.0133	0.0025	mg/kg wet	0.01250		107	40-140			
Endosulfan I [2C]	0.0127	0.0025	mg/kg wet	0.01250		101	40-140			
Endosulfan II	0.0133	0.0025	mg/kg wet	0.01250		106	40-140			
Endosulfan II [2C]	0.0128	0.0025	mg/kg wet	0.01250		102	40-140			
Endosulfan Sulfate	0.0129	0.0025	mg/kg wet	0.01250		103	40-140			
Endosulfan Sulfate [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140			
Endrin	0.0154	0.0025	mg/kg wet	0.01250		123	40-140			
Endrin [2C]	0.0147	0.0025	mg/kg wet	0.01250		118	40-140			
Endrin Ketone	0.0142	0.0025	mg/kg wet	0.01250		114	40-140			
Endrin Ketone [2C]	0.0134	0.0025	mg/kg wet	0.01250		107	40-140			
gamma-BHC (Lindane)	0.0137	0.0015	mg/kg wet	0.01250		109	40-140			
gamma-BHC (Lindane) [2C]	0.0131	0.0015	mg/kg wet	0.01250		105	40-140			
gamma-Chlordane	0.0137	0.0025	mg/kg wet	0.01250		110	40-140			
gamma-Chlordane [2C]	0.0131	0.0025	mg/kg wet	0.01250		105	40-140			
Heptachlor	0.0143	0.0025	mg/kg wet	0.01250		115	40-140			
Heptachlor [2C]	0.0140	0.0025	mg/kg wet	0.01250		112	40-140			
Heptachlor Epoxide	0.0144	0.0025	mg/kg wet	0.01250		115	40-140			
Heptachlor Epoxide [2C]	0.0141	0.0025	mg/kg wet	0.01250		113	40-140			
Hexachlorobenzene	0.0125	0.0025	mg/kg wet	0.01250		100	40-140			
Hexachlorobenzene [2C]	0.0136	0.0025	mg/kg wet	0.01250		109	40-140			
Methoxychlor	0.0145	0.0025	mg/kg wet	0.01250		116	40-140			
Methoxychlor [2C]	0.0133	0.0025	mg/kg wet	0.01250		106	40-140			
Surrogate: Decachlorobiphenyl	*0.0156*		mg/kg wet	*0.01250*		*125*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0145*		mg/kg wet	*0.01250*		*116*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0128*		mg/kg wet	*0.01250*		*102*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0124*		mg/kg wet	*0.01250*		*99*	*30-150*			
LCS Dup										
4,4´-DDD	0.0150	0.0025	mg/kg wet	0.01250		120	40-140	2	30	
4,4´-DDD [2C]	0.0136	0.0025	mg/kg wet	0.01250		109	40-140	0.7	30	
4,4´-DDE	0.0145	0.0025	mg/kg wet	0.01250		116	40-140	1	30	
4,4´-DDE [2C]	0.0141	0.0025	mg/kg wet	0.01250		113	40-140	1	30	
4,4´-DDT	0.0148	0.0025	mg/kg wet	0.01250		119	40-140	1	30	
4,4´-DDT [2C]	0.0142	0.0025	mg/kg wet	0.01250		113	40-140	0.4	30	
Aldrin	0.0144	0.0025	mg/kg wet	0.01250		115	40-140	2	30	
Aldrin [2C]	0.0141	0.0025	mg/kg wet	0.01250		112	40-140	2	30	
alpha-BHC	0.0141	0.0025	mg/kg wet	0.01250		113	40-140	3	30	
alpha-BHC [2C]	0.0136	0.0025	mg/kg wet	0.01250		108	40-140	3	30	
alpha-Chlordane	0.0137	0.0025	mg/kg wet	0.01250		110	40-140	2	30	
alpha-Chlordane [2C]	0.0132	0.0025	mg/kg wet	0.01250		106	40-140	2	30	
beta-BHC	0.0131	0.0025	mg/kg wet	0.01250		104	40-140	2	30	
beta-BHC [2C]	0.0141	0.0025	mg/kg wet	0.01250		113	40-140	2	30	
delta-BHC	0.0114	0.0025	mg/kg wet	0.01250		91	40-140	3	30	

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Client Name: Tighe & Bond
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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CA93109 - 3546										
delta-BHC [2C]	0.0109	0.0025	mg/kg wet	0.01250		87	40-140	2	30	
Dieldrin	0.0152	0.0025	mg/kg wet	0.01250		122	40-140	2	30	
Dieldrin [2C]	0.0145	0.0025	mg/kg wet	0.01250		116	40-140	2	30	
Endosulfan I	0.0136	0.0025	mg/kg wet	0.01250		109	40-140	2	30	
Endosulfan I [2C]	0.0129	0.0025	mg/kg wet	0.01250		104	40-140	2	30	
Endosulfan II	0.0136	0.0025	mg/kg wet	0.01250		109	40-140	2	30	
Endosulfan II [2C]	0.0129	0.0025	mg/kg wet	0.01250		103	40-140	1	30	
Endosulfan Sulfate	0.0129	0.0025	mg/kg wet	0.01250		104	40-140	0.2	30	
Endosulfan Sulfate [2C]	0.0123	0.0025	mg/kg wet	0.01250		98	40-140	0.05	30	
Endrin	0.0157	0.0025	mg/kg wet	0.01250		126	40-140	2	30	
Endrin [2C]	0.0150	0.0025	mg/kg wet	0.01250		120	40-140	2	30	
Endrin Ketone	0.0142	0.0025	mg/kg wet	0.01250		113	40-140	0.6	30	
Endrin Ketone [2C]	0.0133	0.0025	mg/kg wet	0.01250		107	40-140	0.3	30	
gamma-BHC (Lindane)	0.0140	0.0015	mg/kg wet	0.01250		112	40-140	3	30	
gamma-BHC (Lindane) [2C]	0.0135	0.0015	mg/kg wet	0.01250		108	40-140	3	30	
gamma-Chlordane	0.0140	0.0025	mg/kg wet	0.01250		112	40-140	2	30	
gamma-Chlordane [2C]	0.0134	0.0025	mg/kg wet	0.01250		107	40-140	2	30	
Heptachlor	0.0147	0.0025	mg/kg wet	0.01250		118	40-140	3	30	
Heptachlor [2C]	0.0143	0.0025	mg/kg wet	0.01250		115	40-140	2	30	
Heptachlor Epoxide	0.0148	0.0025	mg/kg wet	0.01250		118	40-140	2	30	
Heptachlor Epoxide [2C]	0.0144	0.0025	mg/kg wet	0.01250		115	40-140	2	30	
Hexachlorobenzene	0.0128	0.0025	mg/kg wet	0.01250		102	40-140	2	30	
Hexachlorobenzene [2C]	0.0139	0.0025	mg/kg wet	0.01250		111	40-140	3	30	
Methoxychlor	0.0144	0.0025	mg/kg wet	0.01250		115	40-140	1	30	
Methoxychlor [2C]	0.0132	0.0025	mg/kg wet	0.01250		106	40-140	0.6	30	
Surrogate: Decachlorobiphenyl	*0.0150*		mg/kg wet	*0.01250*		*120*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0139*		mg/kg wet	*0.01250*		*111*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0128*		mg/kg wet	*0.01250*		*102*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0125*		mg/kg wet	*0.01250*		*100*	*30-150*			
8082A Polychlorinated Biphenyls (PCB)										
Batch CA93002 - 3540C										
Blank										
Aroclor 1016	ND	0.02	mg/kg wet							
Aroclor 1016 [2C]	ND	0.02	mg/kg wet							
Aroclor 1221	ND	0.02	mg/kg wet							
Aroclor 1221 [2C]	ND	0.02	mg/kg wet							
Aroclor 1232	ND	0.02	mg/kg wet							
Aroclor 1232 [2C]	ND	0.02	mg/kg wet							
Aroclor 1242	ND	0.02	mg/kg wet							
Aroclor 1242 [2C]	ND	0.02	mg/kg wet							
Aroclor 1248	ND	0.02	mg/kg wet							
Aroclor 1248 [2C]	ND	0.02	mg/kg wet							
Aroclor 1254	ND	0.02	mg/kg wet							

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CA93002 - 3540C										
Aroclor 1254 [2C]	ND	0.02	mg/kg wet							
Aroclor 1260	ND	0.02	mg/kg wet							
Aroclor 1260 [2C]	ND	0.02	mg/kg wet							
Aroclor 1262	ND	0.02	mg/kg wet							
Aroclor 1262 [2C]	ND	0.02	mg/kg wet							
Aroclor 1268	ND	0.02	mg/kg wet							
Aroclor 1268 [2C]	ND	0.02	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0215*		mg/kg wet	*0.02500*		*86*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0218*		mg/kg wet	*0.02500*		*87*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0204*		mg/kg wet	*0.02500*		*82*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0224*		mg/kg wet	*0.02500*		*89*	*30-150*			
LCS										
Aroclor 1016	0.4	0.02	mg/kg wet	0.5000		90	40-140			
Aroclor 1016 [2C]	0.4	0.02	mg/kg wet	0.5000		88	40-140			
Aroclor 1260	0.4	0.02	mg/kg wet	0.5000		86	40-140			
Aroclor 1260 [2C]	0.4	0.02	mg/kg wet	0.5000		83	40-140			
Surrogate: Decachlorobiphenyl	*0.0215*		mg/kg wet	*0.02500*		*86*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0219*		mg/kg wet	*0.02500*		*88*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0208*		mg/kg wet	*0.02500*		*83*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0208*		mg/kg wet	*0.02500*		*83*	*30-150*			
LCS Dup										
Aroclor 1016	0.4	0.02	mg/kg wet	0.5000		87	40-140	4	30	
Aroclor 1016 [2C]	0.4	0.02	mg/kg wet	0.5000		85	40-140	4	30	
Aroclor 1260	0.4	0.02	mg/kg wet	0.5000		83	40-140	4	30	
Aroclor 1260 [2C]	0.4	0.02	mg/kg wet	0.5000		81	40-140	3	30	
Surrogate: Decachlorobiphenyl	*0.0206*		mg/kg wet	*0.02500*		*82*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0210*		mg/kg wet	*0.02500*		*84*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0196*		mg/kg wet	*0.02500*		*78*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0196*		mg/kg wet	*0.02500*		*78*	*30-150*			
Classical Chemistry										
Batch CA93012 - TCN Prep										
Blank										
Total Cyanide	ND	1.00	mg/kg wet							
LCS										
Total Cyanide	4.99	1.00	mg/kg wet	5.015		100	90-110			
Reference										
Total Cyanide	154	9.96	mg/kg wet	157.0		98	24-110			
Reference										
Total Cyanide	151	9.84	mg/kg wet	157.0		96	24-110			
MADEP-EPH Extractable Petroleum Hydrocarbons										

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA93001 - 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							
Surrogate: 1-Chlorooctadecane	*1.67*		mg/kg wet	*2.000*		*83*	*40-140*			
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 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							
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	*51.8*		mg/L	*50.00*		*104*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*52.1*		mg/L	*50.00*		*104*	*40-140*			
Surrogate: O-Terphenyl	*1.85*		mg/kg wet	*2.000*		*92*	*40-140*			
LCS										
C19-C36 Aliphatics1	16.7	15.0	mg/kg wet	16.00		104	40-140			
C9-C18 Aliphatics1	9.8	15.0	mg/kg wet	12.00		82	40-140			
Decane (C10)	1.0	0.5	mg/kg wet	2.000		49	40-140			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA93001 - 3546										
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Dodecane (C12)	1.2	0.5	mg/kg wet	2.000		59	40-140			
Eicosane (C20)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Hexacosane (C26)	1.5	0.5	mg/kg wet	2.000		77	40-140			
Hexadecane (C16)	1.6	0.5	mg/kg wet	2.000		80	40-140			
Hexatriacontane (C36)	1.7	0.5	mg/kg wet	2.000		87	40-140			
Nonadecane (C19)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Nonane (C9)	0.8	0.5	mg/kg wet	2.000		39	30-140			
Octacosane (C28)	1.5	0.5	mg/kg wet	2.000		75	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		80	40-140			
Tetradecane (C14)	1.4	0.5	mg/kg wet	2.000		71	40-140			
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		74	40-140			
Surrogate: 1-Chlorooctadecane	*1.70*		mg/kg wet	*2.000*		*85*	*40-140*			
LCS										
2-Methylnaphthalene	1.70	0.20	mg/kg wet	2.000		85	40-140			
Acenaphthene	1.69	0.40	mg/kg wet	2.000		84	40-140			
Acenaphthylene	1.70	0.20	mg/kg wet	2.000		85	40-140			
Anthracene	1.65	0.40	mg/kg wet	2.000		82	40-140			
Benzo(a)anthracene	1.86	0.40	mg/kg wet	2.000		93	40-140			
Benzo(a)pyrene	1.81	0.40	mg/kg wet	2.000		90	40-140			
Benzo(b)fluoranthene	1.92	0.40	mg/kg wet	2.000		96	40-140			
Benzo(g,h,i)perylene	1.83	0.40	mg/kg wet	2.000		91	40-140			
Benzo(k)fluoranthene	1.83	0.40	mg/kg wet	2.000		91	40-140			
C11-C22 Unadjusted Aromatics1	42.7	15.0	mg/kg wet	34.00		126	40-140			
Chrysene	1.77	0.40	mg/kg wet	2.000		88	40-140			
Dibenzo(a,h)Anthracene	1.97	0.20	mg/kg wet	2.000		99	40-140			
Fluoranthene	1.72	0.40	mg/kg wet	2.000		86	40-140			
Fluorene	1.68	0.40	mg/kg wet	2.000		84	40-140			
Indeno(1,2,3-cd)Pyrene	1.95	0.40	mg/kg wet	2.000		97	40-140			
Naphthalene	1.71	0.40	mg/kg wet	2.000		85	40-140			
Phenanthrene	1.63	0.40	mg/kg wet	2.000		82	40-140			
Pyrene	1.73	0.40	mg/kg wet	2.000		87	40-140			
Surrogate: 2-Bromonaphthalene	*41.8*		mg/L	*50.00*		*84*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*50.8*		mg/L	*50.00*		*102*	*40-140*			
Surrogate: O-Terphenyl	*1.92*		mg/kg wet	*2.000*		*96*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	15.7	15.0	mg/kg wet	16.00		98	40-140	6	25	
C9-C18 Aliphatics1	9.4	15.0	mg/kg wet	12.00		79	40-140	4	25	
Decane (C10)	1.0	0.5	mg/kg wet	2.000		48	40-140	4	25	
Docosane (C22)	1.5	0.5	mg/kg wet	2.000		75	40-140	7	25	

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CA93001 - 3546										
Dodecane (C12)	1.1	0.5	mg/kg wet	2.000		57	40-140	4	25	
Eicosane (C20)	1.5	0.5	mg/kg wet	2.000		74	40-140	7	25	
Hexacosane (C26)	1.4	0.5	mg/kg wet	2.000		71	40-140	8	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		75	40-140	6	25	
Hexatriacontane (C36)	1.6	0.5	mg/kg wet	2.000		80	40-140	8	25	
Nonadecane (C19)	1.5	0.5	mg/kg wet	2.000		74	40-140	7	25	
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		37	30-140	6	25	
Octacosane (C28)	1.4	0.5	mg/kg wet	2.000		70	40-140	7	25	
Octadecane (C18)	1.5	0.5	mg/kg wet	2.000		74	40-140	6	25	
Tetracosane (C24)	1.5	0.5	mg/kg wet	2.000		73	40-140	9	25	
Tetradecane (C14)	1.4	0.5	mg/kg wet	2.000		68	40-140	4	25	
Triacontane (C30)	1.4	0.5	mg/kg wet	2.000		69	40-140	7	25	
Surrogate: 1-Chlorooctadecane	*1.55*		mg/kg wet	*2.000*		*78*	*40-140*			
LCS Dup										
2-Methylnaphthalene	1.74	0.20	mg/kg wet	2.000		87	40-140	2	30	
Acenaphthene	1.72	0.40	mg/kg wet	2.000		86	40-140	2	30	
Acenaphthylene	1.68	0.20	mg/kg wet	2.000		84	40-140	2	30	
Anthracene	1.74	0.40	mg/kg wet	2.000		87	40-140	5	30	
Benzo(a)anthracene	1.84	0.40	mg/kg wet	2.000		92	40-140	1	30	
Benzo(a)pyrene	1.88	0.40	mg/kg wet	2.000		94	40-140	4	30	
Benzo(b)fluoranthene	1.94	0.40	mg/kg wet	2.000		97	40-140	1	30	
Benzo(g,h,i)perylene	1.85	0.40	mg/kg wet	2.000		93	40-140	1	30	
Benzo(k)fluoranthene	1.91	0.40	mg/kg wet	2.000		95	40-140	4	30	
C11-C22 Unadjusted Aromatics1	42.9	15.0	mg/kg wet	34.00		126	40-140	0.5	25	
Chrysene	1.84	0.40	mg/kg wet	2.000		92	40-140	4	30	
Dibenzo(a,h)Anthracene	1.96	0.20	mg/kg wet	2.000		98	40-140	0.7	30	
Fluoranthene	1.76	0.40	mg/kg wet	2.000		88	40-140	2	30	
Fluorene	1.75	0.40	mg/kg wet	2.000		87	40-140	4	30	
Indeno(1,2,3-cd)Pyrene	2.01	0.40	mg/kg wet	2.000		101	40-140	3	30	
Naphthalene	1.69	0.40	mg/kg wet	2.000		84	40-140	1	30	
Phenanthrene	1.66	0.40	mg/kg wet	2.000		83	40-140	2	30	
Pyrene	1.73	0.40	mg/kg wet	2.000		87	40-140	0.05	30	
Surrogate: 2-Bromonaphthalene	*44.7*		mg/L	*50.00*		*89*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*51.4*		mg/L	*50.00*		*103*	*40-140*			
Surrogate: O-Terphenyl	*1.90*		mg/kg wet	*2.000*		*95*	*40-140*			
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: Gallows Hill Park Salem
ESS Laboratory Work Order: 1901617

Notes and Definitions

U	Analyte included in the analysis, but not detected
R-	Standard Reference Material is biased low (R-).
D	Diluted.
B+	Blank Spike recovery is above upper control limit (B+).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1901617

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1901617
Date Received: 1/29/2019
Project Due Date: 2/5/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: .4 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** (Yes) / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: 1/29/19 Time: ~~15:~~ 1557 By: [illegible]

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. 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 608.3 Pesticides)
01	312555	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	312556	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	312557	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	312554	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	312553	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	312558	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	312565	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
03	312566	Yes	NA	Yes	VOA Vial - Other	Other	
03	312567	Yes	NA	Yes	VOA Vial - Other	Other	
04	312552	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	312563	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	312564	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	312551	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	312561	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	312562	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	312550	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	312559	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	312560	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	312549	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab
Are barcode labels on correct containers? (Yes) / No Initials: [illegible]

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

ESS Project ID: 1901617
Date Received: 1/29/2019

Are all necessary stickers attached? Yes / No

Completed By: _____ Date & Time: 1/29/19 15:54

Reviewed By: _____ Date & Time: 1/29/19 1558

Delivered By: _____ 1/29/19 1558

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1901617

Turn Time: Std Rush:
Regulatory State: MA
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Reporting Limits: S-1 / S-2 / S-3
Electonic Deliverables: ☑ Limit Checker ☑ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Contact Person: Todd Kirton / Kerri Lewis
Address: 446 Main St
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@TigheBond.com

Analysis: MCP 14 metals; Total Cr; PCBs; Pesticides; EPH-w/ Target PAHs; Cyanide; VOCs; Arsenic; Lead

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	MCP 14 metals	Total Cr	PCBs	Pesticides	EPH-w/ Target PAHs	Cyanide	VOCs	Arsenic	Lead
1	1/28/19	900	G	S	TP-1 (0-2)	X		X	X					
2		945			TP-1 (3-5')					X				
3		1000			TP-1 (5')	X					X	X		
4		1015			TP-1 (6.5')		X						X	X
5		1100			TP-2 (0-2')		X						X	X
6		1115			TP-2 (5')		X						X	X
7		1130			TP-2 (6-6.5')								X	

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: ag ag

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 0.4 Ice °C

Sampled by: KW
Comments: Please specify "Other" preservative and containers types in this space
Use quote from Gallows Hill Park, Salem

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
1/29/19 1405	1/29/19 14:05	1/29/19 15:31	1/29/19 15:39
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902212

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 1:53 pm, Feb 19, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902212

SAMPLE RECEIPT

The following samples were received on February 11, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Lab Number	Sample Name	Matrix	Analysis
1902212-01	TP-3A 0-2ft	Soil	2580, 7196A, 9045
1902212-02	TP-5 3-5ft	Soil	2580, 7196A, 9045

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902212

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902212

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902212

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902212-01 through 1902212-02**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes (X) No ( )*

****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
Date: February 15, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-3A 0-2ft
Date Sampled: 02/11/19 09:30
Percent Solids: 75

ESS Laboratory Work Order: 1902212
ESS Laboratory Sample ID: 1902212-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**7.93** (N/A)		9045		1	CCP	02/11/19 20:25	S.U.	CB91119
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.2 ºC.**								
Eh (ORP)	**WL 319** (N/A)		2580		1	CCP	02/11/19 20:25	mv	CB91120
Hexavalent Chromium	ND (0.6)		7196A		1	JLK	02/11/19 17:31	mg/kg dry	CB91135

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 3-5ft
Date Sampled: 02/11/19 12:15
Percent Solids: 63

ESS Laboratory Work Order: 1902212
ESS Laboratory Sample ID: 1902212-02
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**6.84** (N/A)		9045		1	CCP	02/11/19 20:25	S.U.	CB91119
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.2 ºC.**								
Eh (ORP)	**WL 287** (N/A)		2580		1	CCP	02/11/19 20:25	mv	CB91120
Hexavalent Chromium	ND (0.7)		7196A		1	JLK	02/11/19 17:31	mg/kg dry	CB91135

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902212

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CB91135 - General Preparation										
Blank										
Hexavalent Chromium	ND	0.7	mg/kg wet							
LCS										
Hexavalent Chromium	31.7	0.7	mg/kg wet	33.32		95	80-120			
LCS Dup										
Hexavalent Chromium	32.3	0.7	mg/kg wet	33.32		97	80-120	2	20	
Reference										
Hexavalent Chromium	74.2	2.0	mg/kg wet	71.00		105	20.3-222.5			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902212

Notes and Definitions

Z-10	Soil pH measured in water at 20.2 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902212

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902212
Date Received: 2/11/2019
Project Due Date: 2/19/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.6 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

Rec'd 1 4oz jar per sample for CrIV analysis

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	315527	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	315526	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 2/11/19 1443
Reviewed By: Date & Time: 2/11/19 15:09
Delivered By: 2/11/19 15:55

ESS Laboratory
Division of Thielsch Engineering, Inc.
85 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902212

Turn Time: Std Rush:
Regulatory State: MA
Reporting Limits: RCS-1
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation
Electonic Deliverables: ☑ Limit Checker ☑ Excel ☐ Other (Please Specifiy) →

Company Name: Tighe + Bond
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Contact Person: Todd Kirton
Address: 446 Main St
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@Tigheband.com cc Kerri Lewis

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Hex Cr.
1	2/11/19	930	G	S	TP-3A (0-2')	X
2	2/11/19	1215	G	S	TP-5 (3-5')	X

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other* — 1
Number of Containers: 2

Laboratory Use Only
Cooler Present: ✓
Seals Intact: N/A
Cooler Temperature: °C ice temp: 0.6

Sampled by: KL
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/11/19 1250	2/11/19 12:50	2/11/19 14:26	2/11/19 1436
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902242

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 11:25 am, Feb 20, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

SAMPLE RECEIPT

The following samples were received on February 12, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Low Level VOA vials were frozen by ESS Laboratory on February 12, 2019 at 18:03.

Lab Number	Sample Name	Matrix	Analysis
1902242-01	TP-7 0-2	Soil	2580, 7196A, 9045
1902242-02	TP-9 0-2	Soil	2580, 7196A, 8260B Low, 9045

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902242

PROJECT NARRATIVE

5035/8260B Volatile Organic Compounds / Low Level
C9B0215-CCV1 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
1,2-Dibromo-3-Chloropropane (33% @ 20%), Bromoform (25% @ 20%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902242

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902242-01 through 1902242-02**

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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" 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 (X) No ( )*

****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
Date: February 20, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-7 0-2
Date Sampled: 02/12/19 08:30
Percent Solids: 81

ESS Laboratory Work Order: 1902242
ESS Laboratory Sample ID: 1902242-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**6.08** (N/A)		9045		1	CCP	02/12/19 20:20	S.U.	CB91220
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.7 ºC.**								
Eh (ORP)	**397** (N/A)		2580		1	CCP	02/12/19 20:20	mv	CB91221
Hexavalent Chromium	ND (0.5)		7196A		1	JLK	02/19/19 16:50	mg/kg dry	CB91946

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 0-2
Date Sampled: 02/12/19 09:45
Percent Solids: 74
Initial Volume: 4.8
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902242
ESS Laboratory Sample ID: 1902242-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1,1-Trichloroethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1,2,2-Tetrachloroethane	ND (0.0028)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1,2-Trichloroethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1-Dichloroethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1-Dichloroethene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,1-Dichloropropene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2,3-Trichlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2,3-Trichloropropane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2,4-Trichlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2,4-Trimethylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2-Dibromo-3-Chloropropane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2-Dibromoethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2-Dichlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2-Dichloroethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,2-Dichloropropane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,3,5-Trimethylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,3-Dichlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,3-Dichloropropane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,4-Dichlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
1,4-Dioxane	ND (0.141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
2,2-Dichloropropane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
2-Butanone	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
2-Chlorotoluene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
2-Hexanone	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
4-Chlorotoluene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
4-Isopropyltoluene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
4-Methyl-2-Pentanone	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Acetone	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Benzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Bromobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Bromochloromethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 0-2
Date Sampled: 02/12/19 09:45
Percent Solids: 74
Initial Volume: 4.8
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902242
ESS Laboratory Sample ID: 1902242-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Bromoform	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Bromomethane	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Carbon Disulfide	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Carbon Tetrachloride	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Chlorobenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Chloroethane	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Chloroform	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Chloromethane	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
cis-1,2-Dichloroethene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
cis-1,3-Dichloropropene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Dibromochloromethane	ND (0.0028)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Dibromomethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Dichlorodifluoromethane	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Diethyl Ether	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Di-isopropyl ether	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Ethyl tertiary-butyl ether	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Ethylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Hexachlorobutadiene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Isopropylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Methyl tert-Butyl Ether	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Methylene Chloride	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Naphthalene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
n-Butylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
n-Propylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
sec-Butylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Styrene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
tert-Butylbenzene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Tertiary-amyl methyl ether	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Tetrachloroethene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Tetrahydrofuran	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Toluene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 0-2
Date Sampled: 02/12/19 09:45
Percent Solids: 74
Initial Volume: 4.8
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902242
ESS Laboratory Sample ID: 1902242-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
trans-1,3-Dichloropropene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Trichloroethene	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Trichlorofluoromethane	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Vinyl Chloride	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Xylene O	ND (0.0070)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Xylene P,M	ND (0.0141)		8260B Low		1	02/14/19 21:08	C9B0215	CB91419
Xylenes (Total)	ND (0.0141)		8260B Low		1	02/14/19 21:08		[CALC]

	%Recovery	Qualifier	Limits
Surrogate: 1,2-Dichloroethane-d4	*109 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*98 %*		*70-130*
Surrogate: Dibromofluoromethane	*98 %*		*70-130*
Surrogate: Toluene-d8	*99 %*		*70-130*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 0-2
Date Sampled: 02/12/19 09:45
Percent Solids: 74

ESS Laboratory Work Order: 1902242
ESS Laboratory Sample ID: 1902242-02
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**7.79** (N/A)		9045		1	CCP	02/12/19 20:20	S.U.	CB91220
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.6 ºC.**								
Eh (ORP)	**321** (N/A)		2580		1	CCP	02/12/19 20:20	mv	CB91221
Hexavalent Chromium	ND (0.6)		7196A		1	JLK	02/19/19 16:50	mg/kg dry	CB91946

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
Blank										
1,1,1,2-Tetrachloroethane	ND	0.0050	mg/kg wet							
1,1,1-Trichloroethane	ND	0.0050	mg/kg wet							
1,1,2,2-Tetrachloroethane	ND	0.0020	mg/kg wet							
1,1,2-Trichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethene	ND	0.0050	mg/kg wet							
1,1-Dichloropropene	ND	0.0050	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,3-Trichloropropane	ND	0.0050	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	0.0050	mg/kg wet							
1,2-Dibromoethane	ND	0.0050	mg/kg wet							
1,2-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,2-Dichloroethane	ND	0.0050	mg/kg wet							
1,2-Dichloropropane	ND	0.0050	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,3-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,3-Dichloropropane	ND	0.0050	mg/kg wet							
1,4-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,4-Dioxane	ND	0.100	mg/kg wet							
2,2-Dichloropropane	ND	0.0050	mg/kg wet							
2-Butanone	ND	0.0100	mg/kg wet							
2-Chlorotoluene	ND	0.0050	mg/kg wet							
2-Hexanone	ND	0.0100	mg/kg wet							
4-Chlorotoluene	ND	0.0050	mg/kg wet							
4-Isopropyltoluene	ND	0.0050	mg/kg wet							
4-Methyl-2-Pentanone	ND	0.0100	mg/kg wet							
Acetone	ND	0.0100	mg/kg wet							
Benzene	ND	0.0050	mg/kg wet							
Bromobenzene	ND	0.0050	mg/kg wet							
Bromochloromethane	ND	0.0050	mg/kg wet							
Bromodichloromethane	ND	0.0050	mg/kg wet							
Bromoform	ND	0.0050	mg/kg wet							
Bromomethane	ND	0.0100	mg/kg wet							
Carbon Disulfide	ND	0.0050	mg/kg wet							
Carbon Tetrachloride	ND	0.0050	mg/kg wet							
Chlorobenzene	ND	0.0050	mg/kg wet							
Chloroethane	ND	0.0100	mg/kg wet							
Chloroform	ND	0.0050	mg/kg wet							
Chloromethane	ND	0.0100	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Dibromochloromethane	ND	0.0020	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
Dibromomethane	ND	0.0050	mg/kg wet							
Dichlorodifluoromethane	ND	0.0100	mg/kg wet							
Diethyl Ether	ND	0.0050	mg/kg wet							
Di-isopropyl ether	ND	0.0050	mg/kg wet							
Ethyl tertiary-butyl ether	ND	0.0050	mg/kg wet							
Ethylbenzene	ND	0.0050	mg/kg wet							
Hexachlorobutadiene	ND	0.0050	mg/kg wet							
Isopropylbenzene	ND	0.0050	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.0050	mg/kg wet							
Methylene Chloride	ND	0.0100	mg/kg wet							
Naphthalene	ND	0.0050	mg/kg wet							
n-Butylbenzene	ND	0.0050	mg/kg wet							
n-Propylbenzene	ND	0.0050	mg/kg wet							
sec-Butylbenzene	ND	0.0050	mg/kg wet							
Styrene	ND	0.0050	mg/kg wet							
tert-Butylbenzene	ND	0.0050	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.0050	mg/kg wet							
Tetrachloroethene	ND	0.0050	mg/kg wet							
Tetrahydrofuran	ND	0.0050	mg/kg wet							
Toluene	ND	0.0050	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Trichloroethene	ND	0.0050	mg/kg wet							
Trichlorofluoromethane	ND	0.0050	mg/kg wet							
Vinyl Chloride	ND	0.0100	mg/kg wet							
Xylene O	ND	0.0050	mg/kg wet							
Xylene P,M	ND	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0491*		mg/kg wet	*0.05000*		*98*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0489*		mg/kg wet	*0.05000*		*98*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0474*		mg/kg wet	*0.05000*		*95*	*70-130*			
Surrogate: Toluene-d8	*0.0494*		mg/kg wet	*0.05000*		*99*	*70-130*			
LCS										
1,1,1,2-Tetrachloroethane	0.0479	0.0050	mg/kg wet	0.05000		96	70-130			
1,1,1-Trichloroethane	0.0516	0.0050	mg/kg wet	0.05000		103	70-130			
1,1,2,2-Tetrachloroethane	0.0466	0.0020	mg/kg wet	0.05000		93	70-130			
1,1,2-Trichloroethane	0.0455	0.0050	mg/kg wet	0.05000		91	70-130			
1,1-Dichloroethane	0.0500	0.0050	mg/kg wet	0.05000		100	70-130			
1,1-Dichloroethene	0.0560	0.0050	mg/kg wet	0.05000		112	70-130			
1,1-Dichloropropene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130			
1,2,3-Trichlorobenzene	0.0500	0.0050	mg/kg wet	0.05000		100	70-130			
1,2,3-Trichloropropane	0.0427	0.0050	mg/kg wet	0.05000		85	70-130			
1,2,4-Trichlorobenzene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
1,2,4-Trimethylbenzene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
1,2-Dibromo-3-Chloropropane	0.0349	0.0050	mg/kg wet	0.05000		70	70-130			
1,2-Dibromoethane	0.0471	0.0050	mg/kg wet	0.05000		94	70-130			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
1,2-Dichlorobenzene	0.0504	0.0050	mg/kg wet	0.05000		101	70-130			
1,2-Dichloroethane	0.0478	0.0050	mg/kg wet	0.05000		96	70-130			
1,2-Dichloropropane	0.0483	0.0050	mg/kg wet	0.05000		97	70-130			
1,3,5-Trimethylbenzene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130			
1,3-Dichlorobenzene	0.0512	0.0050	mg/kg wet	0.05000		102	70-130			
1,3-Dichloropropane	0.0500	0.0050	mg/kg wet	0.05000		100	70-130			
1,4-Dichlorobenzene	0.0530	0.0050	mg/kg wet	0.05000		106	70-130			
1,4-Dioxane	0.865	0.100	mg/kg wet	1.000		87	70-130			
2,2-Dichloropropane	0.0516	0.0050	mg/kg wet	0.05000		103	70-130			
2-Butanone	0.240	0.0100	mg/kg wet	0.2500		96	70-130			
2-Chlorotoluene	0.0530	0.0050	mg/kg wet	0.05000		106	70-130			
2-Hexanone	0.236	0.0100	mg/kg wet	0.2500		94	70-130			
4-Chlorotoluene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130			
4-Isopropyltoluene	0.0546	0.0050	mg/kg wet	0.05000		109	70-130			
4-Methyl-2-Pentanone	0.224	0.0100	mg/kg wet	0.2500		89	70-130			
Acetone	0.215	0.0100	mg/kg wet	0.2500		86	70-130			
Benzene	0.0516	0.0050	mg/kg wet	0.05000		103	70-130			
Bromobenzene	0.0511	0.0050	mg/kg wet	0.05000		102	70-130			
Bromochloromethane	0.0477	0.0050	mg/kg wet	0.05000		95	70-130			
Bromodichloromethane	0.0468	0.0050	mg/kg wet	0.05000		94	70-130			
Bromoform	0.0399	0.0050	mg/kg wet	0.05000		80	70-130			
Bromomethane	0.0611	0.0100	mg/kg wet	0.05000		122	70-130			
Carbon Disulfide	0.0564	0.0050	mg/kg wet	0.05000		113	70-130			
Carbon Tetrachloride	0.0500	0.0050	mg/kg wet	0.05000		100	70-130			
Chlorobenzene	0.0517	0.0050	mg/kg wet	0.05000		103	70-130			
Chloroethane	0.0530	0.0100	mg/kg wet	0.05000		106	70-130			
Chloroform	0.0498	0.0050	mg/kg wet	0.05000		100	70-130			
Chloromethane	0.0490	0.0100	mg/kg wet	0.05000		98	70-130			
cis-1,2-Dichloroethene	0.0514	0.0050	mg/kg wet	0.05000		103	70-130			
cis-1,3-Dichloropropene	0.0451	0.0050	mg/kg wet	0.05000		90	70-130			
Dibromochloromethane	0.0426	0.0020	mg/kg wet	0.05000		85	70-130			
Dibromomethane	0.0468	0.0050	mg/kg wet	0.05000		94	70-130			
Dichlorodifluoromethane	0.0590	0.0100	mg/kg wet	0.05000		118	70-130			
Diethyl Ether	0.0488	0.0050	mg/kg wet	0.05000		98	70-130			
Di-isopropyl ether	0.0490	0.0050	mg/kg wet	0.05000		98	70-130			
Ethyl tertiary-butyl ether	0.0436	0.0050	mg/kg wet	0.05000		87	70-130			
Ethylbenzene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130			
Hexachlorobutadiene	0.0525	0.0050	mg/kg wet	0.05000		105	70-130			
Isopropylbenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130			
Methyl tert-Butyl Ether	0.0460	0.0050	mg/kg wet	0.05000		92	70-130			
Methylene Chloride	0.0464	0.0100	mg/kg wet	0.05000		93	70-130			
Naphthalene	0.0481	0.0050	mg/kg wet	0.05000		96	70-130			
n-Butylbenzene	0.0562	0.0050	mg/kg wet	0.05000		112	70-130			
n-Propylbenzene	0.0556	0.0050	mg/kg wet	0.05000		111	70-130			
sec-Butylbenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
Styrene	0.0517	0.0050	mg/kg wet	0.05000		103	70-130			
tert-Butylbenzene	0.0544	0.0050	mg/kg wet	0.05000		109	70-130			
Tertiary-amyl methyl ether	0.0437	0.0050	mg/kg wet	0.05000		87	70-130			
Tetrachloroethene	0.0551	0.0050	mg/kg wet	0.05000		110	70-130			
Tetrahydrofuran	0.0427	0.0050	mg/kg wet	0.05000		85	70-130			
Toluene	0.0509	0.0050	mg/kg wet	0.05000		102	70-130			
trans-1,2-Dichloroethene	0.0509	0.0050	mg/kg wet	0.05000		102	70-130			
trans-1,3-Dichloropropene	0.0405	0.0050	mg/kg wet	0.05000		81	70-130			
Trichloroethene	0.0511	0.0050	mg/kg wet	0.05000		102	70-130			
Trichlorofluoromethane	0.0561	0.0050	mg/kg wet	0.05000		112	70-130			
Vinyl Chloride	0.0558	0.0100	mg/kg wet	0.05000		112	70-130			
Xylene O	0.0537	0.0050	mg/kg wet	0.05000		107	70-130			
Xylene P,M	0.110	0.0100	mg/kg wet	0.1000		110	70-130			
Surrogate: 1,2-Dichloroethane-d4	*0.0471*		mg/kg wet	*0.05000*		*94*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0495*		mg/kg wet	*0.05000*		*99*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0478*		mg/kg wet	*0.05000*		*96*	*70-130*			
Surrogate: Toluene-d8	*0.0520*		mg/kg wet	*0.05000*		*104*	*70-130*			
LCS Dup										
1,1,1,2-Tetrachloroethane	0.0490	0.0050	mg/kg wet	0.05000		98	70-130	2	20	
1,1,1-Trichloroethane	0.0538	0.0050	mg/kg wet	0.05000		108	70-130	4	20	
1,1,2,2-Tetrachloroethane	0.0508	0.0020	mg/kg wet	0.05000		102	70-130	9	20	
1,1,2-Trichloroethane	0.0494	0.0050	mg/kg wet	0.05000		99	70-130	8	20	
1,1-Dichloroethane	0.0526	0.0050	mg/kg wet	0.05000		105	70-130	5	20	
1,1-Dichloroethene	0.0579	0.0050	mg/kg wet	0.05000		116	70-130	3	20	
1,1-Dichloropropene	0.0561	0.0050	mg/kg wet	0.05000		112	70-130	4	20	
1,2,3-Trichlorobenzene	0.0526	0.0050	mg/kg wet	0.05000		105	70-130	5	20	
1,2,3-Trichloropropane	0.0471	0.0050	mg/kg wet	0.05000		94	70-130	10	20	
1,2,4-Trichlorobenzene	0.0544	0.0050	mg/kg wet	0.05000		109	70-130	3	20	
1,2,4-Trimethylbenzene	0.0547	0.0050	mg/kg wet	0.05000		109	70-130	4	20	
1,2-Dibromo-3-Chloropropane	0.0384	0.0050	mg/kg wet	0.05000		77	70-130	10	20	
1,2-Dibromoethane	0.0498	0.0050	mg/kg wet	0.05000		100	70-130	5	20	
1,2-Dichlorobenzene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130	5	20	
1,2-Dichloroethane	0.0518	0.0050	mg/kg wet	0.05000		104	70-130	8	20	
1,2-Dichloropropane	0.0512	0.0050	mg/kg wet	0.05000		102	70-130	6	20	
1,3,5-Trimethylbenzene	0.0554	0.0050	mg/kg wet	0.05000		111	70-130	4	20	
1,3-Dichlorobenzene	0.0541	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
1,3-Dichloropropane	0.0518	0.0050	mg/kg wet	0.05000		104	70-130	4	20	
1,4-Dichlorobenzene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	3	20	
1,4-Dioxane	0.929	0.100	mg/kg wet	1.000		93	70-130	7	20	
2,2-Dichloropropane	0.0539	0.0050	mg/kg wet	0.05000		108	70-130	4	20	
2-Butanone	0.264	0.0100	mg/kg wet	0.2500		105	70-130	9	20	
2-Chlorotoluene	0.0550	0.0050	mg/kg wet	0.05000		110	70-130	4	20	
2-Hexanone	0.254	0.0100	mg/kg wet	0.2500		101	70-130	7	20	
4-Chlorotoluene	0.0558	0.0050	mg/kg wet	0.05000		112	70-130	3	20	
4-Isopropyltoluene	0.0564	0.0050	mg/kg wet	0.05000		113	70-130	3	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
4-Methyl-2-Pentanone	0.249	0.0100	mg/kg wet	0.2500		100	70-130	11	20	
Acetone	0.235	0.0100	mg/kg wet	0.2500		94	70-130	9	20	
Benzene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
Bromobenzene	0.0535	0.0050	mg/kg wet	0.05000		107	70-130	5	20	
Bromochloromethane	0.0516	0.0050	mg/kg wet	0.05000		103	70-130	8	20	
Bromodichloromethane	0.0499	0.0050	mg/kg wet	0.05000		100	70-130	6	20	
Bromoform	0.0422	0.0050	mg/kg wet	0.05000		84	70-130	6	20	
Bromomethane	0.0541	0.0100	mg/kg wet	0.05000		108	70-130	12	20	
Carbon Disulfide	0.0582	0.0050	mg/kg wet	0.05000		116	70-130	3	20	
Carbon Tetrachloride	0.0522	0.0050	mg/kg wet	0.05000		104	70-130	4	20	
Chlorobenzene	0.0527	0.0050	mg/kg wet	0.05000		105	70-130	2	20	
Chloroethane	0.0551	0.0100	mg/kg wet	0.05000		110	70-130	4	20	
Chloroform	0.0528	0.0050	mg/kg wet	0.05000		106	70-130	6	20	
Chloromethane	0.0508	0.0100	mg/kg wet	0.05000		102	70-130	4	20	
cis-1,2-Dichloroethene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
cis-1,3-Dichloropropene	0.0486	0.0050	mg/kg wet	0.05000		97	70-130	7	20	
Dibromochloromethane	0.0445	0.0020	mg/kg wet	0.05000		89	70-130	4	20	
Dibromomethane	0.0509	0.0050	mg/kg wet	0.05000		102	70-130	8	20	
Dichlorodifluoromethane	0.0598	0.0100	mg/kg wet	0.05000		120	70-130	1	20	
Diethyl Ether	0.0527	0.0050	mg/kg wet	0.05000		105	70-130	8	20	
Di-isopropyl ether	0.0525	0.0050	mg/kg wet	0.05000		105	70-130	7	20	
Ethyl tertiary-butyl ether	0.0469	0.0050	mg/kg wet	0.05000		94	70-130	7	20	
Ethylbenzene	0.0543	0.0050	mg/kg wet	0.05000		109	70-130	0.1	20	
Hexachlorobutadiene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	4	20	
Isopropylbenzene	0.0561	0.0050	mg/kg wet	0.05000		112	70-130	3	20	
Methyl tert-Butyl Ether	0.0506	0.0050	mg/kg wet	0.05000		101	70-130	9	20	
Methylene Chloride	0.0491	0.0100	mg/kg wet	0.05000		98	70-130	6	20	
Naphthalene	0.0512	0.0050	mg/kg wet	0.05000		102	70-130	6	20	
n-Butylbenzene	0.0572	0.0050	mg/kg wet	0.05000		114	70-130	2	20	
n-Propylbenzene	0.0572	0.0050	mg/kg wet	0.05000		114	70-130	3	20	
sec-Butylbenzene	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	3	20	
Styrene	0.0523	0.0050	mg/kg wet	0.05000		105	70-130	1	20	
tert-Butylbenzene	0.0562	0.0050	mg/kg wet	0.05000		112	70-130	3	20	
Tertiary-amyl methyl ether	0.0480	0.0050	mg/kg wet	0.05000		96	70-130	9	20	
Tetrachloroethene	0.0545	0.0050	mg/kg wet	0.05000		109	70-130	1	20	
Tetrahydrofuran	0.0475	0.0050	mg/kg wet	0.05000		95	70-130	11	20	
Toluene	0.0537	0.0050	mg/kg wet	0.05000		107	70-130	5	20	
trans-1,2-Dichloroethene	0.0529	0.0050	mg/kg wet	0.05000		106	70-130	4	20	
trans-1,3-Dichloropropene	0.0438	0.0050	mg/kg wet	0.05000		88	70-130	8	20	
Trichloroethene	0.0532	0.0050	mg/kg wet	0.05000		106	70-130	4	20	
Trichlorofluoromethane	0.0578	0.0050	mg/kg wet	0.05000		116	70-130	3	20	
Vinyl Chloride	0.0579	0.0100	mg/kg wet	0.05000		116	70-130	4	20	
Xylene O	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	1	20	
Xylene P,M	0.111	0.0100	mg/kg wet	0.1000		111	70-130	0.4	20	
Surrogate: 1,2-Dichloroethane-d4	*0.0476*		mg/kg wet	*0.05000*		*95*	*70-130*			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CB91419 - 5035										
Surrogate: 4-Bromofluorobenzene	*0.0477*		mg/kg wet	*0.05000*		*95*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0490*		mg/kg wet	*0.05000*		*98*	*70-130*			
Surrogate: Toluene-d8	*0.0497*		mg/kg wet	*0.05000*		*99*	*70-130*			
Classical Chemistry										
Batch CB91946 - General Preparation										
Blank										
Hexavalent Chromium	ND	0.7	mg/kg wet							
LCS										
Hexavalent Chromium	32.6	0.7	mg/kg wet	33.32		98	80-120			
LCS Dup										
Hexavalent Chromium	32.8	0.7	mg/kg wet	33.32		98	80-120	0.6	20	
Reference										
Hexavalent Chromium	72.8	2.0	mg/kg wet	71.00		103	20.3-222.5			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
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Notes and Definitions

Z-10a	Soil pH measured in water at 20.7 ºC.
Z-10	Soil pH measured in water at 20.6 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
CD-	Continuing Calibration %Diff/Drift is below control limit (CD-).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902242

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902242
Date Received: 2/12/2019
Project Due Date: 2/20/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 4.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: 2/12/19 Time: 1803 By: M
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	315885	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	315886	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	315882	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
02	315883	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	315884	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	315888	Yes	NA	Yes	VOA Vial - Other	Other	
02	315889	Yes	NA	Yes	VOA Vial - Other	Other	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 2/12/19 1801
Reviewed By: Date & Time: 2/12/19 1803
Delivered By: 2/12/19 1803

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902242

Turn Time: Std Rush:
Regulatory State: MA
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Reporting Limits: S-1 / S-2 / S-3
Electonic Deliverables: ☑ Limit Checker ☑ Excel ☐ Other (Please Specify) → PDF

Company Name: Tighe + Bond
Contact Person: Todd Kirton c.c. Kerri Lewis
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Address: 446 Main St
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@Tigheband.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Hex Cr	Analysis: VOCs
1	2/12/19	830	G	S	TP-7 (0-2)	X	
2	↓	945	G	S	TP-9 (0-2)	X	X

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other* 1/6/10
Number of Containers: 7

Sampled by: Kll
Comments: Please specify "Other" preservative and containers types in this space

Laboratory Use Only
Cooler Present: Y
Seals Intact: N/A
Cooler Temperature: 4.1 °C

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/12/19 1100	[signature]	[signature]	[signature] 2/12/19 1140
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
	12:15	5:41	

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902265

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 5:41 pm, Feb 27, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

SAMPLE RECEIPT

The following samples were received on February 13, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: Samples 1902265-01, -03, -04, -06, -09, -11, -12, -14, -15, -16, and -18 for Metals were analyzed for a subset of the required MCP list per the client's request.

Revision 1, February 27, 2019: This report has been revised to include Chlordane on the Pesticide list. This compound was analyzed but not reported.

Lab Number	Sample Name	Matrix	Analysis
1902265-01	TP-3A 0-2	Soil	6010C
1902265-02	TP-3A 2-5.5	Soil	EPH8270, MADEP-EPH
1902265-03	TP-3A 5.5-6.5	Soil	6010C
1902265-04	TP-4 0-2	Soil	6010C
1902265-05	TP-4 4.5-5	Soil	6010C, 7471B
1902265-06	TP-5 0-2	Soil	6010C
1902265-07	TP-5 3-5	Soil	6010C, 7471B, 8081B, 8082A, 9014
1902265-08	TP-5 5-6	Soil	6010C, 7471B
1902265-09	TP-6 0-2	Soil	6010C
1902265-10	TP-6 2-5	Soil	6010C, 7471B, 8082A, EPH8270, MADEP-EPH
1902265-11	TP-7 0-2	Soil	6010C
1902265-12	TP-7 2-5	Soil	6010C, EPH8270, MADEP-EPH
1902265-13	TP-7 5-5.5	Soil	6010C, 7471B
1902265-14	TP-8 0-2	Soil	6010C
1902265-15	TP-8 2-6	Soil	6010C
1902265-16	TP-9 0-2	Soil	6010C
1902265-17	TP-9 2-3	Soil	6010C, 7471B, 8082A, EPH8270, MADEP-EPH
1902265-18	TP-9 3-5	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

PROJECT NARRATIVE

Total Metals
CB91544-BSD1 **Blank Spike recovery is below lower control limit (B-).**
Cadmium (86% @ 87-113%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902265-01 through 1902265-18**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. 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" 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" 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: _____ Date: February 21, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-3A 0-2
Date Sampled: 02/11/19 08:15
Percent Solids: 75

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5150** (32.2)		6010C		10	KJK	02/19/19 14:43	2.07	100	CB91544
Chromium	**1820** (1.29)		6010C		1	KJK	02/16/19 1:14	2.07	100	CB91544
Lead	**91.7** (6.43)		6010C		1	KJK	02/16/19 1:14	2.07	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-3A 2-5.5
Date Sampled: 02/11/19 08:30
Percent Solids: 24
Initial Volume: 24.7
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-02
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 2/14/19 14:00

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (63.2)		MADEP-EPH		1	CAD	02/15/19 3:34	C9B0223	CB91403
C19-C36 Aliphatics1	**150** (63.2)		MADEP-EPH		1	CAD	02/15/19 3:34	C9B0223	CB91403
C11-C22 Unadjusted Aromatics1	**145** (63.2)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
C11-C22 Aromatics1,2	**145** (63.2)		EPH8270			ZLC	02/15/19 23:55		[CALC]
2-Methylnaphthalene	ND (0.84)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Acenaphthene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Naphthalene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Phenanthrene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Acenaphthylene	ND (0.84)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Anthracene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Benzo(a)anthracene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Benzo(a)pyrene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Benzo(b)fluoranthene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Benzo(g,h,i)perylene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Benzo(k)fluoranthene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Chrysene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Dibenzo(a,h)Anthracene	ND (0.84)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Fluoranthene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Fluorene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Indeno(1,2,3-cd)Pyrene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403
Pyrene	ND (1.69)		EPH8270		1	ZLC	02/15/19 23:55	C9B0233	CB91403

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*55 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*88 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*88 %*		*40-140*
Surrogate: O-Terphenyl	*74 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-3A 5.5-6.5
Date Sampled: 02/11/19 08:45
Percent Solids: 70

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**32.8** (2.64)		6010C		1	KJK	02/16/19 1:19	2.72	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-4 0-2
Date Sampled: 02/11/19 09:15
Percent Solids: 69

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2330** (3.05)		6010C		1	KJK	02/16/19 1:24	2.36	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-4 4.5-5
Date Sampled: 02/11/19 09:30
Percent Solids: 80

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.64)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Arsenic	**34.9** (2.82)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Barium	**60.8** (2.82)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Beryllium	**0.64** (0.12)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Cadmium	ND (0.56)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Chromium	**23.0** (1.13)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Lead	**8.93** (5.64)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Mercury	**0.066** (0.024)		7471B		1	MKS	02/20/19 11:10	1.03	40	CB91545
Nickel	**18.7** (2.82)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Selenium	ND (5.64)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Silver	ND (0.56)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Thallium	ND (5.64)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Vanadium	**54.8** (1.13)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544
Zinc	**80.7** (2.82)		6010C		1	KJK	02/16/19 1:42	2.23	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 0-2
Date Sampled: 02/11/19 10:00
Percent Solids: 79

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**508** (2.52)		6010C		1	KJK	02/16/19 2:05	2.5	100	CB91544
Chromium	**106** (1.01)		6010C		1	KJK	02/16/19 2:05	2.5	100	CB91544
Lead	**51.1** (5.05)		6010C		1	KJK	02/16/19 2:05	2.5	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 3-5
Date Sampled: 02/11/19 10:15
Percent Solids: 57

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (6.80)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Arsenic	**4.10** (3.40)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Barium	**38.5** (3.40)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Beryllium	**0.70** (0.15)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Cadmium	ND (0.68)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Chromium	**24.2** (1.36)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Lead	**22.4** (6.80)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Mercury	**0.061** (0.043)		7471B		1	MKS	02/20/19 11:20	0.8	40	CB91545
Nickel	**15.0** (3.40)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Selenium	ND (6.80)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Silver	ND (0.68)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Thallium	ND (6.80)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Vanadium	**54.6** (1.36)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544
Zinc	**56.4** (3.40)		6010C		1	KJK	02/16/19 2:09	2.56	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 3-5
Date Sampled: 02/11/19 10:15
Percent Solids: 57
Initial Volume: 19.5
Final Volume: 5
Extraction Method: 3546

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-07
Sample Matrix: Soil
Units: mg/kg dry
Analyst: DMC
Prepared: 2/19/19 14:18

8081B Organochlorine Pesticides

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
4,4´-DDD	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
4,4´-DDE	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
4,4´-DDT	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Aldrin	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
alpha-BHC	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
alpha-Chlordane	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
beta-BHC	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Chlordane (Total)	ND (0.0357)		8081B		1	02/20/19 18:34	C9B0265	CB91903
delta-BHC	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Dieldrin	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Endosulfan I	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Endosulfan II	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Endosulfan Sulfate	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Endrin	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Endrin Ketone	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
gamma-BHC (Lindane)	ND (0.0027)		8081B		1	02/20/19 18:34	C9B0265	CB91903
gamma-Chlordane	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Heptachlor	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Heptachlor Epoxide	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Hexachlorobenzene	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903
Methoxychlor	ND (0.0045)		8081B		1	02/20/19 18:34	C9B0265	CB91903

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*87 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*82 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*86 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*83 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 3-5
Date Sampled: 02/11/19 10:15
Percent Solids: 57
Initial Volume: 20.1
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-07
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 2/14/19 16:15

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1221	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1232	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1242	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1248	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1254	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1260	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1262	ND (0.04)		8082A		1	02/15/19 23:12		CB91541
Aroclor 1268	ND (0.04)		8082A		1	02/15/19 23:12		CB91541

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*102 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*104 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*115 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*127 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 3-5
Date Sampled: 02/11/19 10:15
Percent Solids: 57

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-07
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Total Cyanide	ND (1.68)		9014		1	EEM	02/19/19 12:00	mg/kg dry	CB91919

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-5 5-6
Date Sampled: 02/11/19 10:30
Percent Solids: 86

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-08
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Arsenic	**5.12** (2.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Barium	**53.9** (2.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Beryllium	**0.70** (0.11)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Cadmium	ND (0.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Chromium	**20.8** (1.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Lead	**8.11** (5.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Mercury	ND (0.034)		7471B		1	MKS	02/20/19 11:34	0.68	40	CB91545
Nickel	**20.0** (2.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Selenium	ND (5.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Silver	ND (0.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Thallium	ND (5.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Vanadium	**39.3** (1.00)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544
Zinc	**68.5** (2.50)		6010C		1	KJK	02/16/19 2:41	2.32	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-6 0-2
Date Sampled: 02/11/19 11:00
Percent Solids: 69

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-09
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**623** (3.40)		6010C		1	KJK	02/16/19 2:47	2.14	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-6 2-5
Date Sampled: 02/11/19 11:15
Percent Solids: 77

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-10
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.41)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Arsenic	**250** (2.71)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Barium	**75.1** (2.71)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Beryllium	**0.34** (0.12)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Cadmium	**2.60** (0.54)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Chromium	**92.9** (1.08)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Lead	**65.9** (5.41)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Mercury	**13.5** (1.37)		7471B		50	MKS	02/20/19 15:24	0.94	40	CB91545
Nickel	**12.6** (2.71)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Selenium	ND (5.41)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Silver	ND (0.54)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Thallium	ND (5.41)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Vanadium	**29.3** (1.08)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544
Zinc	**114** (2.71)		6010C		1	KJK	02/16/19 2:51	2.4	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-6 2-5
Date Sampled: 02/11/19 11:15
Percent Solids: 77
Initial Volume: 20.9
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-10
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 2/14/19 16:15

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1221	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1232	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1242	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1248	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1254	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1260	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1262	ND (0.03)		8082A		1	02/15/19 15:32		CB91406
Aroclor 1268	ND (0.03)		8082A		1	02/15/19 15:32		CB91406

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*75 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*72 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*75 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*97 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-6 2-5
Date Sampled: 02/11/19 11:15
Percent Solids: 77
Initial Volume: 24.7
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-10
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 2/14/19 14:00

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (19.7)		MADEP-EPH		1	CAD	02/15/19 4:21	C9B0223	CB91403
C19-C36 Aliphatics1	**20.2** (19.7)		MADEP-EPH		1	CAD	02/15/19 4:21	C9B0223	CB91403
C11-C22 Unadjusted Aromatics1	**137** (19.7)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
C11-C22 Aromatics1,2	**83.1** (19.7)		EPH8270			VSC	02/19/19 14:21		[CALC]
2-Methylnaphthalene	**0.29** (0.26)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Acenaphthene	**0.99** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Naphthalene	**0.72** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Phenanthrene	**11.4** (2.63)		EPH8270		5	VSC	02/19/19 14:21	C9B0233	CB91403
Acenaphthylene	ND (0.26)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Anthracene	**1.82** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Benzo(a)anthracene	**3.15** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Benzo(a)pyrene	**2.97** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Benzo(b)fluoranthene	**3.23** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Benzo(g,h,i)perylene	**1.49** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Benzo(k)fluoranthene	**1.18** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Chrysene	**3.20** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Dibenzo(a,h)Anthracene	**0.48** (0.26)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Fluoranthene	**9.32** (2.63)		EPH8270		5	VSC	02/19/19 14:21	C9B0233	CB91403
Fluorene	**0.96** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Indeno(1,2,3-cd)Pyrene	**1.78** (0.53)		EPH8270		1	ZLC	02/16/19 0:38	C9B0233	CB91403
Pyrene	**11.1** (2.63)		EPH8270		5	VSC	02/19/19 14:21	C9B0233	CB91403

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*63 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*90 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*93 %*		*40-140*
Surrogate: O-Terphenyl	*85 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-7 0-2
Date Sampled: 02/12/19 08:00
Percent Solids: 81

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-11
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**10.4** (2.78)		6010C		1	KJK	02/16/19 2:55	2.21	100	CB91544
Chromium	**25.5** (1.11)		6010C		1	KJK	02/16/19 2:55	2.21	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-7 2-5
Date Sampled: 02/12/19 08:30
Percent Solids: 86

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-12
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**3.65** (2.42)		6010C		1	KJK	02/16/19 2:59	2.41	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-7 2-5
Date Sampled: 02/12/19 08:30
Percent Solids: 86
Initial Volume: 24
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-12
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 2/14/19 14:00

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (18.2)		MADEP-EPH		1	CAD	02/15/19 5:08	C9B0223	CB91403
C19-C36 Aliphatics1	ND (18.2)		MADEP-EPH		1	CAD	02/15/19 5:08	C9B0223	CB91403
C11-C22 Unadjusted Aromatics1	ND (18.2)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
C11-C22 Aromatics1,2	ND (18.2)		EPH8270			ZLC	02/16/19 1:21		[CALC]
2-Methylnaphthalene	ND (0.24)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Acenaphthene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Naphthalene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Phenanthrene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Acenaphthylene	ND (0.24)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Anthracene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Benzo(a)anthracene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Benzo(a)pyrene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Benzo(b)fluoranthene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Benzo(g,h,i)perylene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Benzo(k)fluoranthene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Chrysene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Dibenzo(a,h)Anthracene	ND (0.24)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Fluoranthene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Fluorene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Indeno(1,2,3-cd)Pyrene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403
Pyrene	ND (0.49)		EPH8270		1	ZLC	02/16/19 1:21	C9B0233	CB91403

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*62 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*94 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*94 %*		*40-140*
Surrogate: O-Terphenyl	*84 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-7 5-5.5
Date Sampled: 02/12/19 08:45
Percent Solids: 86

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-13
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (4.42)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Arsenic	**2.66** (2.21)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Barium	**35.6** (2.21)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Beryllium	**0.48** (0.10)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Cadmium	ND (0.44)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Chromium	**17.0** (0.88)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Lead	**6.25** (4.42)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Mercury	ND (0.032)		7471B		1	MKS	02/20/19 11:38	0.72	40	CB91545
Nickel	**13.8** (2.21)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Selenium	ND (4.42)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Silver	ND (0.44)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Thallium	ND (4.42)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Vanadium	**31.6** (0.88)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544
Zinc	**51.0** (2.21)		6010C		1	KJK	02/16/19 3:03	2.62	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-8 0-2
Date Sampled: 02/12/19 10:30
Percent Solids: 85

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-14
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**132** (2.53)		6010C		1	KJK	02/16/19 3:06	2.32	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-8 2-6
Date Sampled: 02/12/19 10:45
Percent Solids: 87

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-15
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**18.4** (2.82)		6010C		1	KJK	02/16/19 3:10	2.03	100	CB91544
Chromium	**44.6** (1.13)		6010C		1	KJK	02/16/19 3:10	2.03	100	CB91544
Lead	**12.8** (5.64)		6010C		1	KJK	02/16/19 3:10	2.03	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 0-2
Date Sampled: 02/12/19 09:15
Percent Solids: 80

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-16
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**62.7** (3.08)		6010C		1	KJK	02/16/19 3:14	2.03	100	CB91544
Chromium	**302** (1.23)		6010C		1	KJK	02/16/19 3:14	2.03	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 2-3
Date Sampled: 02/12/19 09:30
Percent Solids: 80

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-17
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.03)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Arsenic	**6.94** (2.51)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Barium	**54.9** (2.51)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Beryllium	**0.57** (0.11)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Cadmium	ND (0.50)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Chromium	**46.6** (1.01)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Lead	**31.4** (5.03)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Mercury	**0.046** (0.025)		7471B		1	MKS	02/20/19 11:40	1	40	CB91545
Nickel	**16.0** (2.51)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Selenium	ND (5.03)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Silver	ND (0.50)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Thallium	ND (5.03)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Vanadium	**29.8** (1.01)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544
Zinc	**88.4** (2.51)		6010C		1	KJK	02/16/19 3:31	2.48	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 2-3
Date Sampled: 02/12/19 09:30
Percent Solids: 80
Initial Volume: 20
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-17
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 2/14/19 16:15

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1221	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1232	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1242	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1248	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1254	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1260	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1262	ND (0.03)		8082A		1	02/15/19 15:51		CB91406
Aroclor 1268	ND (0.03)		8082A		1	02/15/19 15:51		CB91406

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*101 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*109 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*121 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*131 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 2-3
Date Sampled: 02/12/19 09:30
Percent Solids: 80
Initial Volume: 25.1
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-17
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 2/14/19 14:00

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (18.6)		MADEP-EPH		1	CAD	02/15/19 5:55	C9B0223	CB91403
C19-C36 Aliphatics1	ND (18.6)		MADEP-EPH		1	CAD	02/15/19 5:55	C9B0223	CB91403
C11-C22 Unadjusted Aromatics1	ND (18.6)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
C11-C22 Aromatics1,2	ND (18.6)		EPH8270			ZLC	02/16/19 2:05		[CALC]
2-Methylnaphthalene	ND (0.25)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Acenaphthene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Naphthalene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Phenanthrene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Acenaphthylene	ND (0.25)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Anthracene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Benzo(a)anthracene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Benzo(a)pyrene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Benzo(b)fluoranthene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Benzo(g,h,i)perylene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Benzo(k)fluoranthene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Chrysene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Dibenzo(a,h)Anthracene	ND (0.25)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Fluoranthene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Fluorene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Indeno(1,2,3-cd)Pyrene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403
Pyrene	ND (0.50)		EPH8270		1	ZLC	02/16/19 2:05	C9B0233	CB91403

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*63 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*88 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*89 %*		*40-140*
Surrogate: O-Terphenyl	*89 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: TP-9 3-5
Date Sampled: 02/12/19 09:45
Percent Solids: 85

ESS Laboratory Work Order: 1902265
ESS Laboratory Sample ID: 1902265-18
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**31.5** (2.85)		6010C		1	KJK	02/16/19 3:34	2.06	100	CB91544

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CB91544 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	44.0	18.5	mg/kg wet	42.40		104	80-120			
Arsenic	109	9.26	mg/kg wet	128.0		85	85-114			
Barium	594	9.26	mg/kg wet	536.0		111	82-118			
Beryllium	190	0.41	mg/kg wet	217.0		88	84-116			
Cadmium	85.9	1.85	mg/kg wet	99.00		87	87-113			
Chromium	105	3.70	mg/kg wet	116.0		90	82-118			
Lead	258	18.5	mg/kg wet	277.0		93	84-116			
Nickel	103	9.26	mg/kg wet	107.0		96	84-117			
Selenium	211	18.5	mg/kg wet	242.0		87	80-120			
Silver	56.2	1.85	mg/kg wet	64.30		87	86-114			
Thallium	165	18.5	mg/kg wet	183.0		90	80-120			
Vanadium	134	3.70	mg/kg wet	146.0		92	86-114			
Zinc	486	9.26	mg/kg wet	561.0		87	86-114			
LCS Dup										
Antimony	43.6	20.0	mg/kg wet	42.40		103	80-120	1	20	
Arsenic	110	10.0	mg/kg wet	128.0		86	85-114	1	20	
Barium	532	10.0	mg/kg wet	536.0		99	82-118	11	20	
Beryllium	192	0.44	mg/kg wet	217.0		88	84-116	0.9	20	
Cadmium	85.2	2.00	mg/kg wet	99.00		86	87-113	0.9	20	B-
Chromium	107	4.00	mg/kg wet	116.0		93	82-118	2	20	
Lead	261	20.0	mg/kg wet	277.0		94	84-116	1	20	
Nickel	110	10.0	mg/kg wet	107.0		103	84-117	7	20	
Selenium	212	20.0	mg/kg wet	242.0		87	80-120	0.3	20	
Silver	57.7	2.00	mg/kg wet	64.30		90	86-114	3	20	
Thallium	165	20.0	mg/kg wet	183.0		90	80-120	0.08	20	
Vanadium	137	4.00	mg/kg wet	146.0		94	86-114	2	20	
Zinc	495	10.0	mg/kg wet	561.0		88	86-114	2	20	
Batch CB91545 - 7471B										
Blank										

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CB91545 - 7471B										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.53	0.336	mg/kg wet	3.710		95	65-135			
LCS Dup										
Mercury	3.71	0.374	mg/kg wet	3.710		100	65-135	5	20	
Reference										
Mercury	1.02	0.177	mg/kg wet	1000		0.1	0-200			
8081B Organochlorine Pesticides										
Batch CB91903 - 3546										
Blank										
4,4´-DDD	ND	0.0025	mg/kg wet							
4,4´-DDD [2C]	ND	0.0025	mg/kg wet							
4,4´-DDE	ND	0.0025	mg/kg wet							
4,4´-DDE [2C]	ND	0.0025	mg/kg wet							
4,4´-DDT	ND	0.0025	mg/kg wet							
4,4´-DDT [2C]	ND	0.0025	mg/kg wet							
Aldrin	ND	0.0025	mg/kg wet							
Aldrin [2C]	ND	0.0025	mg/kg wet							
alpha-BHC	ND	0.0025	mg/kg wet							
alpha-BHC [2C]	ND	0.0025	mg/kg wet							
alpha-Chlordane	ND	0.0025	mg/kg wet							
alpha-Chlordane [2C]	ND	0.0025	mg/kg wet							
beta-BHC	ND	0.0025	mg/kg wet							
beta-BHC [2C]	ND	0.0025	mg/kg wet							
Chlordane (Total)	ND	0.0200	mg/kg wet							
Chlordane (Total) [2C]	ND	0.0200	mg/kg wet							
delta-BHC	ND	0.0025	mg/kg wet							
delta-BHC [2C]	ND	0.0025	mg/kg wet							
Dieldrin	ND	0.0010	mg/kg wet							
Dieldrin [2C]	ND	0.0010	mg/kg wet							
Endosulfan I	ND	0.0025	mg/kg wet							
Endosulfan I [2C]	ND	0.0025	mg/kg wet							
Endosulfan II	ND	0.0025	mg/kg wet							
Endosulfan II [2C]	ND	0.0025	mg/kg wet							
Endosulfan Sulfate	ND	0.0025	mg/kg wet							
Endosulfan Sulfate [2C]	ND	0.0025	mg/kg wet							
Endrin	ND	0.0025	mg/kg wet							
Endrin [2C]	ND	0.0025	mg/kg wet							
Endrin Ketone	ND	0.0025	mg/kg wet							
Endrin Ketone [2C]	ND	0.0025	mg/kg wet							
gamma-BHC (Lindane)	ND	0.0008	mg/kg wet							
gamma-BHC (Lindane) [2C]	ND	0.0008	mg/kg wet							
gamma-Chlordane	ND	0.0025	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CB91903 - 3546										
gamma-Chlordane [2C]	ND	0.0025	mg/kg wet							
Heptachlor	ND	0.0025	mg/kg wet							
Heptachlor [2C]	ND	0.0025	mg/kg wet							
Heptachlor Epoxide	ND	0.0025	mg/kg wet							
Heptachlor Epoxide [2C]	ND	0.0025	mg/kg wet							
Hexachlorobenzene	ND	0.0025	mg/kg wet							
Hexachlorobenzene [2C]	ND	0.0025	mg/kg wet							
Methoxychlor	ND	0.0025	mg/kg wet							
Methoxychlor [2C]	ND	0.0025	mg/kg wet							
Toxaphene	ND	0.125	mg/kg wet							
Toxaphene [2C]	ND	0.125	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0140*		mg/kg wet	*0.01250*		*112*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0133*		mg/kg wet	*0.01250*		*106*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0143*		mg/kg wet	*0.01250*		*114*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0134*		mg/kg wet	*0.01250*		*107*	*30-150*			
LCS										
4,4´-DDD	0.0116	0.0025	mg/kg wet	0.01250		93	40-140			
4,4´-DDD [2C]	0.0116	0.0025	mg/kg wet	0.01250		93	40-140			
4,4´-DDE	0.0125	0.0025	mg/kg wet	0.01250		100	40-140			
4,4´-DDE [2C]	0.0124	0.0025	mg/kg wet	0.01250		99	40-140			
4,4´-DDT	0.0129	0.0025	mg/kg wet	0.01250		103	40-140			
4,4´-DDT [2C]	0.0133	0.0025	mg/kg wet	0.01250		106	40-140			
Aldrin	0.0131	0.0025	mg/kg wet	0.01250		105	40-140			
Aldrin [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140			
alpha-BHC	0.0133	0.0025	mg/kg wet	0.01250		107	40-140			
alpha-BHC [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140			
alpha-Chlordane	0.0118	0.0025	mg/kg wet	0.01250		95	40-140			
alpha-Chlordane [2C]	0.0118	0.0025	mg/kg wet	0.01250		94	40-140			
beta-BHC	0.0114	0.0025	mg/kg wet	0.01250		91	40-140			
beta-BHC [2C]	0.0110	0.0025	mg/kg wet	0.01250		88	40-140			
delta-BHC	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
delta-BHC [2C]	0.0109	0.0025	mg/kg wet	0.01250		87	40-140			
Dieldrin	0.0136	0.0025	mg/kg wet	0.01250		109	40-140			
Dieldrin [2C]	0.0131	0.0025	mg/kg wet	0.01250		105	40-140			
Endosulfan I	0.0118	0.0025	mg/kg wet	0.01250		95	40-140			
Endosulfan I [2C]	0.0117	0.0025	mg/kg wet	0.01250		93	40-140			
Endosulfan II	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Endosulfan II [2C]	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Endosulfan Sulfate	0.0119	0.0025	mg/kg wet	0.01250		95	40-140			
Endosulfan Sulfate [2C]	0.0120	0.0025	mg/kg wet	0.01250		96	40-140			
Endrin	0.0127	0.0025	mg/kg wet	0.01250		101	40-140			
Endrin [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140			
Endrin Ketone	0.0132	0.0025	mg/kg wet	0.01250		105	40-140			
Endrin Ketone [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140			

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Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CB91903 - 3546										
gamma-BHC (Lindane)	0.0132	0.0015	mg/kg wet	0.01250		106	40-140			
gamma-BHC (Lindane) [2C]	0.0124	0.0015	mg/kg wet	0.01250		99	40-140			
gamma-Chlordane	0.0124	0.0025	mg/kg wet	0.01250		99	40-140			
gamma-Chlordane [2C]	0.0120	0.0025	mg/kg wet	0.01250		96	40-140			
Heptachlor	0.0128	0.0025	mg/kg wet	0.01250		102	40-140			
Heptachlor [2C]	0.0125	0.0025	mg/kg wet	0.01250		100	40-140			
Heptachlor Epoxide	0.0131	0.0025	mg/kg wet	0.01250		105	40-140			
Heptachlor Epoxide [2C]	0.0127	0.0025	mg/kg wet	0.01250		102	40-140			
Hexachlorobenzene	0.0115	0.0025	mg/kg wet	0.01250		92	40-140			
Hexachlorobenzene [2C]	0.0110	0.0025	mg/kg wet	0.01250		88	40-140			
Methoxychlor	0.0110	0.0025	mg/kg wet	0.01250		88	40-140			
Methoxychlor [2C]	0.0110	0.0025	mg/kg wet	0.01250		88	40-140			
Surrogate: Decachlorobiphenyl	*0.0153*		mg/kg wet	*0.01250*		*123*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0147*		mg/kg wet	*0.01250*		*118*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0148*		mg/kg wet	*0.01250*		*119*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0142*		mg/kg wet	*0.01250*		*113*	*30-150*			
LCS Dup										
4,4´-DDD	0.0124	0.0025	mg/kg wet	0.01250		99	40-140	7	30	
4,4´-DDD [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	4	30	
4,4´-DDE	0.0131	0.0025	mg/kg wet	0.01250		105	40-140	5	30	
4,4´-DDE [2C]	0.0129	0.0025	mg/kg wet	0.01250		103	40-140	3	30	
4,4´-DDT	0.0142	0.0025	mg/kg wet	0.01250		113	40-140	9	30	
4,4´-DDT [2C]	0.0142	0.0025	mg/kg wet	0.01250		113	40-140	7	30	
Aldrin	0.0132	0.0025	mg/kg wet	0.01250		105	40-140	0.7	30	
Aldrin [2C]	0.0127	0.0025	mg/kg wet	0.01250		101	40-140	0.7	30	
alpha-BHC	0.0133	0.0025	mg/kg wet	0.01250		107	40-140	0.04	30	
alpha-BHC [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140	0.4	30	
alpha-Chlordane	0.0122	0.0025	mg/kg wet	0.01250		97	40-140	3	30	
alpha-Chlordane [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	3	30	
beta-BHC	0.0117	0.0025	mg/kg wet	0.01250		93	40-140	2	30	
beta-BHC [2C]	0.0113	0.0025	mg/kg wet	0.01250		90	40-140	2	30	
delta-BHC	0.0118	0.0025	mg/kg wet	0.01250		94	40-140	2	30	
delta-BHC [2C]	0.0112	0.0025	mg/kg wet	0.01250		90	40-140	3	30	
Dieldrin	0.0140	0.0025	mg/kg wet	0.01250		112	40-140	3	30	
Dieldrin [2C]	0.0135	0.0025	mg/kg wet	0.01250		108	40-140	3	30	
Endosulfan I	0.0122	0.0025	mg/kg wet	0.01250		97	40-140	3	30	
Endosulfan I [2C]	0.0120	0.0025	mg/kg wet	0.01250		96	40-140	2	30	
Endosulfan II	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	5	30	
Endosulfan II [2C]	0.0121	0.0025	mg/kg wet	0.01250		97	40-140	5	30	
Endosulfan Sulfate	0.0126	0.0025	mg/kg wet	0.01250		101	40-140	6	30	
Endosulfan Sulfate [2C]	0.0127	0.0025	mg/kg wet	0.01250		102	40-140	6	30	
Endrin	0.0132	0.0025	mg/kg wet	0.01250		105	40-140	4	30	
Endrin [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140	3	30	
Endrin Ketone	0.0140	0.0025	mg/kg wet	0.01250		112	40-140	6	30	

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8081B Organochlorine Pesticides										
Batch CB91903 - 3546										
Endrin Ketone [2C]	0.0138	0.0025	mg/kg wet	0.01250		110	40-140	6	30	
gamma-BHC (Lindane)	0.0134	0.0015	mg/kg wet	0.01250		107	40-140	1	30	
gamma-BHC (Lindane) [2C]	0.0126	0.0015	mg/kg wet	0.01250		101	40-140	2	30	
gamma-Chlordane	0.0127	0.0025	mg/kg wet	0.01250		102	40-140	3	30	
gamma-Chlordane [2C]	0.0123	0.0025	mg/kg wet	0.01250		99	40-140	3	30	
Heptachlor	0.0129	0.0025	mg/kg wet	0.01250		103	40-140	1	30	
Heptachlor [2C]	0.0126	0.0025	mg/kg wet	0.01250		101	40-140	1	30	
Heptachlor Epoxide	0.0133	0.0025	mg/kg wet	0.01250		107	40-140	2	30	
Heptachlor Epoxide [2C]	0.0130	0.0025	mg/kg wet	0.01250		104	40-140	2	30	
Hexachlorobenzene	0.0114	0.0025	mg/kg wet	0.01250		92	40-140	0.7	30	
Hexachlorobenzene [2C]	0.0110	0.0025	mg/kg wet	0.01250		88	40-140	0.6	30	
Methoxychlor	0.0122	0.0025	mg/kg wet	0.01250		97	40-140	10	30	
Methoxychlor [2C]	0.0122	0.0025	mg/kg wet	0.01250		98	40-140	10	30	
Surrogate: Decachlorobiphenyl	*0.0164*		mg/kg wet	*0.01250*		*131*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0157*		mg/kg wet	*0.01250*		*126*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0141*		mg/kg wet	*0.01250*		*113*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0136*		mg/kg wet	*0.01250*		*108*	*30-150*			
8082A Polychlorinated Biphenyls (PCB)										
Batch CB91406 - 3540C										
Blank										
Aroclor 1016	ND	0.02	mg/kg wet							
Aroclor 1016 [2C]	ND	0.02	mg/kg wet							
Aroclor 1221	ND	0.02	mg/kg wet							
Aroclor 1221 [2C]	ND	0.02	mg/kg wet							
Aroclor 1232	ND	0.02	mg/kg wet							
Aroclor 1232 [2C]	ND	0.02	mg/kg wet							
Aroclor 1242	ND	0.02	mg/kg wet							
Aroclor 1242 [2C]	ND	0.02	mg/kg wet							
Aroclor 1248	ND	0.02	mg/kg wet							
Aroclor 1248 [2C]	ND	0.02	mg/kg wet							
Aroclor 1254	ND	0.02	mg/kg wet							
Aroclor 1254 [2C]	ND	0.02	mg/kg wet							
Aroclor 1260	ND	0.02	mg/kg wet							
Aroclor 1260 [2C]	ND	0.02	mg/kg wet							
Aroclor 1262	ND	0.02	mg/kg wet							
Aroclor 1262 [2C]	ND	0.02	mg/kg wet							
Aroclor 1268	ND	0.02	mg/kg wet							
Aroclor 1268 [2C]	ND	0.02	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0253*		mg/kg wet	*0.02500*		*101*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0263*		mg/kg wet	*0.02500*		*105*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0286*		mg/kg wet	*0.02500*		*114*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0315*		mg/kg wet	*0.02500*		*126*	*30-150*			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CB91406 - 3540C										
LCS										
Aroclor 1016	0.5	0.02	mg/kg wet	0.5000		103	40-140			
Aroclor 1016 [2C]	0.5	0.02	mg/kg wet	0.5000		104	40-140			
Aroclor 1260	0.5	0.02	mg/kg wet	0.5000		91	40-140			
Aroclor 1260 [2C]	0.5	0.02	mg/kg wet	0.5000		93	40-140			
Surrogate: Decachlorobiphenyl	*0.0264*		mg/kg wet	*0.02500*		*106*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0283*		mg/kg wet	*0.02500*		*113*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0306*		mg/kg wet	*0.02500*		*122*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0312*		mg/kg wet	*0.02500*		*125*	*30-150*			
LCS Dup										
Aroclor 1016	0.5	0.02	mg/kg wet	0.5000		104	40-140	1	30	
Aroclor 1016 [2C]	0.5	0.02	mg/kg wet	0.5000		104	40-140	0.2	30	
Aroclor 1260	0.5	0.02	mg/kg wet	0.5000		95	40-140	4	30	
Aroclor 1260 [2C]	0.5	0.02	mg/kg wet	0.5000		96	40-140	3	30	
Surrogate: Decachlorobiphenyl	*0.0273*		mg/kg wet	*0.02500*		*109*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0285*		mg/kg wet	*0.02500*		*114*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0302*		mg/kg wet	*0.02500*		*121*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0306*		mg/kg wet	*0.02500*		*123*	*30-150*			
Batch CB91541 - 3540C										
Blank										
Aroclor 1016	ND	0.02	mg/kg wet							
Aroclor 1016 [2C]	ND	0.02	mg/kg wet							
Aroclor 1221	ND	0.02	mg/kg wet							
Aroclor 1221 [2C]	ND	0.02	mg/kg wet							
Aroclor 1232	ND	0.02	mg/kg wet							
Aroclor 1232 [2C]	ND	0.02	mg/kg wet							
Aroclor 1242	ND	0.02	mg/kg wet							
Aroclor 1242 [2C]	ND	0.02	mg/kg wet							
Aroclor 1248	ND	0.02	mg/kg wet							
Aroclor 1248 [2C]	ND	0.02	mg/kg wet							
Aroclor 1254	ND	0.02	mg/kg wet							
Aroclor 1254 [2C]	ND	0.02	mg/kg wet							
Aroclor 1260	ND	0.02	mg/kg wet							
Aroclor 1260 [2C]	ND	0.02	mg/kg wet							
Aroclor 1262	ND	0.02	mg/kg wet							
Aroclor 1262 [2C]	ND	0.02	mg/kg wet							
Aroclor 1268	ND	0.02	mg/kg wet							
Aroclor 1268 [2C]	ND	0.02	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0276*		mg/kg wet	*0.02500*		*110*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0285*		mg/kg wet	*0.02500*		*114*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0316*		mg/kg wet	*0.02500*		*127*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0327*		mg/kg wet	*0.02500*		*131*	*30-150*			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CB91541 - 3540C										
LCS										
Aroclor 1016	0.5	0.02	mg/kg wet	0.5000		108	40-140			
Aroclor 1016 [2C]	0.5	0.02	mg/kg wet	0.5000		107	40-140			
Aroclor 1260	0.5	0.02	mg/kg wet	0.5000		102	40-140			
Aroclor 1260 [2C]	0.5	0.02	mg/kg wet	0.5000		99	40-140			
Surrogate: Decachlorobiphenyl	*0.0286*		mg/kg wet	*0.02500*		*114*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0295*		mg/kg wet	*0.02500*		*118*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0320*		mg/kg wet	*0.02500*		*128*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0320*		mg/kg wet	*0.02500*		*128*	*30-150*			
LCS Dup										
Aroclor 1016	0.5	0.02	mg/kg wet	0.5000		106	40-140	2	30	
Aroclor 1016 [2C]	0.6	0.02	mg/kg wet	0.5000		116	40-140	8	30	
Aroclor 1260	0.5	0.02	mg/kg wet	0.5000		102	40-140	0.4	30	
Aroclor 1260 [2C]	0.5	0.02	mg/kg wet	0.5000		100	40-140	1	30	
Surrogate: Decachlorobiphenyl	*0.0284*		mg/kg wet	*0.02500*		*113*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0294*		mg/kg wet	*0.02500*		*117*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0306*		mg/kg wet	*0.02500*		*123*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0309*		mg/kg wet	*0.02500*		*124*	*30-150*			
Classical Chemistry										
Batch CB91919 - TCN Prep										
Blank										
Total Cyanide	ND	1.00	mg/kg wet							
LCS										
Total Cyanide	4.97	1.00	mg/kg wet	5.015		99	90-110			
Reference										
Total Cyanide	151	9.87	mg/kg wet	157.0		96	24-110			
Reference										
Total Cyanide	149	9.79	mg/kg wet	157.0		95	24-110			
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB91403 - 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							

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Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB91403 - 3546										
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							
Surrogate: 1-Chlorooctadecane	*1.46*		mg/kg wet	*2.000*		*73*	*40-140*			
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	0.20	mg/kg wet							
Benzo(g,h,i)perylene	ND	0.40	mg/kg wet							
Benzo(k)fluoranthene	ND	0.20	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							
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	*48.6*		mg/L	*50.00*		*97*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*48.5*		mg/L	*50.00*		*97*	*40-140*			
Surrogate: O-Terphenyl	*2.10*		mg/kg wet	*2.000*		*105*	*40-140*			
LCS										
C19-C36 Aliphatics1	16.5	15.0	mg/kg wet	16.00		103	40-140			
C9-C18 Aliphatics1	9.1	15.0	mg/kg wet	12.00		76	40-140			
Decane (C10)	0.8	0.5	mg/kg wet	2.000		40	40-140			
Docosane (C22)	1.5	0.5	mg/kg wet	2.000		73	40-140			
Dodecane (C12)	0.9	0.5	mg/kg wet	2.000		47	40-140			
Eicosane (C20)	1.4	0.5	mg/kg wet	2.000		72	40-140			
Hexacosane (C26)	1.4	0.5	mg/kg wet	2.000		72	40-140			
Hexadecane (C16)	1.4	0.5	mg/kg wet	2.000		68	40-140			
Hexatriacontane (C36)	1.5	0.5	mg/kg wet	2.000		77	40-140			
Nonadecane (C19)	1.4	0.5	mg/kg wet	2.000		72	40-140			
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		33	30-140			
Octacosane (C28)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Octadecane (C18)	1.4	0.5	mg/kg wet	2.000		72	40-140			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB91403 - 3546										
Tetracosane (C24)	1.5	0.5	mg/kg wet	2.000		74	40-140			
Tetradecane (C14)	1.1	0.5	mg/kg wet	2.000		56	40-140			
Triacontane (C30)	1.4	0.5	mg/kg wet	2.000		69	40-140			
Surrogate: 1-Chlorooctadecane	*1.45*		mg/kg wet	*2.000*		*73*	*40-140*			
LCS										
2-Methylnaphthalene	1.56	0.20	mg/kg wet	2.000		78	40-140			
Acenaphthene	1.61	0.40	mg/kg wet	2.000		80	40-140			
Acenaphthylene	1.82	0.20	mg/kg wet	2.000		91	40-140			
Anthracene	1.79	0.40	mg/kg wet	2.000		90	40-140			
Benzo(a)anthracene	1.87	0.40	mg/kg wet	2.000		94	40-140			
Benzo(a)pyrene	1.77	0.40	mg/kg wet	2.000		88	40-140			
Benzo(b)fluoranthene	1.85	0.20	mg/kg wet	2.000		92	40-140			
Benzo(g,h,i)perylene	1.55	0.40	mg/kg wet	2.000		77	40-140			
Benzo(k)fluoranthene	1.87	0.20	mg/kg wet	2.000		94	40-140			
C11-C22 Unadjusted Aromatics1	37.6	15.0	mg/kg wet	34.00		111	40-140			
Chrysene	1.87	0.40	mg/kg wet	2.000		93	40-140			
Dibenzo(a,h)Anthracene	1.60	0.20	mg/kg wet	2.000		80	40-140			
Fluoranthene	1.86	0.40	mg/kg wet	2.000		93	40-140			
Fluorene	1.78	0.40	mg/kg wet	2.000		89	40-140			
Indeno(1,2,3-cd)Pyrene	1.69	0.40	mg/kg wet	2.000		85	40-140			
Naphthalene	1.41	0.40	mg/kg wet	2.000		71	40-140			
Phenanthrene	1.82	0.40	mg/kg wet	2.000		91	40-140			
Pyrene	1.86	0.40	mg/kg wet	2.000		93	40-140			
Surrogate: 2-Bromonaphthalene	*48.8*		mg/L	*50.00*		*98*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*48.8*		mg/L	*50.00*		*98*	*40-140*			
Surrogate: O-Terphenyl	*2.10*		mg/kg wet	*2.000*		*105*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	17.6	15.0	mg/kg wet	16.00		110	40-140	6	25	
C9-C18 Aliphatics1	9.4	15.0	mg/kg wet	12.00		78	40-140	3	25	
Decane (C10)	0.8	0.5	mg/kg wet	2.000		40	40-140	0.9	25	
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		79	40-140	7	25	
Dodecane (C12)	0.9	0.5	mg/kg wet	2.000		47	40-140	0.3	25	
Eicosane (C20)	1.5	0.5	mg/kg wet	2.000		77	40-140	7	25	
Hexacosane (C26)	1.5	0.5	mg/kg wet	2.000		77	40-140	8	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		74	40-140	8	25	
Hexatriacontane (C36)	1.7	0.5	mg/kg wet	2.000		84	40-140	8	25	
Nonadecane (C19)	1.5	0.5	mg/kg wet	2.000		77	40-140	8	25	
Nonane (C9)	0.6	0.5	mg/kg wet	2.000		31	30-140	4	25	
Octacosane (C28)	1.5	0.5	mg/kg wet	2.000		75	40-140	7	25	
Octadecane (C18)	1.6	0.5	mg/kg wet	2.000		78	40-140	8	25	
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		79	40-140	8	25	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB91403 - 3546										
Tetradecane (C14)	1.2	0.5	mg/kg wet	2.000		59	40-140	7	25	
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		74	40-140	7	25	
Surrogate: 1-Chlorooctadecane	*1.57*		mg/kg wet	*2.000*		*78*	*40-140*			
LCS Dup										
2-Methylnaphthalene	1.56	0.20	mg/kg wet	2.000		78	40-140	0.2	30	
Acenaphthene	1.66	0.40	mg/kg wet	2.000		83	40-140	3	30	
Acenaphthylene	1.85	0.20	mg/kg wet	2.000		93	40-140	2	30	
Anthracene	1.86	0.40	mg/kg wet	2.000		93	40-140	4	30	
Benzo(a)anthracene	1.95	0.40	mg/kg wet	2.000		98	40-140	4	30	
Benzo(a)pyrene	1.84	0.40	mg/kg wet	2.000		92	40-140	4	30	
Benzo(b)fluoranthene	1.93	0.20	mg/kg wet	2.000		96	40-140	4	30	
Benzo(g,h,i)perylene	1.60	0.40	mg/kg wet	2.000		80	40-140	3	30	
Benzo(k)fluoranthene	1.95	0.20	mg/kg wet	2.000		97	40-140	4	30	
C11-C22 Unadjusted Aromatics1	39.6	15.0	mg/kg wet	34.00		116	40-140	5	25	
Chrysene	1.94	0.40	mg/kg wet	2.000		97	40-140	4	30	
Dibenzo(a,h)Anthracene	1.66	0.20	mg/kg wet	2.000		83	40-140	4	30	
Fluoranthene	1.93	0.40	mg/kg wet	2.000		96	40-140	4	30	
Fluorene	1.84	0.40	mg/kg wet	2.000		92	40-140	4	30	
Indeno(1,2,3-cd)Pyrene	1.76	0.40	mg/kg wet	2.000		88	40-140	4	30	
Naphthalene	1.39	0.40	mg/kg wet	2.000		70	40-140	1	30	
Phenanthrene	1.89	0.40	mg/kg wet	2.000		95	40-140	4	30	
Pyrene	1.93	0.40	mg/kg wet	2.000		96	40-140	3	30	
Surrogate: 2-Bromonaphthalene	*49.0*		mg/L	*50.00*		*98*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*49.1*		mg/L	*50.00*		*98*	*40-140*			
Surrogate: O-Terphenyl	*2.15*		mg/kg wet	*2.000*		*108*	*40-140*			
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: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902265

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
B-	Blank Spike recovery is below lower control limit (B-).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902265

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902265
Date Received: 2/13/2019
Project Due Date: 2/21/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: .3 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	316105	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	316106	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	316107	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	316104	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	316103	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	316102	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	316108	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	316101	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	316100	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	316109	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	316110	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	316099	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	316111	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	316112	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	316113	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
08	316098	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
09	316097	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	316096	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	316114	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	316115	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
11	316095	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
12	316116	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
12	316117	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
13	316093	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

ESS Project ID: 1902265
Date Received: 2/13/2019

14	316092	Yes	NA	Yes	4 oz. Jar - Unpres	NP
15	316091	Yes	NA	Yes	4 oz. Jar - Unpres	NP
15	316118	Yes	NA	Yes	4 oz. Jar - Unpres	NP
15	316119	Yes	NA	Yes	4 oz. Jar - Unpres	NP
16	316090	Yes	NA	Yes	4 oz. Jar - Unpres	NP
16	316120	Yes	NA	Yes	4 oz. Jar - Unpres	NP
17	316089	Yes	NA	Yes	4 oz. Jar - Unpres	NP
17	316121	Yes	NA	Yes	4 oz. Jar - Unpres	NP
17	316122	Yes	NA	Yes	4 oz. Jar - Unpres	NP
18	316088	Yes	NA	Yes	4 oz. Jar - Unpres	NP

2nd Review

All containers scanned into storage/lab Initials: _____

Are barcode labels on correct containers? Yes / No

Are all necessary stickers attached? Yes / No

Completed By: _____ Date & Time: 2/13/19 16:07

Reviewed By: _____ Date & Time: 2/13/19 1625

Delivered By: _____ 2/13/19 1625

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

CHAIN OF CUSTODY

Turn Time: 5-7d Rush:
Regulatory State: MA
Is this project for any of the following?: ☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902265
Reporting Limits S-1/S-2/S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond
Contact Person: Todd Kirton
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Address: 446 Main Street
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@Tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Total Cr	PCBs	Lead	MCP 14 Metals	Pesticides	EPH (Target PAH)	Arsenic	Total Cyanide							
1	2/11/19	815	G	S	TP-3A (0-2)	X		X				X								
2	↓	830	↓	↓	TP-3A (2-5.5)						X									
3		845			TP-3A (5.5-6.5)							X								
4		915			TP-4 (0-2)							X								
5		930			TP-4 (4.5-5)				X											
6		1000			TP-5 (0-2)	X		X				X								
7		1015			TP-5 (3-5)		X		X	X			X							
8		1030			TP-5 (5-6)				X				ML - 2/14/19							
9		1100			TP-6 (0-2)							X								
10		1115			TP-6 (2-5)		X		X		X									

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: ag ag

Laboratory Use Only
Cooler Present: ✓
Seals Intact: NA
Cooler Temperature: °C ice temp: 0.3

Sampled by: [illegible]
Comments: Please specify "Other" preservative and containers types in this space
Use Gallows Hill Park Quote

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/13/19 1400	2/13/19 14:00	2/13/19 15:21	2/13/19 16:06
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

2 of 2

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www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: Std Rush:
Regulatory State: MA
Is this project for any of the following?: ☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902265
Reporting Limits S1/S-2/S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond
Contact Person: Todd Kirton
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Address: 446 Main St
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@Tigheband.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Total Cr	PCBs	Lead	MCP metals 5M	Pesticides	EPH C10-C18	Arsenic
11	2/12/19	700	G	S	TP-7 (0-2)	X						X
12	↓	730	↓	↓	TP-7 (2-5)						X	X
13		745			TP-7 (5-5.5)				X			
14		1030			TP-8 (0-2)							X
15 ~~16~~		1045			TP-8 (2-6)	X		X				X
16 ~~17~~		915			TP-9 (0-2)	X						X
17 ~~18~~		930			TP-9 (2-3)		X		X		X	
18 ~~19~~	↓	945	↓	↓	TP-9 (3-5)							X
Container Type:						ag	ag					
Preservation Code:												
Number of Containers:												

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Laboratory Use Only
Cooler Present: ✓
Seals Intact: NA
Cooler Temperature: °c Icetemp: 0.3

Sampled by: KLL
Comments: Please specify "Other" preservative and containers types in this space
Use Gallows Hill Park Quote

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/13/19 1400	2/13/19 14:00	2/13/19 15:21	2/13/19 16:06
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

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CHAIN OF CUSTODY

Turn Time: 5 d Rush:
Regulatory State: MA
Is this project for any of the following?: ☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902265
Reporting Limits S-1/S-2/S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond
Contact Person: Todd Kirton
Project #: S-1758-020
Project Name: Gallows Hill Park, Salem
Address: 446 Main Street
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@Tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Total Cr	PCBs	Lead	MCP 14 Metals	Pesticides	EPH (Target PAH)	Arsenic
1	2/11/19	815	G	S	TP-3A (0-2)	X		X				X
2		830			TP-3A (2-5.5)						X	
3		845			TP-3A (5.5-6.5)							X
4		915			TP-4 (0-2)							X
5		930			TP-4 (4.5-5)				X			
6		1000			TP-5 (0-2)	X		X				X
7		1015			TP-5 (3-5)		X		X	X		
8		1030			TP-5 (5-6)				X			
9		1100			TP-6 (0-2)							X
10		1115			TP-6 (2-5)		X		X		X	

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: ag ag

Laboratory Use Only
Cooler Present: ✓
Seals Intact: NA
Cooler Temperature: °C ice temp: 0.3

Sampled by: [illegible]
Comments: Please specify "Other" preservative and containers types in this space
Use Gallows Hill Park Quote

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/13/19 1400	2/13/19 14:00	2/13/19 15:21	2/13/19 16:06
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

2 of 2

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CHAIN OF CUSTODY

Turn Time: Std Rush:
Regulatory State: MA
Is this project for any of the following?: ☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902265
Reporting Limits S1/S-2/S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

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ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Total Cr	PCBs	Lead	MCP metals 15 M	Pesticides	EPH C10-C18	Arsenic
11	2/12/19	700	G	S	TP-7 (0-2)	X						X
12		730			TP-7 (2-5)						X	X
13		745			TP-7 (5-5.5)				X			
14		1030			TP-8 (0-2)							X
16		1045			TP-8 (2-6)	X		X				X
17		915			TP-9 (0-2)	X						X
18		930			TP-9 (2-3)		X		X		X	
19		945			TP-9 (3-5)							X
Container Type:			AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other			ag	ag					
Preservation Code:			1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*										
					Number of Containers:							

Laboratory Use Only
Cooler Present: ✓
Seals Intact: NA
Cooler Temperature: °c Icetemp: 0.3

Sampled by: KLL
Comments: Please specify "Other" preservative and containers types in this space
Use Gallows Hill Park Quote

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/13/19 1400	2/13/19 14:00	2/13/19 15:21	2/13/19 16:06
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902619

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 5:38 pm, Mar 07, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

SAMPLE RECEIPT

The following samples were received on February 28, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: All samples for Metals except 1902619-06 were analyzed for a subset of the required MCP list per the client's request.

Lab Number	Sample Name	Matrix	Analysis
1902619-01	B-40 0-2ft	Soil	6010C
1902619-02	B-41 0-2ft	Soil	6010C, 8082A
1902619-03	B-41 2-4ft	Soil	6010C, 9014
1902619-04	B-42 0-2ft	Soil	6010C
1902619-05	B-43 0-2ft	Soil	6010C
1902619-06	B-43 2-4ft	Soil	6010C, 7471B, EPH8270, MADEP-EPH
1902619-07	B-43 4-8ft	Soil	6010C
1902619-08	B-44 0-2ft	Soil	6010C
1902619-09	B-44 2-4ft	Soil	6010C
1902619-10	B-45 0-2ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902619

PROJECT NARRATIVE

MADEP-EPH Extractable Petroleum Hydrocarbons
1902619-06 **Elevated Method Reporting Limits due to sample matrix (EL).**

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902619-01 through 1902619-10**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. 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" status

G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocols(s)?	Yes ( ) No (X)*
	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.***	
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard
Date: March 07, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-40 0-2ft
Date Sampled: 02/26/19 11:45
Percent Solids: 68

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**145** (3.01)		6010C		1	KJK	03/06/19 22:26	2.43	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-41 0-2ft
Date Sampled: 02/26/19 11:50
Percent Solids: 68

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2150** (3.01)		6010C		1	KJK	03/06/19 22:30	2.45	100	CC90538
Chromium	**185** (1.20)		6010C		1	KJK	03/06/19 22:30	2.45	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-41 0-2ft
Date Sampled: 02/26/19 11:50
Percent Solids: 68
Initial Volume: 19.4
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-02
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 3/1/19 16:51

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1221	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1232	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1242	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1248	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1254	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1260	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1262	ND (0.08)		8082A		1	03/04/19 20:54		CC90102
Aroclor 1268	ND (0.08)		8082A		1	03/04/19 20:54		CC90102

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*63 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*75 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*77 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*100 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-41 2-4ft
Date Sampled: 02/26/19 12:00
Percent Solids: 59

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**179** (3.85)		6010C		1	KJK	03/06/19 22:36	2.19	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-41 2-4ft
Date Sampled: 02/26/19 12:00
Percent Solids: 59

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-03
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Total Cyanide	ND (1.66)		9014		1	EEM	03/04/19 13:45	mg/kg dry	CC90419

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-42 0-2ft
Date Sampled: 02/26/19 12:10
Percent Solids: 68

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**81.8** (3.65)		6010C		1	KJK	03/06/19 22:40	2.03	100	CC90538
Chromium	**399** (1.46)		6010C		1	KJK	03/06/19 22:40	2.03	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-43 0-2ft
Date Sampled: 02/26/19 12:15
Percent Solids: 79

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**13.5** (2.93)		6010C		1	KJK	03/06/19 22:59	2.17	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-43 2-4ft
Date Sampled: 02/26/19 12:30
Percent Solids: 78

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.52)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Arsenic	**6.72** (2.76)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Barium	**49.3** (2.76)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Beryllium	**0.32** (0.12)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Cadmium	ND (0.55)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Chromium	**266** (1.10)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Lead	**41.3** (5.52)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Mercury	**2.02** (0.383)		7471B		10	MKS	03/05/19 13:32	0.66	40	CC90447
Nickel	**12.8** (2.76)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Selenium	ND (5.52)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Silver	ND (1.10)		6010C		2	KJK	03/07/19 14:27	2.31	100	CC90538
Thallium	ND (5.52)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Vanadium	**36.9** (1.10)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538
Zinc	**48.6** (2.76)		6010C		1	KJK	03/06/19 23:31	2.31	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-43 2-4ft
Date Sampled: 02/26/19 12:30
Percent Solids: 78
Initial Volume: 25.3
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-06
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 3/1/19 9:45

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (94.5)		MADEP-EPH		5	CAD	03/06/19 0:59	C9C0056	CB92803
C19-C36 Aliphatics1	**2050** (94.5)		MADEP-EPH		5	CAD	03/06/19 0:59	C9C0056	CB92803
C11-C22 Unadjusted Aromatics1	**2210** (94.5)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
C11-C22 Aromatics1,2	**2210** (94.5)		EPH8270			ZLC	03/05/19 11:02		[CALC]
2-Methylnaphthalene	ND (1.26)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Acenaphthene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Naphthalene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Phenanthrene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Acenaphthylene	ND (1.26)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Anthracene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Benzo(a)anthracene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Benzo(a)pyrene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Benzo(b)fluoranthene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Benzo(g,h,i)perylene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Benzo(k)fluoranthene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Chrysene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Dibenzo(a,h)Anthracene	ND (1.26)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Fluoranthene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Fluorene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Indeno(1,2,3-cd)Pyrene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803
Pyrene	ND (2.52)		EPH8270		5	ZLC	03/05/19 11:02	C9C0052	CB92803

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*76 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*112 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*116 %*		*40-140*
Surrogate: O-Terphenyl	*93 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-43 4-8ft
Date Sampled: 02/26/19 12:40
Percent Solids: 79

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.92** (5.99)		6010C		2	KJK	03/07/19 14:31	2.11	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-44 0-2ft
Date Sampled: 02/26/19 12:45
Percent Solids: 72

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-08
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**189** (6.29)		6010C		2	KJK	03/07/19 14:35	2.21	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-44 2-4ft
Date Sampled: 02/26/19 13:00
Percent Solids: 82

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-09
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**77.7** (5.76)		6010C		2	KJK	03/07/19 14:39	2.13	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-45 0-2ft
Date Sampled: 02/26/19 13:15
Percent Solids: 78

ESS Laboratory Work Order: 1902619
ESS Laboratory Sample ID: 1902619-10
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**27.7** (2.55)		6010C		1	KJK	03/06/19 23:48	2.51	100	CC90538

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC90447 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.29	0.347	mg/kg wet	3.710		89	80-120			
LCS Dup										
Mercury	3.51	0.347	mg/kg wet	3.710		95	80-120	6	20	
Batch CC90538 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	43.9	18.9	mg/kg wet	42.40		103	80-120			
Arsenic	114	9.43	mg/kg wet	128.0		89	85-114			
Barium	532	9.43	mg/kg wet	536.0		99	82-118			
Beryllium	209	0.42	mg/kg wet	217.0		96	84-116			
Cadmium	93.7	1.89	mg/kg wet	99.00		95	87-113			
Chromium	113	3.77	mg/kg wet	116.0		98	82-118			
Lead	280	18.9	mg/kg wet	277.0		101	84-116			
Nickel	105	9.43	mg/kg wet	107.0		98	84-117			
Selenium	225	18.9	mg/kg wet	242.0		93	80-120			
Silver	60.2	1.89	mg/kg wet	64.30		94	86-114			
Thallium	179	18.9	mg/kg wet	183.0		98	80-120			
Vanadium	147	3.77	mg/kg wet	146.0		101	86-114			
Zinc	532	9.43	mg/kg wet	561.0		95	86-114			
LCS Dup										
Antimony	41.7	17.2	mg/kg wet	42.40		98	80-120	5	20	
Arsenic	113	8.62	mg/kg wet	128.0		88	85-114	0.5	20	
Barium	519	8.62	mg/kg wet	536.0		97	82-118	2	20	
Beryllium	203	0.38	mg/kg wet	217.0		94	84-116	3	20	
Cadmium	89.4	1.72	mg/kg wet	99.00		90	87-113	5	20	
Chromium	110	3.45	mg/kg wet	116.0		95	82-118	3	20	
Lead	271	17.2	mg/kg wet	277.0		98	84-116	3	20	
Nickel	101	8.62	mg/kg wet	107.0		94	84-117	4	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CC90538 - 3050B										
Selenium	221	17.2	mg/kg wet	242.0		91	80-120	2	20	
Silver	57.8	1.72	mg/kg wet	64.30		90	86-114	4	20	
Thallium	171	17.2	mg/kg wet	183.0		93	80-120	5	20	
Vanadium	141	3.45	mg/kg wet	146.0		96	86-114	5	20	
Zinc	510	8.62	mg/kg wet	561.0		91	86-114	4	20	
8082A Polychlorinated Biphenyls (PCB)										
Batch CC90102 - 3540C										
Blank										
Aroclor 1016	ND	0.02	mg/kg wet							
Aroclor 1016 [2C]	ND	0.02	mg/kg wet							
Aroclor 1221	ND	0.02	mg/kg wet							
Aroclor 1221 [2C]	ND	0.02	mg/kg wet							
Aroclor 1232	ND	0.02	mg/kg wet							
Aroclor 1232 [2C]	ND	0.02	mg/kg wet							
Aroclor 1242	ND	0.02	mg/kg wet							
Aroclor 1242 [2C]	ND	0.02	mg/kg wet							
Aroclor 1248	ND	0.02	mg/kg wet							
Aroclor 1248 [2C]	ND	0.02	mg/kg wet							
Aroclor 1254	ND	0.02	mg/kg wet							
Aroclor 1254 [2C]	ND	0.02	mg/kg wet							
Aroclor 1260	ND	0.02	mg/kg wet							
Aroclor 1260 [2C]	ND	0.02	mg/kg wet							
Aroclor 1262	ND	0.02	mg/kg wet							
Aroclor 1262 [2C]	ND	0.02	mg/kg wet							
Aroclor 1268	ND	0.02	mg/kg wet							
Aroclor 1268 [2C]	ND	0.02	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0200*		mg/kg wet	*0.02500*		*80*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0213*		mg/kg wet	*0.02500*		*85*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0194*		mg/kg wet	*0.02500*		*78*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0212*		mg/kg wet	*0.02500*		*85*	*30-150*			
LCS										
Aroclor 1016	0.5	0.05	mg/kg wet	0.5000		109	40-140			
Aroclor 1016 [2C]	0.5	0.05	mg/kg wet	0.5000		101	40-140			
Aroclor 1260	0.5	0.05	mg/kg wet	0.5000		98	40-140			
Aroclor 1260 [2C]	0.5	0.05	mg/kg wet	0.5000		96	40-140			
Surrogate: Decachlorobiphenyl	*0.0217*		mg/kg wet	*0.02500*		*87*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0229*		mg/kg wet	*0.02500*		*92*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0227*		mg/kg wet	*0.02500*		*91*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0219*		mg/kg wet	*0.02500*		*88*	*30-150*			
LCS Dup										
Aroclor 1016	0.5	0.05	mg/kg wet	0.5000		109	40-140	0.1	30	
Aroclor 1016 [2C]	0.5	0.05	mg/kg wet	0.5000		104	40-140	2	30	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CC90102 - 3540C										
Aroclor 1260	0.5	0.05	mg/kg wet	0.5000		101	40-140	3	30	
Aroclor 1260 [2C]	0.5	0.05	mg/kg wet	0.5000		100	40-140	5	30	
Surrogate: Decachlorobiphenyl	*0.0222*		mg/kg wet	*0.02500*		*89*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0235*		mg/kg wet	*0.02500*		*94*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0234*		mg/kg wet	*0.02500*		*93*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0225*		mg/kg wet	*0.02500*		*90*	*30-150*			
Classical Chemistry										
Batch CC90419 - TCN Prep										
Blank										
Total Cyanide	ND	1.00	mg/kg wet							
LCS										
Total Cyanide	5.00	1.00	mg/kg wet	5.015		100	90-110			
Reference										
Total Cyanide	152	9.82	mg/kg wet	157.0		97	24-110			
Reference										
Total Cyanide	152	9.89	mg/kg wet	157.0		97	24-110			
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB92803 - 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							
Surrogate: 1-Chlorooctadecane	*1.48*		mg/kg wet	*2.000*		*74*	*40-140*			
Blank										
2-Methylnaphthalene	ND	0.20	mg/kg wet							
Acenaphthene	ND	0.40	mg/kg wet							
Acenaphthylene	ND	0.20	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB92803 - 3546										
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 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							
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	*52.6*		mg/L	*50.00*		*105*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*52.4*		mg/L	*50.00*		*105*	*40-140*			
Surrogate: O-Terphenyl	*2.02*		mg/kg wet	*2.000*		*101*	*40-140*			
LCS										
C19-C36 Aliphatics1	15.7	15.0	mg/kg wet	16.00		98	40-140			
C9-C18 Aliphatics1	8.7	15.0	mg/kg wet	12.00		72	40-140			
Decane (C10)	0.9	0.5	mg/kg wet	2.000		47	40-140			
Docosane (C22)	1.4	0.5	mg/kg wet	2.000		71	40-140			
Dodecane (C12)	1.0	0.5	mg/kg wet	2.000		52	40-140			
Eicosane (C20)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Hexacosane (C26)	1.4	0.5	mg/kg wet	2.000		69	40-140			
Hexadecane (C16)	1.3	0.5	mg/kg wet	2.000		67	40-140			
Hexatriacontane (C36)	1.5	0.5	mg/kg wet	2.000		76	40-140			
Nonadecane (C19)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		37	30-140			
Octacosane (C28)	1.4	0.5	mg/kg wet	2.000		68	40-140			
Octadecane (C18)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Tetracosane (C24)	1.4	0.5	mg/kg wet	2.000		72	40-140			
Tetradecane (C14)	1.1	0.5	mg/kg wet	2.000		57	40-140			
Triacontane (C30)	1.4	0.5	mg/kg wet	2.000		68	40-140			
Surrogate: 1-Chlorooctadecane	*1.45*		mg/kg wet	*2.000*		*73*	*40-140*			
LCS										
2-Methylnaphthalene	1.50	0.20	mg/kg wet	2.000		75	40-140			
Acenaphthene	1.54	0.40	mg/kg wet	2.000		77	40-140			
Acenaphthylene	1.74	0.20	mg/kg wet	2.000		87	40-140			
Anthracene	1.77	0.40	mg/kg wet	2.000		88	40-140			
Benzo(a)anthracene	1.88	0.40	mg/kg wet	2.000		94	40-140			
Benzo(a)pyrene	1.84	0.40	mg/kg wet	2.000		92	40-140			
Benzo(b)fluoranthene	1.91	0.40	mg/kg wet	2.000		96	40-140			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB92803 - 3546										
Benzo(g,h,i)perylene	1.96	0.40	mg/kg wet	2.000		98	40-140			
Benzo(k)fluoranthene	1.91	0.40	mg/kg wet	2.000		95	40-140			
C11-C22 Unadjusted Aromatics1	36.5	15.0	mg/kg wet	34.00		107	40-140			
Chrysene	1.88	0.40	mg/kg wet	2.000		94	40-140			
Dibenzo(a,h)Anthracene	2.02	0.20	mg/kg wet	2.000		101	40-140			
Fluoranthene	1.82	0.40	mg/kg wet	2.000		91	40-140			
Fluorene	1.74	0.40	mg/kg wet	2.000		87	40-140			
Indeno(1,2,3-cd)Pyrene	2.09	0.40	mg/kg wet	2.000		105	40-140			
Naphthalene	1.34	0.40	mg/kg wet	2.000		67	40-140			
Phenanthrene	1.78	0.40	mg/kg wet	2.000		89	40-140			
Pyrene	1.83	0.40	mg/kg wet	2.000		91	40-140			
Surrogate: 2-Bromonaphthalene	*49.8*		mg/L	*50.00*		*100*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*49.8*		mg/L	*50.00*		*100*	*40-140*			
Surrogate: O-Terphenyl	*1.96*		mg/kg wet	*2.000*		*98*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	18.0	15.0	mg/kg wet	16.00		113	40-140	14	25	
C9-C18 Aliphatics1	9.9	15.0	mg/kg wet	12.00		82	40-140	13	25	
Decane (C10)	1.0	0.5	mg/kg wet	2.000		50	40-140	7	25	
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		81	40-140	13	25	
Dodecane (C12)	1.1	0.5	mg/kg wet	2.000		57	40-140	9	25	
Eicosane (C20)	1.6	0.5	mg/kg wet	2.000		79	40-140	12	25	
Hexacosane (C26)	1.6	0.5	mg/kg wet	2.000		79	40-140	13	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		75	40-140	12	25	
Hexatriacontane (C36)	1.7	0.5	mg/kg wet	2.000		87	40-140	13	25	
Nonadecane (C19)	1.6	0.5	mg/kg wet	2.000		79	40-140	12	25	
Nonane (C9)	0.8	0.5	mg/kg wet	2.000		40	30-140	7	25	
Octacosane (C28)	1.5	0.5	mg/kg wet	2.000		77	40-140	13	25	
Octadecane (C18)	1.6	0.5	mg/kg wet	2.000		78	40-140	12	25	
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		82	40-140	13	25	
Tetradecane (C14)	1.3	0.5	mg/kg wet	2.000		64	40-140	11	25	
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		77	40-140	12	25	
Surrogate: 1-Chlorooctadecane	*1.63*		mg/kg wet	*2.000*		*82*	*40-140*			
LCS Dup										
2-Methylnaphthalene	1.58	0.20	mg/kg wet	2.000		79	40-140	5	30	
Acenaphthene	1.63	0.40	mg/kg wet	2.000		81	40-140	5	30	
Acenaphthylene	1.84	0.20	mg/kg wet	2.000		92	40-140	6	30	
Anthracene	1.86	0.40	mg/kg wet	2.000		93	40-140	5	30	
Benzo(a)anthracene	1.98	0.40	mg/kg wet	2.000		99	40-140	6	30	
Benzo(a)pyrene	1.95	0.40	mg/kg wet	2.000		97	40-140	6	30	
Benzo(b)fluoranthene	2.01	0.40	mg/kg wet	2.000		101	40-140	5	30	
Benzo(g,h,i)perylene	2.07	0.40	mg/kg wet	2.000		103	40-140	6	30	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CB92803 - 3546										
Benzo(k)fluoranthene	2.01	0.40	mg/kg wet	2.000		101	40-140	5	30	
C11-C22 Unadjusted Aromatics1	41.1	15.0	mg/kg wet	34.00		121	40-140	12	25	
Chrysene	1.98	0.40	mg/kg wet	2.000		99	40-140	5	30	
Dibenzo(a,h)Anthracene	2.08	0.20	mg/kg wet	2.000		104	40-140	3	30	
Fluoranthene	1.93	0.40	mg/kg wet	2.000		97	40-140	6	30	
Fluorene	1.84	0.40	mg/kg wet	2.000		92	40-140	5	30	
Indeno(1,2,3-cd)Pyrene	2.20	0.40	mg/kg wet	2.000		110	40-140	5	30	
Naphthalene	1.40	0.40	mg/kg wet	2.000		70	40-140	4	30	
Phenanthrene	1.87	0.40	mg/kg wet	2.000		94	40-140	5	30	
Pyrene	1.93	0.40	mg/kg wet	2.000		97	40-140	5	30	
Surrogate: 2-Bromonaphthalene	*52.9*		mg/L	*50.00*		*106*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*52.6*		mg/L	*50.00*		*105*	*40-140*			
Surrogate: O-Terphenyl	*2.04*		mg/kg wet	*2.000*		*102*	*40-140*			
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: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902619

Notes and Definitions

U	Analyte included in the analysis, but not detected
EL	Elevated Method Reporting Limits due to sample matrix (EL).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902619

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902619
Date Received: 2/28/2019
Project Due Date: 3/7/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	320278	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	320268	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	320277	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	320267	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	320276	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320266	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320275	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	320274	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	320265	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	320273	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	320272	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
08	320271	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
09	320270	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	320269	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By:
Reviewed

Date & Time: 2/26/19 2010

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

ESS Project ID: 1902619

Date Received: 2/28/2019

By: [illegible]

Date & Time: 2/28/19 2020

Delivered By: [illegible]

2/28/19 2020

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902619

Turn Time: 5 day Rush:

Regulatory State: MA

Reporting Limits: S-1/S-2/S-3

Is this project for any of the following?: ☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Electonic Deliverables: ☐ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond

Project #: S-1752-020

Project Name: Gallows Hill Park Salem

Contact Person: Todd Kirton

Address: 446 Main St

City: Worcester

State: MA

Zip Code:

PO #:

Telephone Number:

FAX Number:

Email Address: TDKirton@tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Arsenic	Total Cr	MCP 14 Metals	EPH	Cyanide	PCBs
1	2/26/19	1145	G	S	B-40 (0-2)	X					
2		1150			B-41 (0-2)	X	X			X	X
3		1200			B-41 (2-4)	X				X	
4		1210			B-42 (0-2)	X	X				
5		1215			B-43 (0-2)	X					
6		1230			B-43 (2-4)			X	X		
7		1240			B-43 (4-8)	X					
8		1245			B-44 (0-2)	X					
9		1300			B-44 (2-4)	X					
10		1315			B-45 (0-2)	X					
Container Type:			AG-Amber Glass	B-BOD Bottle	G-Glass P-Poly S-Sterile V-Vial O-Other	ag	ag				
Preservation Code:			1-Non Preserved	2-HCl	3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*						
Number of Containers:						4					

Sampled by: JM

Comments: Please specify "Other" preservative and containers types in this space

Laboratory Use Only

Cooler Present: ✓

Seals Intact:

Cooler Temperature: 1.1 °C ICE RC

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	R Carlson 2/28/19 1500	R Carlson 2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902616

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 3:45 pm, Mar 07, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

SAMPLE RECEIPT

The following samples were received on February 28, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: All samples for Metals except for 1902616-02 were analyzed for a subset of the required MCP list per the client's request.

Lab Number	Sample Name	Matrix	Analysis
1902616-01	B-17 0-2ft	Soil	6010C
1902616-02	B-18 0-2ft	Soil	6010C, 7471B
1902616-03	B-19A 0-2ft	Soil	6010C
1902616-04	B-20 0-2ft	Soil	6010C
1902616-05	B-21 0-2ft	Soil	6010C
1902616-06	B-22 0-2ft	Soil	6010C
1902616-07	B-23 0-2ft	Soil	6010C
1902616-08	B-24 0-2ft	Soil	6010C
1902616-09	B-24 2-4ft	Soil	6010C
1902616-10	B-25 0-2ft	Soil	6010C
1902616-11	B-25 2-4ft	Soil	6010C
1902616-12	B-26 0-2ft	Soil	6010C
1902616-13	B-26 2-4ft	Soil	6010C
1902616-14	B-27 0-2ft	Soil	6010C
1902616-15	B-27 2-4ft	Soil	6010C
1902616-16	B-28 0-2ft	Soil	6010C
1902616-17	B-28A 0-2ft	Soil	6010C
1902616-18	B-28A 2-4ft	Soil	6010C
1902616-19	B-29 0-2ft	Soil	6010C
1902616-20	B-29 2-4ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902616-01 through 1902616-20**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard Date: March 07, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-17 0-2ft
Date Sampled: 02/25/19 08:00
Percent Solids: 77

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**21.0** (2.02)		6010C		1	KJK	03/05/19 22:40	3.23	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-18 0-2ft
Date Sampled: 02/25/19 08:20
Percent Solids: 69

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (5.12)		6010C		1	KJK	03/06/19 18:18	2.82	100	CC90446
Arsenic	**19.5** (2.56)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Barium	**68.5** (2.56)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Beryllium	**0.69** (0.11)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Cadmium	ND (0.51)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Chromium	**34.2** (1.02)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Lead	**28.2** (5.12)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Mercury	**0.039** (0.032)		7471B		1	MKS	03/05/19 11:59	0.89	40	CC90447
Nickel	**24.4** (2.56)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Selenium	ND (5.12)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Silver	ND (0.51)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Thallium	ND (5.12)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Vanadium	**32.7** (1.02)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446
Zinc	**60.3** (2.56)		6010C		1	KJK	03/05/19 22:44	2.82	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-19A 0-2ft
Date Sampled: 02/25/19 08:30
Percent Solids: 96

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2.69** (2.17)		6010C		1	KJK	03/05/19 23:16	2.41	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-20 0-2ft
Date Sampled: 02/25/19 08:45
Percent Solids: 94

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (2.54)		6010C		1	KJK	03/05/19 23:36	2.1	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-21 0-2ft
Date Sampled: 02/25/19 09:00
Percent Solids: 84

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**3.71** (2.77)		6010C		1	KJK	03/06/19 18:49	2.16	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-22 0-2ft
Date Sampled: 02/25/19 09:15
Percent Solids: 82

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.15** (2.99)		6010C		1	KJK	03/05/19 23:44	2.04	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-23 0-2ft
Date Sampled: 02/25/19 09:30
Percent Solids: 85

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**4.16** (2.22)		6010C		1	KJK	03/06/19 0:00	2.67	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-24 0-2ft
Date Sampled: 02/25/19 09:45
Percent Solids: 98

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-08
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.12** (2.47)		6010C		1	KJK	03/06/19 0:04	2.07	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-24 2-4ft
Date Sampled: 02/25/19 10:00
Percent Solids: 88

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-09
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (2.50)		6010C		1	KJK	03/06/19 0:08	2.26	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-25 0-2ft
Date Sampled: 02/25/19 10:15
Percent Solids: 68

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-10
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.32** (3.15)		6010C		1	KJK	03/06/19 0:12	2.35	100	CC90446
Chromium	**26.6** (1.26)		6010C		1	KJK	03/06/19 0:12	2.35	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-25 2-4ft
Date Sampled: 02/25/19 10:15
Percent Solids: 83

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-11
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**4.37** (2.94)		6010C		1	KJK	03/06/19 0:15	2.05	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-26 0-2ft
Date Sampled: 02/25/19 10:30
Percent Solids: 84

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-12
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.99** (2.80)		6010C		1	KJK	03/06/19 0:19	2.11	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-26 2-4ft
Date Sampled: 02/25/19 10:30
Percent Solids: 76

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-13
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.20** (2.94)		6010C		1	KJK	03/06/19 0:23	2.24	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-27 0-2ft
Date Sampled: 02/25/19 10:45
Percent Solids: 79

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-14
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.60** (2.70)		6010C		1	KJK	03/06/19 0:27	2.33	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-27 2-4ft
Date Sampled: 02/25/19 10:50
Percent Solids: 97

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-15
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2.77** (2.53)		6010C		1	KJK	03/06/19 0:31	2.04	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-28 0-2ft
Date Sampled: 02/25/19 11:00
Percent Solids: 84

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-16
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**12.9** (2.35)		6010C		1	KJK	03/06/19 0:47	2.52	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-28A 0-2ft
Date Sampled: 02/25/19 11:15
Percent Solids: 69

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-17
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**17.0** (3.18)		6010C		1	KJK	03/06/19 0:51	2.27	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-28A 2-4ft
Date Sampled: 02/25/19 11:20
Percent Solids: 84

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-18
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.63** (1.93)		6010C		1	KJK	03/06/19 0:55	3.09	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-29 0-2ft
Date Sampled: 02/25/19 11:30
Percent Solids: 76

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-19
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**32.0** (2.63)		6010C		1	KJK	03/06/19 0:59	2.51	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-29 2-4ft
Date Sampled: 02/25/19 11:35
Percent Solids: 83

ESS Laboratory Work Order: 1902616
ESS Laboratory Sample ID: 1902616-20
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.89** (2.42)		6010C		1	KJK	03/06/19 1:03	2.5	100	CC90446

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC90446 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	36.9	16.4	mg/kg wet	42.40		87	80-120			
Barium	517	8.20	mg/kg wet	536.0		96	82-118			
Beryllium	195	0.36	mg/kg wet	217.0		90	84-116			
Chromium	106	3.28	mg/kg wet	116.0		92	82-118			
Lead	266	16.4	mg/kg wet	277.0		96	84-116			
Nickel	106	8.20	mg/kg wet	107.0		99	84-117			
Selenium	209	16.4	mg/kg wet	242.0		86	80-120			
Silver	57.0	1.64	mg/kg wet	64.30		89	86-114			
Thallium	167	16.4	mg/kg wet	183.0		91	80-120			
Vanadium	136	3.28	mg/kg wet	146.0		93	86-114			
Zinc	501	8.20	mg/kg wet	561.0		89	86-114			
LCS										
Arsenic	172	8.20	mg/kg wet	202.0		85	76-107			
Cadmium	116	1.64	mg/kg wet	141.0		82	76-108			
LCS Dup										
Antimony	38.9	19.2	mg/kg wet	42.40		92	80-120	5	20	
Barium	579	9.62	mg/kg wet	536.0		108	82-118	11	20	
Beryllium	192	0.42	mg/kg wet	217.0		88	84-116	2	20	
Chromium	106	3.85	mg/kg wet	116.0		91	82-118	0.04	20	
Lead	264	19.2	mg/kg wet	277.0		95	84-116	0.8	20	
Nickel	115	9.62	mg/kg wet	107.0		107	84-117	8	20	
Selenium	208	19.2	mg/kg wet	242.0		86	80-120	0.3	20	
Silver	56.8	1.92	mg/kg wet	64.30		88	86-114	0.3	20	
Thallium	163	19.2	mg/kg wet	183.0		89	80-120	2	20	
Vanadium	136	3.85	mg/kg wet	146.0		93	86-114	0.0007	20	
Zinc	502	9.62	mg/kg wet	561.0		90	86-114	0.3	20	
LCS Dup										
Arsenic	166	9.43	mg/kg wet	202.0		82	76-107	4	20	
Cadmium	117	1.89	mg/kg wet	141.0		83	76-108	0.8	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC90447 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.29	0.347	mg/kg wet	3.710		89	80-120			
LCS Dup										
Mercury	3.51	0.347	mg/kg wet	3.710		95	80-120	6	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902616

Notes and Definitions

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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902616

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902616
Date Received: 2/28/2019
Project Due Date: 3/7/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	320262	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	320261	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	320260	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320259	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320264	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	320258	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	320257	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	320256	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
08	320255	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
09	320254	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	320253	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	320263	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
11	320252	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
12	320251	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
13	320250	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
14	320249	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
15	320248	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
16	320247	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
17	320246	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
18	320245	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
19	320244	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
20	320243	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

ESS Project ID: 1902616
Date Received: 2/28/2019

2nd Review

All containers scanned into storage/lab Initials: ll

Are barcode labels on correct containers? Yes / No

Are all necessary stickers attached? Yes / No

Completed By: _____ Date & Time: 2/28/19 2017

Reviewed By: _____ Date & Time: 2/28/19 2026

Delivered By: _____ 2/28/19 2026

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: 5 day Rush:
Regulatory State: MA
Is this project for any of the following?: [X] MA-MCP [ ] CT-RCP [ ] RGP [ ] Remediation

ESS Lab # 1902616
Reporting Limits S-1/S-2/S-3
Electonic Deliverables [X] Limit Checker [X] Excel [ ] Other (Please Specifiy) → PDF

Company Name: Tighe + Bond
Project #: S-1758-020
Project Name: Gallows Hill Park Salem
Contact Person: Todd Kirton / Kerri Lewis
Address: 446 Main St
City: Worcester
State: MA
Zip Code: 01608
PO #:
Telephone Number:
FAX Number:
Email Address: TDKirton@TigheBond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	PCBs	VOCs	Arsenic	MCP 14 Metals	EPH	Cr (total)	Cyanide
1	2/25/19	800	G	S	B-17 (0-2')			X				
2		820			B-18 (0-2')			X	X			
3		830			B-19A (0-2')			X				
4		845			B-20 (0-2')			X				
5		900			B-21 (0-2')			X				
6		915			B-22 (0-2')			X				
7		930			B-23 (0-2')			X				
8		945			B-24 (0-2')			X				
9		1000			B-24 (2-4')			X				
10		1015			B-25 (0-2')			X			X	

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: ag ag

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 1.1 °C ICE RC

Sampled by: KM
Comments: Please specify "Other" preservative and containers types in this space
Use Gallow Hills Park Quote Pricing

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	R. Carlson 2/28/19 1500	R. Carlson 2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

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Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: 5 day Rush:
Regulatory State: MA
Is this project for any of the following?:
☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902616
Reporting Limits S-1 / S-2 / S-3
Electonic Deliverables ☑ Limit Checker ☑ Excel ☐ Other (Please Specifiy) →

Company Name	Project #	Project Name
Tighe + Bond	S-1758-020	Gallows Hill Park Salem

Contact Person	Address
Todd Kirton	446 Main St

City	State	Zip Code	PO #
Worcester	MA	01609	

Telephone Number	FAX Number	Email Address
		TDKirton@TigheBond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	PCBs	VOCs	Arsenic	Metals	EDH	Cr (total)	Cyanide
11	2/25/19	1015	G	S	B-25 (2-4)			X				
12		1030			B-26 (0-2)			X				
13		1030			B-26 (2-4)			X				
14		1045			B-27 (0-2)			X				
15		1050			B-27 (2-4)			X				
16		1100			B-28 (0-2)			X				
17		1115			B-28A (0-2)			X				
18		1120			B-28A (2-4)			X				
19		1130			B-29 (0-2)			X				
20		1135			B-29 (2-4)			X				

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers:

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 1.1 °C ICE RC

Sampled by: KW
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	2/28/19 1500	2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902539

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 2:24 pm, Mar 05, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

SAMPLE RECEIPT

The following samples were received on February 26, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Lab Number	Sample Name	Matrix	Analysis
1902539-01	B-41 0-2ft	Soil	2580, 7196A, 9045
1902539-02	B-42 0-2ft	Soil	2580, 7196A, 9045
1902539-03	B-35 4-6ft	Soil	2580, 7196A, 9045
1902539-04	B-49 0-1ft	Soil	2580, 7196A, 9045

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902539-01 through 1902539-04**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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" 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 (X) No ( )*
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	Yes (X) No ( )*

****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
Date: March 05, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-41 0-2ft
Date Sampled: 02/26/19 14:11
Percent Solids: 68

ESS Laboratory Work Order: 1902539
ESS Laboratory Sample ID: 1902539-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**11.8** (N/A)		9045		1	CCP	02/26/19 17:46	S.U.	CB92629
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.5 ºC.**								
Eh (ORP)	**WL 28** (N/A)		2580		1	CCP	02/26/19 17:46	mv	CB92628
Hexavalent Chromium	ND (0.6)		7196A		1	JLK	02/27/19 17:37	mg/kg dry	CB92726

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-42 0-2ft
Date Sampled: 02/26/19 14:20
Percent Solids: 72

ESS Laboratory Work Order: 1902539
ESS Laboratory Sample ID: 1902539-02
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**5.33** (N/A)		9045		1	CCP	02/26/19 17:46	S.U.	CB92629
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.4 ºC.**								
Eh (ORP)	**WL 308** (N/A)		2580		1	CCP	02/26/19 17:46	mv	CB92628
Hexavalent Chromium	ND (0.6)		7196A		1	JLK	02/27/19 17:37	mg/kg dry	CB92726

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 4-6ft
Date Sampled: 02/26/19 14:30
Percent Solids: 50

ESS Laboratory Work Order: 1902539
ESS Laboratory Sample ID: 1902539-03
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**12.2** (N/A)		9045		1	CCP	02/26/19 17:46	S.U.	CB92629
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.0 ºC.**								
Eh (ORP)	**WL 23** (N/A)		2580		1	CCP	02/26/19 17:46	mv	CB92628
Hexavalent Chromium	ND (0.8)		7196A		1	JLK	02/27/19 17:37	mg/kg dry	CB92726

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-49 0-1ft
Date Sampled: 02/26/19 14:00
Percent Solids: 66

ESS Laboratory Work Order: 1902539
ESS Laboratory Sample ID: 1902539-04
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Corrosivity (pH)	**8.22** (N/A)		9045		1	CCP	02/26/19 17:46	S.U.	CB92629
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 20.4 ºC.**								
Eh (ORP)	**WL 144** (N/A)		2580		1	CCP	02/26/19 17:46	mv	CB92628
Hexavalent Chromium	**9.3** (0.7)		7196A		1	JLK	02/27/19 17:37	mg/kg dry	CB92726

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CB92726 - General Preparation										
Blank										
Hexavalent Chromium	ND	0.7	mg/kg wet							
LCS										
Hexavalent Chromium	32.8	0.7	mg/kg wet	33.32		98	80-120			
LCS Dup										
Hexavalent Chromium	33.3	0.7	mg/kg wet	33.32		100	80-120	2	20	
Reference										
Hexavalent Chromium	75.2	2.0	mg/kg wet	71.00		106	20.3-222.5			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902539

Notes and Definitions

Z-10b	Soil pH measured in water at 20.5 ºC.
Z-10a	Soil pH measured in water at 20.4 ºC.
Z-10	Soil pH measured in water at 20.0 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902539

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902539
Date Received: 2/26/2019
Project Due Date: 3/5/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: -0.6 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	319412	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	319467	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	319411	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	319466	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	319410	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	319465	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	319409	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	319464	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials: [illegible]
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: [signature] Date & Time: 2/26/19 1611
Reviewed By: [signature] Date & Time: 2/26/19 16:47
Delivered By: [signature] 2/26/19 16:47

ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902539

Turn Time: 5day Rush:

Regulatory State: MA

Reporting Limits: S-1/S-2/S-3

Is this project for any of the following?:
☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Electonic Deliverables: ☑ Limit Checker ☑ Excel ☐ Other (Please Specifiy) → PDF

Company Name: Tighe + Bond

Project #: S-1758-020

Project Name: Gallows Hill Park Salem

Contact Person: Todd Kirtay

Address: 446 Main St

City: Worcester

State: MA

Zip Code: 01608

PO #:

Telephone Number:

FAX Number:

Email Address: TDKirtay@tighebond.com

Analysis: Hg Cr

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Hg	Cr
1	2/26/19	1411	G	S	B-41 (0-2)	X	
2	↓	1420	↓	↓	B-42 (0-2)	X	
3		1430			B-35 (4-6')	X	
4		1400			B-49 (0-1')	X	

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

	ag	
Number of Containers:	4	

Laboratory Use Only

Cooler Present: ✓

Seals Intact: NA

Cooler Temperature: °C ice temp: -0.6

Sampled by: [illegible]

Comments: Please specify "Other" preservative and containers types in this space

Use Gallows Hill quote pricing

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
[illegible] 2/26/19 1415	[illegible] 2/26/19 15:55	[illegible] 2/26/19 15:53	[illegible] 2/26/19 1601
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902617

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 2:53 pm, Mar 08, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

SAMPLE RECEIPT

The following samples were received on February 28, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Low Level VOA vials were frozen by ESS Laboratory on February 28, 2019 at 20:29.

Question I: All Samples for Metals except 1902617-01 and 1902617-12 were analyzed for a subset of the required MCP list per the client's request.

Lab Number	Sample Name	Matrix	Analysis
1902617-01	B-29 4-5.5ft	Soil	6010C, 7471B
1902617-02	B-30 0-2ft	Soil	6010C
1902617-03	B-30 2-4ft	Soil	6010C
1902617-04	B-31 0-2ft	Soil	6010C
1902617-05	B-31 2-4ft	Soil	6010C
1902617-06	B-32 0-2ft	Soil	6010C
1902617-07	B-33 0-2ft	Soil	6010C
1902617-08	B-33 2-4ft	Soil	6010C
1902617-09	B-34 0-2ft	Soil	6010C
1902617-10	B-35 0-2ft	Soil	6010C
1902617-11	B-35 2-4ft	Soil	6010C
1902617-12	B-35 4-5.5ft	Soil	6010C, 6020A, 7471B, EPH8270, MADEP-EPH
1902617-13	B-36 0-2ft	Soil	6010C
1902617-14	B-36 2-4ft	Soil	6010C
1902617-15	B-37 0-2ft	Soil	6010C
1902617-16	B-37 2-4ft	Soil	6010C
1902617-17	B-37 4-8ft	Soil	6010C, 8082A, 8260B Low, EPH8270, MADEP-EPH
1902617-18	B-38 0-2ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902617

1902617-19	B-39 0-2ft	Soil	6010C
1902617-20	B-39 2-4ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902617

PROJECT NARRATIVE

5035/8260B Volatile Organic Compounds / Low Level

CC90143-BS1 **Blank Spike recovery is above upper control limit (B+).**
1,4-Dioxane (132% @ 70-130%)

CC90143-BSD1 **Blank Spike recovery is above upper control limit (B+).**
1,4-Dioxane (137% @ 70-130%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902617-01 through 1902617-20**

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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" 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: Laurel Stoddard
Date: March 08, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-29 4-5.5ft
Date Sampled: 02/25/19 11:40
Percent Solids: 81

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	ND (6.54)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Arsenic	**5.02** (3.27)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Barium	**26.4** (3.27)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Beryllium	**0.46** (0.14)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Cadmium	ND (0.65)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Chromium	**12.8** (1.31)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Lead	**12.7** (6.54)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Mercury	ND (0.025)		7471B		1	MKS	03/05/19 12:09	0.96	40	CC90447
Nickel	**9.58** (3.27)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Selenium	ND (6.54)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Silver	ND (0.65)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Thallium	ND (6.54)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Vanadium	**22.1** (1.31)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536
Zinc	**43.2** (3.27)		6010C		3	KJK	03/07/19 14:19	5.66	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-30 0-2ft
Date Sampled: 02/25/19 11:45
Percent Solids: 81

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**15.4** (2.49)		6010C		1	KJK	03/06/19 19:18	2.48	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-30 2-4ft
Date Sampled: 02/25/19 11:50
Percent Solids: 82

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**6.90** (2.71)		6010C		1	KJK	03/06/19 20:53	2.25	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-31 0-2ft
Date Sampled: 02/25/19 12:00
Percent Solids: 69

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**102** (2.87)		6010C		1	KJK	03/06/19 20:57	2.52	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-31 2-4ft
Date Sampled: 02/25/19 12:05
Percent Solids: 82

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**12.2** (2.04)		6010C		1	KJK	03/06/19 21:02	3.01	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-32 0-2ft
Date Sampled: 02/26/19 08:00
Percent Solids: 85

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.33** (2.91)		6010C		1	KJK	03/06/19 21:05	2.03	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-33 0-2ft
Date Sampled: 02/26/19 08:30
Percent Solids: 95

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.02** (2.32)		6010C		1	KJK	03/06/19 21:09	2.26	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-33 2-4ft
Date Sampled: 02/26/19 08:45
Percent Solids: 78

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-08
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**603** (2.95)		6010C		1	KJK	03/06/19 19:53	2.17	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-34 0-2ft
Date Sampled: 02/26/19 09:00
Percent Solids: 73

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-09
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**11.6** (2.63)		6010C		1	KJK	03/06/19 19:58	2.62	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 0-2ft
Date Sampled: 02/26/19 09:30
Percent Solids: 69

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-10
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**1510** (2.91)		6010C		1	KJK	03/06/19 20:02	2.48	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 2-4ft
Date Sampled: 02/26/19 09:40
Percent Solids: 56

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-11
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**12300** (87.7)		6010C		20	KJK	03/06/19 22:05	2.03	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 4-5.5ft
Date Sampled: 02/26/19 09:45
Percent Solids: 55

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-12
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**7.18** (0.79)		6020A		1	KJK	03/07/19 17:33	2.31	100	CC90536
Arsenic	**10900** (197)		6010C		50	KJK	03/06/19 22:10	2.31	100	CC90536
Barium	**97.4** (3.94)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Beryllium	ND (0.17)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Cadmium	**102** (0.79)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Chromium	**428** (1.57)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Lead	**70.6** (7.87)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Mercury	**1.20** (0.240)		7471B		5	MKS	03/05/19 13:28	0.75	40	CC90447
Nickel	ND (3.94)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Selenium	ND (7.87)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Silver	**1.50** (0.79)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Thallium	ND (7.87)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Vanadium	**5.73** (1.57)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536
Zinc	**69.1** (3.94)		6010C		1	KJK	03/06/19 20:13	2.31	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 4-5.5ft
Date Sampled: 02/26/19 09:45
Percent Solids: 55
Initial Volume: 24.6
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-12
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 3/4/19 16:05

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (27.7)		MADEP-EPH		1	CAD	03/06/19 10:16	C9C0056	CC90405
C19-C36 Aliphatics1	ND (27.7)		MADEP-EPH		1	CAD	03/06/19 10:16	C9C0056	CC90405
C11-C22 Unadjusted Aromatics1	**80.1** (27.7)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
C11-C22 Aromatics1,2	**56.1** (27.7)		EPH8270			VSC	03/07/19 12:38		[CALC]
2-Methylnaphthalene	ND (0.37)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Acenaphthene	ND (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Naphthalene	**0.85** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Phenanthrene	**4.13** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Acenaphthylene	ND (0.37)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Anthracene	**0.97** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Benzo(a)anthracene	**2.03** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Benzo(a)pyrene	**1.75** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Benzo(b)fluoranthene	**2.32** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Benzo(g,h,i)perylene	**0.94** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Benzo(k)fluoranthene	ND (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Chrysene	**1.82** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Dibenzo(a,h)Anthracene	ND (0.37)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Fluoranthene	**4.27** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Fluorene	ND (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Indeno(1,2,3-cd)Pyrene	**1.13** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405
Pyrene	**3.82** (0.74)		EPH8270		1	VSC	03/07/19 12:38	C9C0070	CC90405

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*45 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*123 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*95 %*		*40-140*
Surrogate: O-Terphenyl	*49 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-36 0-2ft
Date Sampled: 02/26/19 10:00
Percent Solids: 68

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-13
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**345** (3.30)		6010C		1	KJK	03/06/19 20:18	2.21	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-36 2-4ft
Date Sampled: 02/26/19 10:10
Percent Solids: 72

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-14
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**419** (2.68)		6010C		1	KJK	03/06/19 20:22	2.58	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 0-2ft
Date Sampled: 02/26/19 10:30
Percent Solids: 60

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-15
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**1260** (3.37)		6010C		1	KJK	03/06/19 21:33	2.47	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 2-4ft
Date Sampled: 02/26/19 10:35
Percent Solids: 44

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-16
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**1700** (5.02)		6010C		1	KJK	03/06/19 21:39	2.25	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**99.5** (3.46)		6010C		1	KJK	03/06/19 21:44	2.13	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68
Initial Volume: 5.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
1,1,1,2-Tetrachloroethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1,1-Trichloroethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1,2,2-Tetrachloroethane	ND (0.0028)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1,2-Trichloroethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1-Dichloroethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1-Dichloroethene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,1-Dichloropropene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2,3-Trichlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2,3-Trichloropropane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2,4-Trichlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2,4-Trimethylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2-Dibromo-3-Chloropropane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2-Dibromoethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2-Dichlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2-Dichloroethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,2-Dichloropropane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,3,5-Trimethylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,3-Dichlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,3-Dichloropropane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,4-Dichlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
1,4-Dioxane	ND (0.139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
2,2-Dichloropropane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
2-Butanone	**0.0556** (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
2-Chlorotoluene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
2-Hexanone	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
4-Chlorotoluene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
4-Isopropyltoluene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
4-Methyl-2-Pentanone	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Acetone	**0.442** (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Benzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Bromobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Bromochloromethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68
Initial Volume: 5.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Bromodichloromethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Bromoform	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Bromomethane	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Carbon Disulfide	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Carbon Tetrachloride	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Chlorobenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Chloroethane	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Chloroform	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Chloromethane	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
cis-1,2-Dichloroethene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
cis-1,3-Dichloropropene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Dibromochloromethane	ND (0.0028)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Dibromomethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Dichlorodifluoromethane	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Diethyl Ether	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Di-isopropyl ether	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Ethyl tertiary-butyl ether	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Ethylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Hexachlorobutadiene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Isopropylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Methyl tert-Butyl Ether	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Methylene Chloride	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Naphthalene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
n-Butylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
n-Propylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
sec-Butylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Styrene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
tert-Butylbenzene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Tertiary-amyl methyl ether	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Tetrachloroethene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Tetrahydrofuran	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Toluene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68
Initial Volume: 5.3
Final Volume: 10
Extraction Method: 5035

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MEK

5035/8260B Volatile Organic Compounds / Low Level

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
trans-1,2-Dichloroethene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
trans-1,3-Dichloropropene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Trichloroethene	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Trichlorofluoromethane	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Vinyl Chloride	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Xylene O	ND (0.0070)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Xylene P,M	ND (0.0139)		8260B Low		1	03/01/19 15:39	C9C0010	CC90143
Xylenes (Total)	ND (0.0139)		8260B Low		1	03/01/19 15:39		[CALC]

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1,2-Dichloroethane-d4	*111 %*		*70-130*
Surrogate: 4-Bromofluorobenzene	*97 %*		*70-130*
Surrogate: Dibromofluoromethane	*106 %*		*70-130*
Surrogate: Toluene-d8	*94 %*		*70-130*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68
Initial Volume: 19.3
Final Volume: 10
Extraction Method: 3540C

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry
Analyst: MJV
Prepared: 3/1/19 16:51

8082A Polychlorinated Biphenyls (PCB)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyzed	Sequence	Batch
Aroclor 1016	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1221	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1232	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1242	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1248	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1254	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1260	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1262	ND (0.08)		8082A		1	03/05/19 11:32		CC90508
Aroclor 1268	ND (0.08)		8082A		1	03/05/19 11:32		CC90508

	%Recovery	*Qualifier*	*Limits*
Surrogate: Decachlorobiphenyl	*62 %*		*30-150*
Surrogate: Decachlorobiphenyl [2C]	*69 %*		*30-150*
Surrogate: Tetrachloro-m-xylene	*73 %*		*30-150*
Surrogate: Tetrachloro-m-xylene [2C]	*83 %*		*30-150*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-37 4-8ft
Date Sampled: 02/26/19 10:40
Percent Solids: 68
Initial Volume: 24.5
Final Volume: 1
Extraction Method: 3546

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-17
Sample Matrix: Soil
Units: mg/kg dry

Prepared: 3/4/19 16:05

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (22.6)		MADEP-EPH		1	CAD	03/06/19 11:03	C9C0056	CC90405
C19-C36 Aliphatics1	ND (22.6)		MADEP-EPH		1	CAD	03/06/19 11:03	C9C0056	CC90405
C11-C22 Unadjusted Aromatics1	ND (22.6)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
C11-C22 Aromatics1,2	ND (22.6)		EPH8270			VSC	03/06/19 16:32		[CALC]
2-Methylnaphthalene	ND (0.30)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Acenaphthene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Naphthalene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Phenanthrene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Acenaphthylene	ND (0.30)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Anthracene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Benzo(a)anthracene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Benzo(a)pyrene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Benzo(b)fluoranthene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Benzo(g,h,i)perylene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Benzo(k)fluoranthene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Chrysene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Dibenzo(a,h)Anthracene	ND (0.30)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Fluoranthene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Fluorene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Indeno(1,2,3-cd)Pyrene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405
Pyrene	ND (0.60)		EPH8270		1	VSC	03/06/19 16:32	C9C0070	CC90405

	%Recovery	Qualifier	Limits
Surrogate: 1-Chlorooctadecane	*54 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*127 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*103 %*		*40-140*
Surrogate: O-Terphenyl	*59 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-38 0-2ft
Date Sampled: 02/26/19 11:00
Percent Solids: 46

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-18
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**41.1** (5.39)		6010C		1	KJK	03/06/19 21:48	2.01	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-39 0-2ft
Date Sampled: 02/26/19 11:30
Percent Solids: 68

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-19
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**2140** (3.33)		6010C		1	KJK	03/06/19 21:52	2.21	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-39 2-4ft
Date Sampled: 02/26/19 11:35
Percent Solids: 63

ESS Laboratory Work Order: 1902617
ESS Laboratory Sample ID: 1902617-20
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**62.9** (7.03)		6010C		2	KJK	03/07/19 14:23	2.26	100	CC90536

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Total Metals

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch CC90447 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.29	0.347	mg/kg wet	3.710		89	80-120			
LCS Dup										
Mercury	3.51	0.347	mg/kg wet	3.710		95	80-120	6	20	
Batch CC90536 - 3050B										
Blank										
Antimony	ND	5.00	mg/kg wet							
Antimony	ND	0.50	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	41.9	8.33	mg/kg wet	42.40		99	80-120			
Antimony	35.2	16.7	mg/kg wet	42.40		83	80-120			
Arsenic	110	8.33	mg/kg wet	128.0		86	85-114			
Barium	476	8.33	mg/kg wet	536.0		89	82-118			
Beryllium	191	0.37	mg/kg wet	217.0		88	84-116			
Chromium	104	3.33	mg/kg wet	116.0		90	82-118			
Lead	257	16.7	mg/kg wet	277.0		93	84-116			
Nickel	104	8.33	mg/kg wet	107.0		97	84-117			
Selenium	209	16.7	mg/kg wet	242.0		86	80-120			
Silver	55.9	1.67	mg/kg wet	64.30		87	86-114			
Thallium	160	16.7	mg/kg wet	183.0		88	80-120			
Vanadium	133	3.33	mg/kg wet	146.0		91	86-114			
Zinc	491	8.33	mg/kg wet	561.0		88	86-114			
LCS										
Cadmium	121	1.82	mg/kg wet	141.0		86	76-108			
LCS Dup										
Antimony	50.4	9.26	mg/kg wet	42.40		119	80-120	18	30	
Antimony	37.2	18.5	mg/kg wet	42.40		88	80-120	5	20	
Arsenic	110	9.26	mg/kg wet	128.0		86	85-114	0.5	20	
Barium	471	9.26	mg/kg wet	536.0		88	82-118	1	20	
Beryllium	189	0.41	mg/kg wet	217.0		87	84-116	0.8	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CC90536 - 3050B										
Chromium	104	3.70	mg/kg wet	116.0		89	82-118	0.8	20	
Lead	262	18.5	mg/kg wet	277.0		95	84-116	2	20	
Nickel	104	9.26	mg/kg wet	107.0		97	84-117	0.3	20	
Selenium	208	18.5	mg/kg wet	242.0		86	80-120	0.6	20	
Silver	55.7	1.85	mg/kg wet	64.30		87	86-114	0.4	20	
Thallium	167	18.5	mg/kg wet	183.0		91	80-120	4	20	
Vanadium	132	3.70	mg/kg wet	146.0		91	86-114	0.6	20	
Zinc	486	9.26	mg/kg wet	561.0		87	86-114	1	20	
LCS Dup										
Cadmium	114	1.82	mg/kg wet	141.0		81	76-108	6	20	
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
Blank										
1,1,1,2-Tetrachloroethane	ND	0.0050	mg/kg wet							
1,1,1-Trichloroethane	ND	0.0050	mg/kg wet							
1,1,2,2-Tetrachloroethane	ND	0.0020	mg/kg wet							
1,1,2-Trichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethane	ND	0.0050	mg/kg wet							
1,1-Dichloroethene	ND	0.0050	mg/kg wet							
1,1-Dichloropropene	ND	0.0050	mg/kg wet							
1,2,3-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,3-Trichloropropane	ND	0.0050	mg/kg wet							
1,2,4-Trichlorobenzene	ND	0.0050	mg/kg wet							
1,2,4-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,2-Dibromo-3-Chloropropane	ND	0.0050	mg/kg wet							
1,2-Dibromoethane	ND	0.0050	mg/kg wet							
1,2-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,2-Dichloroethane	ND	0.0050	mg/kg wet							
1,2-Dichloropropane	ND	0.0050	mg/kg wet							
1,3,5-Trimethylbenzene	ND	0.0050	mg/kg wet							
1,3-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,3-Dichloropropane	ND	0.0050	mg/kg wet							
1,4-Dichlorobenzene	ND	0.0050	mg/kg wet							
1,4-Dioxane	ND	0.100	mg/kg wet							
2,2-Dichloropropane	ND	0.0050	mg/kg wet							
2-Butanone	ND	0.0100	mg/kg wet							
2-Chlorotoluene	ND	0.0050	mg/kg wet							
2-Hexanone	ND	0.0100	mg/kg wet							
4-Chlorotoluene	ND	0.0050	mg/kg wet							
4-Isopropyltoluene	ND	0.0050	mg/kg wet							
4-Methyl-2-Pentanone	ND	0.0100	mg/kg wet							
Acetone	ND	0.0100	mg/kg wet							
Benzene	ND	0.0050	mg/kg wet							
Bromobenzene	ND	0.0050	mg/kg wet							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
Bromochloromethane	ND	0.0050	mg/kg wet							
Bromodichloromethane	ND	0.0050	mg/kg wet							
Bromoform	ND	0.0050	mg/kg wet							
Bromomethane	ND	0.0100	mg/kg wet							
Carbon Disulfide	ND	0.0050	mg/kg wet							
Carbon Tetrachloride	ND	0.0050	mg/kg wet							
Chlorobenzene	ND	0.0050	mg/kg wet							
Chloroethane	ND	0.0100	mg/kg wet							
Chloroform	ND	0.0050	mg/kg wet							
Chloromethane	ND	0.0100	mg/kg wet							
cis-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
cis-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Dibromochloromethane	ND	0.0020	mg/kg wet							
Dibromomethane	ND	0.0050	mg/kg wet							
Dichlorodifluoromethane	ND	0.0100	mg/kg wet							
Diethyl Ether	ND	0.0050	mg/kg wet							
Di-isopropyl ether	ND	0.0050	mg/kg wet							
Ethyl tertiary-butyl ether	ND	0.0050	mg/kg wet							
Ethylbenzene	ND	0.0050	mg/kg wet							
Hexachlorobutadiene	ND	0.0050	mg/kg wet							
Isopropylbenzene	ND	0.0050	mg/kg wet							
Methyl tert-Butyl Ether	ND	0.0050	mg/kg wet							
Methylene Chloride	ND	0.0100	mg/kg wet							
Naphthalene	ND	0.0050	mg/kg wet							
n-Butylbenzene	ND	0.0050	mg/kg wet							
n-Propylbenzene	ND	0.0050	mg/kg wet							
sec-Butylbenzene	ND	0.0050	mg/kg wet							
Styrene	ND	0.0050	mg/kg wet							
tert-Butylbenzene	ND	0.0050	mg/kg wet							
Tertiary-amyl methyl ether	ND	0.0050	mg/kg wet							
Tetrachloroethene	ND	0.0050	mg/kg wet							
Tetrahydrofuran	ND	0.0050	mg/kg wet							
Toluene	ND	0.0050	mg/kg wet							
trans-1,2-Dichloroethene	ND	0.0050	mg/kg wet							
trans-1,3-Dichloropropene	ND	0.0050	mg/kg wet							
Trichloroethene	ND	0.0050	mg/kg wet							
Trichlorofluoromethane	ND	0.0050	mg/kg wet							
Vinyl Chloride	ND	0.0100	mg/kg wet							
Xylene O	ND	0.0050	mg/kg wet							
Xylene P,M	ND	0.0100	mg/kg wet							
Surrogate: 1,2-Dichloroethane-d4	*0.0506*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0496*		mg/kg wet	*0.05000*		*99*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0506*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: Toluene-d8	*0.0465*		mg/kg wet	*0.05000*		*93*	*70-130*			
LCS										

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
1,1,1,2-Tetrachloroethane	0.0528	0.0050	mg/kg wet	0.05000		106	70-130			
1,1,1-Trichloroethane	0.0565	0.0050	mg/kg wet	0.05000		113	70-130			
1,1,2,2-Tetrachloroethane	0.0468	0.0020	mg/kg wet	0.05000		94	70-130			
1,1,2-Trichloroethane	0.0533	0.0050	mg/kg wet	0.05000		107	70-130			
1,1-Dichloroethane	0.0509	0.0050	mg/kg wet	0.05000		102	70-130			
1,1-Dichloroethene	0.0566	0.0050	mg/kg wet	0.05000		113	70-130			
1,1-Dichloropropene	0.0547	0.0050	mg/kg wet	0.05000		109	70-130			
1,2,3-Trichlorobenzene	0.0483	0.0050	mg/kg wet	0.05000		97	70-130			
1,2,3-Trichloropropane	0.0489	0.0050	mg/kg wet	0.05000		98	70-130			
1,2,4-Trichlorobenzene	0.0494	0.0050	mg/kg wet	0.05000		99	70-130			
1,2,4-Trimethylbenzene	0.0467	0.0050	mg/kg wet	0.05000		93	70-130			
1,2-Dibromo-3-Chloropropane	0.0544	0.0050	mg/kg wet	0.05000		109	70-130			
1,2-Dibromoethane	0.0521	0.0050	mg/kg wet	0.05000		104	70-130			
1,2-Dichlorobenzene	0.0461	0.0050	mg/kg wet	0.05000		92	70-130			
1,2-Dichloroethane	0.0555	0.0050	mg/kg wet	0.05000		111	70-130			
1,2-Dichloropropane	0.0513	0.0050	mg/kg wet	0.05000		103	70-130			
1,3,5-Trimethylbenzene	0.0476	0.0050	mg/kg wet	0.05000		95	70-130			
1,3-Dichlorobenzene	0.0453	0.0050	mg/kg wet	0.05000		91	70-130			
1,3-Dichloropropane	0.0512	0.0050	mg/kg wet	0.05000		102	70-130			
1,4-Dichlorobenzene	0.0471	0.0050	mg/kg wet	0.05000		94	70-130			
1,4-Dioxane	1.32	0.100	mg/kg wet	1.000		132	70-130			B+
2,2-Dichloropropane	0.0585	0.0050	mg/kg wet	0.05000		117	70-130			
2-Butanone	0.265	0.0100	mg/kg wet	0.2500		106	70-130			
2-Chlorotoluene	0.0460	0.0050	mg/kg wet	0.05000		92	70-130			
2-Hexanone	0.267	0.0100	mg/kg wet	0.2500		107	70-130			
4-Chlorotoluene	0.0471	0.0050	mg/kg wet	0.05000		94	70-130			
4-Isopropyltoluene	0.0473	0.0050	mg/kg wet	0.05000		95	70-130			
4-Methyl-2-Pentanone	0.294	0.0100	mg/kg wet	0.2500		118	70-130			
Acetone	0.269	0.0100	mg/kg wet	0.2500		108	70-130			
Benzene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130			
Bromobenzene	0.0471	0.0050	mg/kg wet	0.05000		94	70-130			
Bromochloromethane	0.0554	0.0050	mg/kg wet	0.05000		111	70-130			
Bromodichloromethane	0.0565	0.0050	mg/kg wet	0.05000		113	70-130			
Bromoform	0.0518	0.0050	mg/kg wet	0.05000		104	70-130			
Bromomethane	0.0582	0.0100	mg/kg wet	0.05000		116	70-130			
Carbon Disulfide	0.0609	0.0050	mg/kg wet	0.05000		122	70-130			
Carbon Tetrachloride	0.0594	0.0050	mg/kg wet	0.05000		119	70-130			
Chlorobenzene	0.0484	0.0050	mg/kg wet	0.05000		97	70-130			
Chloroethane	0.0507	0.0100	mg/kg wet	0.05000		101	70-130			
Chloroform	0.0538	0.0050	mg/kg wet	0.05000		108	70-130			
Chloromethane	0.0479	0.0100	mg/kg wet	0.05000		96	70-130			
cis-1,2-Dichloroethene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130			
cis-1,3-Dichloropropene	0.0557	0.0050	mg/kg wet	0.05000		111	70-130			
Dibromochloromethane	0.0472	0.0020	mg/kg wet	0.05000		94	70-130			
Dibromomethane	0.0565	0.0050	mg/kg wet	0.05000		113	70-130			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
Dichlorodifluoromethane	0.0469	0.0100	mg/kg wet	0.05000		94	70-130			
Diethyl Ether	0.0570	0.0050	mg/kg wet	0.05000		114	70-130			
Di-isopropyl ether	0.0527	0.0050	mg/kg wet	0.05000		105	70-130			
Ethyl tertiary-butyl ether	0.0516	0.0050	mg/kg wet	0.05000		103	70-130			
Ethylbenzene	0.0490	0.0050	mg/kg wet	0.05000		98	70-130			
Hexachlorobutadiene	0.0477	0.0050	mg/kg wet	0.05000		95	70-130			
Isopropylbenzene	0.0474	0.0050	mg/kg wet	0.05000		95	70-130			
Methyl tert-Butyl Ether	0.0582	0.0050	mg/kg wet	0.05000		116	70-130			
Methylene Chloride	0.0527	0.0100	mg/kg wet	0.05000		105	70-130			
Naphthalene	0.0513	0.0050	mg/kg wet	0.05000		103	70-130			
n-Butylbenzene	0.0488	0.0050	mg/kg wet	0.05000		98	70-130			
n-Propylbenzene	0.0472	0.0050	mg/kg wet	0.05000		94	70-130			
sec-Butylbenzene	0.0463	0.0050	mg/kg wet	0.05000		93	70-130			
Styrene	0.0500	0.0050	mg/kg wet	0.05000		100	70-130			
tert-Butylbenzene	0.0478	0.0050	mg/kg wet	0.05000		96	70-130			
Tertiary-amyl methyl ether	0.0558	0.0050	mg/kg wet	0.05000		112	70-130			
Tetrachloroethene	0.0441	0.0050	mg/kg wet	0.05000		88	70-130			
Tetrahydrofuran	0.0620	0.0050	mg/kg wet	0.05000		124	70-130			
Toluene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130			
trans-1,2-Dichloroethene	0.0523	0.0050	mg/kg wet	0.05000		105	70-130			
trans-1,3-Dichloropropene	0.0465	0.0050	mg/kg wet	0.05000		93	70-130			
Trichloroethene	0.0521	0.0050	mg/kg wet	0.05000		104	70-130			
Trichlorofluoromethane	0.0556	0.0050	mg/kg wet	0.05000		111	70-130			
Vinyl Chloride	0.0519	0.0100	mg/kg wet	0.05000		104	70-130			
Xylene O	0.0479	0.0050	mg/kg wet	0.05000		96	70-130			
Xylene P,M	0.0959	0.0100	mg/kg wet	0.1000		96	70-130			
Surrogate: 1,2-Dichloroethane-d4	*0.0499*		mg/kg wet	*0.05000*		*100*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0513*		mg/kg wet	*0.05000*		*103*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0518*		mg/kg wet	*0.05000*		*104*	*70-130*			
Surrogate: Toluene-d8	*0.0472*		mg/kg wet	*0.05000*		*94*	*70-130*			
LCS Dup										
1,1,1,2-Tetrachloroethane	0.0562	0.0050	mg/kg wet	0.05000		112	70-130	6	20	
1,1,1-Trichloroethane	0.0582	0.0050	mg/kg wet	0.05000		116	70-130	3	20	
1,1,2,2-Tetrachloroethane	0.0476	0.0020	mg/kg wet	0.05000		95	70-130	2	20	
1,1,2-Trichloroethane	0.0557	0.0050	mg/kg wet	0.05000		111	70-130	4	20	
1,1-Dichloroethane	0.0531	0.0050	mg/kg wet	0.05000		106	70-130	4	20	
1,1-Dichloroethene	0.0583	0.0050	mg/kg wet	0.05000		117	70-130	3	20	
1,1-Dichloropropene	0.0566	0.0050	mg/kg wet	0.05000		113	70-130	3	20	
1,2,3-Trichlorobenzene	0.0510	0.0050	mg/kg wet	0.05000		102	70-130	5	20	
1,2,3-Trichloropropane	0.0495	0.0050	mg/kg wet	0.05000		99	70-130	1	20	
1,2,4-Trichlorobenzene	0.0518	0.0050	mg/kg wet	0.05000		104	70-130	5	20	
1,2,4-Trimethylbenzene	0.0484	0.0050	mg/kg wet	0.05000		97	70-130	4	20	
1,2-Dibromo-3-Chloropropane	0.0556	0.0050	mg/kg wet	0.05000		111	70-130	2	20	
1,2-Dibromoethane	0.0555	0.0050	mg/kg wet	0.05000		111	70-130	6	20	
1,2-Dichlorobenzene	0.0480	0.0050	mg/kg wet	0.05000		96	70-130	4	20	

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
1,2-Dichloroethane	0.0577	0.0050	mg/kg wet	0.05000		115	70-130	4	20	
1,2-Dichloropropane	0.0540	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
1,3,5-Trimethylbenzene	0.0488	0.0050	mg/kg wet	0.05000		98	70-130	3	20	
1,3-Dichlorobenzene	0.0474	0.0050	mg/kg wet	0.05000		95	70-130	5	20	
1,3-Dichloropropane	0.0543	0.0050	mg/kg wet	0.05000		109	70-130	6	20	
1,4-Dichlorobenzene	0.0485	0.0050	mg/kg wet	0.05000		97	70-130	3	20	
1,4-Dioxane	1.37	0.100	mg/kg wet	1.000		137	70-130	4	20	B+
2,2-Dichloropropane	0.0596	0.0050	mg/kg wet	0.05000		119	70-130	2	20	
2-Butanone	0.270	0.0100	mg/kg wet	0.2500		108	70-130	2	20	
2-Chlorotoluene	0.0473	0.0050	mg/kg wet	0.05000		95	70-130	3	20	
2-Hexanone	0.277	0.0100	mg/kg wet	0.2500		111	70-130	3	20	
4-Chlorotoluene	0.0484	0.0050	mg/kg wet	0.05000		97	70-130	3	20	
4-Isopropyltoluene	0.0488	0.0050	mg/kg wet	0.05000		98	70-130	3	20	
4-Methyl-2-Pentanone	0.298	0.0100	mg/kg wet	0.2500		119	70-130	1	20	
Acetone	0.271	0.0100	mg/kg wet	0.2500		108	70-130	0.7	20	
Benzene	0.0543	0.0050	mg/kg wet	0.05000		109	70-130	4	20	
Bromobenzene	0.0496	0.0050	mg/kg wet	0.05000		99	70-130	5	20	
Bromochloromethane	0.0584	0.0050	mg/kg wet	0.05000		117	70-130	5	20	
Bromodichloromethane	0.0592	0.0050	mg/kg wet	0.05000		118	70-130	5	20	
Bromoform	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
Bromomethane	0.0544	0.0100	mg/kg wet	0.05000		109	70-130	7	20	
Carbon Disulfide	0.0630	0.0050	mg/kg wet	0.05000		126	70-130	3	20	
Carbon Tetrachloride	0.0609	0.0050	mg/kg wet	0.05000		122	70-130	2	20	
Chlorobenzene	0.0516	0.0050	mg/kg wet	0.05000		103	70-130	6	20	
Chloroethane	0.0526	0.0100	mg/kg wet	0.05000		105	70-130	4	20	
Chloroform	0.0563	0.0050	mg/kg wet	0.05000		113	70-130	5	20	
Chloromethane	0.0490	0.0100	mg/kg wet	0.05000		98	70-130	2	20	
cis-1,2-Dichloroethene	0.0567	0.0050	mg/kg wet	0.05000		113	70-130	5	20	
cis-1,3-Dichloropropene	0.0586	0.0050	mg/kg wet	0.05000		117	70-130	5	20	
Dibromochloromethane	0.0499	0.0020	mg/kg wet	0.05000		100	70-130	6	20	
Dibromomethane	0.0593	0.0050	mg/kg wet	0.05000		119	70-130	5	20	
Dichlorodifluoromethane	0.0473	0.0100	mg/kg wet	0.05000		95	70-130	0.9	20	
Diethyl Ether	0.0588	0.0050	mg/kg wet	0.05000		118	70-130	3	20	
Di-isopropyl ether	0.0556	0.0050	mg/kg wet	0.05000		111	70-130	5	20	
Ethyl tertiary-butyl ether	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	5	20	
Ethylbenzene	0.0520	0.0050	mg/kg wet	0.05000		104	70-130	6	20	
Hexachlorobutadiene	0.0488	0.0050	mg/kg wet	0.05000		98	70-130	2	20	
Isopropylbenzene	0.0483	0.0050	mg/kg wet	0.05000		97	70-130	2	20	
Methyl tert-Butyl Ether	0.0613	0.0050	mg/kg wet	0.05000		123	70-130	5	20	
Methylene Chloride	0.0555	0.0100	mg/kg wet	0.05000		111	70-130	5	20	
Naphthalene	0.0534	0.0050	mg/kg wet	0.05000		107	70-130	4	20	
n-Butylbenzene	0.0503	0.0050	mg/kg wet	0.05000		101	70-130	3	20	
n-Propylbenzene	0.0482	0.0050	mg/kg wet	0.05000		96	70-130	2	20	
sec-Butylbenzene	0.0476	0.0050	mg/kg wet	0.05000		95	70-130	3	20	
Styrene	0.0542	0.0050	mg/kg wet	0.05000		108	70-130	8	20	

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
5035/8260B Volatile Organic Compounds / Low Level										
Batch CC90143 - 5035										
tert-Butylbenzene	0.0490	0.0050	mg/kg wet	0.05000		98	70-130	2	20	
Tertiary-amyl methyl ether	0.0586	0.0050	mg/kg wet	0.05000		117	70-130	5	20	
Tetrachloroethene	0.0462	0.0050	mg/kg wet	0.05000		92	70-130	5	20	
Tetrahydrofuran	0.0617	0.0050	mg/kg wet	0.05000		123	70-130	0.5	20	
Toluene	0.0540	0.0050	mg/kg wet	0.05000		108	70-130	4	20	
trans-1,2-Dichloroethene	0.0544	0.0050	mg/kg wet	0.05000		109	70-130	4	20	
trans-1,3-Dichloropropene	0.0491	0.0050	mg/kg wet	0.05000		98	70-130	5	20	
Trichloroethene	0.0537	0.0050	mg/kg wet	0.05000		107	70-130	3	20	
Trichlorofluoromethane	0.0564	0.0050	mg/kg wet	0.05000		113	70-130	1	20	
Vinyl Chloride	0.0535	0.0100	mg/kg wet	0.05000		107	70-130	3	20	
Xylene O	0.0509	0.0050	mg/kg wet	0.05000		102	70-130	6	20	
Xylene P,M	0.102	0.0100	mg/kg wet	0.1000		102	70-130	6	20	
Surrogate: 1,2-Dichloroethane-d4	*0.0503*		mg/kg wet	*0.05000*		*101*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*0.0524*		mg/kg wet	*0.05000*		*105*	*70-130*			
Surrogate: Dibromofluoromethane	*0.0518*		mg/kg wet	*0.05000*		*104*	*70-130*			
Surrogate: Toluene-d8	*0.0485*		mg/kg wet	*0.05000*		*97*	*70-130*			
8082A Polychlorinated Biphenyls (PCB)										
Batch CC90508 - 3540C										
Blank										
Aroclor 1016	ND	0.05	mg/kg wet							
Aroclor 1016 [2C]	ND	0.05	mg/kg wet							
Aroclor 1221	ND	0.05	mg/kg wet							
Aroclor 1221 [2C]	ND	0.05	mg/kg wet							
Aroclor 1232	ND	0.05	mg/kg wet							
Aroclor 1232 [2C]	ND	0.05	mg/kg wet							
Aroclor 1242	ND	0.05	mg/kg wet							
Aroclor 1242 [2C]	ND	0.05	mg/kg wet							
Aroclor 1248	ND	0.05	mg/kg wet							
Aroclor 1248 [2C]	ND	0.05	mg/kg wet							
Aroclor 1254	ND	0.05	mg/kg wet							
Aroclor 1254 [2C]	ND	0.05	mg/kg wet							
Aroclor 1260	ND	0.05	mg/kg wet							
Aroclor 1260 [2C]	ND	0.05	mg/kg wet							
Aroclor 1262	ND	0.05	mg/kg wet							
Aroclor 1262 [2C]	ND	0.05	mg/kg wet							
Aroclor 1268	ND	0.05	mg/kg wet							
Aroclor 1268 [2C]	ND	0.05	mg/kg wet							
Surrogate: Decachlorobiphenyl	*0.0210*		mg/kg wet	*0.02500*		*84*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0216*		mg/kg wet	*0.02500*		*86*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0194*		mg/kg wet	*0.02500*		*78*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0215*		mg/kg wet	*0.02500*		*86*	*30-150*			
LCS										
Aroclor 1016	0.6	0.05	mg/kg wet	0.5000		110	40-140			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
8082A Polychlorinated Biphenyls (PCB)										
Batch CC90508 - 3540C										
Aroclor 1016 [2C]	0.5	0.05	mg/kg wet	0.5000		101	40-140			
Aroclor 1260	0.5	0.05	mg/kg wet	0.5000		99	40-140			
Aroclor 1260 [2C]	0.5	0.05	mg/kg wet	0.5000		98	40-140			
Surrogate: Decachlorobiphenyl	*0.0226*		mg/kg wet	*0.02500*		*91*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0236*		mg/kg wet	*0.02500*		*94*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0226*		mg/kg wet	*0.02500*		*90*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0220*		mg/kg wet	*0.02500*		*88*	*30-150*			
LCS Dup										
Aroclor 1016	0.6	0.05	mg/kg wet	0.5000		110	40-140	0.02	30	
Aroclor 1016 [2C]	0.5	0.05	mg/kg wet	0.5000		101	40-140	0.2	30	
Aroclor 1260	0.5	0.05	mg/kg wet	0.5000		99	40-140	0.1	30	
Aroclor 1260 [2C]	0.5	0.05	mg/kg wet	0.5000		98	40-140	0.2	30	
Surrogate: Decachlorobiphenyl	*0.0224*		mg/kg wet	*0.02500*		*90*	*30-150*			
Surrogate: Decachlorobiphenyl [2C]	*0.0232*		mg/kg wet	*0.02500*		*93*	*30-150*			
Surrogate: Tetrachloro-m-xylene	*0.0225*		mg/kg wet	*0.02500*		*90*	*30-150*			
Surrogate: Tetrachloro-m-xylene [2C]	*0.0218*		mg/kg wet	*0.02500*		*87*	*30-150*			
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC90405 - 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							
Surrogate: 1-Chlorooctadecane	*1.50*		mg/kg wet	*2.000*		*75*	*40-140*			
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							

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MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC90405 - 3546										
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 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							
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	*54.5*		mg/L	*50.00*		*109*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*54.7*		mg/L	*50.00*		*109*	*40-140*			
Surrogate: O-Terphenyl	*2.14*		mg/kg wet	*2.000*		*107*	*40-140*			
LCS										
C19-C36 Aliphatics1	17.0	15.0	mg/kg wet	16.00		106	40-140			
C9-C18 Aliphatics1	9.0	15.0	mg/kg wet	12.00		75	40-140			
Decane (C10)	0.8	0.5	mg/kg wet	2.000		41	40-140			
Docosane (C22)	1.5	0.5	mg/kg wet	2.000		75	40-140			
Dodecane (C12)	0.9	0.5	mg/kg wet	2.000		46	40-140			
Eicosane (C20)	1.5	0.5	mg/kg wet	2.000		73	40-140			
Hexacosane (C26)	1.4	0.5	mg/kg wet	2.000		72	40-140			
Hexadecane (C16)	1.4	0.5	mg/kg wet	2.000		71	40-140			
Hexatriacontane (C36)	1.6	0.5	mg/kg wet	2.000		79	40-140			
Nonadecane (C19)	1.5	0.5	mg/kg wet	2.000		73	40-140			
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		33	30-140			
Octacosane (C28)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Octadecane (C18)	1.5	0.5	mg/kg wet	2.000		73	40-140			
Tetracosane (C24)	1.5	0.5	mg/kg wet	2.000		75	40-140			
Tetradecane (C14)	1.1	0.5	mg/kg wet	2.000		56	40-140			
Triacontane (C30)	1.4	0.5	mg/kg wet	2.000		70	40-140			
Surrogate: 1-Chlorooctadecane	*1.53*		mg/kg wet	*2.000*		*77*	*40-140*			
LCS										
2-Methylnaphthalene	1.71	0.20	mg/kg wet	2.000		85	40-140			
Acenaphthene	1.76	0.40	mg/kg wet	2.000		88	40-140			
Acenaphthylene	2.00	0.20	mg/kg wet	2.000		100	40-140			
Anthracene	1.95	0.40	mg/kg wet	2.000		97	40-140			
Benzo(a)anthracene	2.10	0.40	mg/kg wet	2.000		105	40-140			
Benzo(a)pyrene	2.06	0.40	mg/kg wet	2.000		103	40-140			
Benzo(b)fluoranthene	2.17	0.40	mg/kg wet	2.000		108	40-140			
Benzo(g,h,i)perylene	1.65	0.40	mg/kg wet	2.000		83	40-140			

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Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC90405 - 3546										
Benzo(k)fluoranthene	2.13	0.40	mg/kg wet	2.000		106	40-140			
C11-C22 Unadjusted Aromatics1	37.1	15.0	mg/kg wet	34.00		109	40-140			
Chrysene	2.09	0.40	mg/kg wet	2.000		105	40-140			
Dibenzo(a,h)Anthracene	1.92	0.20	mg/kg wet	2.000		96	40-140			
Fluoranthene	2.03	0.40	mg/kg wet	2.000		101	40-140			
Fluorene	1.96	0.40	mg/kg wet	2.000		98	40-140			
Indeno(1,2,3-cd)Pyrene	1.97	0.40	mg/kg wet	2.000		99	40-140			
Naphthalene	1.54	0.40	mg/kg wet	2.000		77	40-140			
Phenanthrene	1.98	0.40	mg/kg wet	2.000		99	40-140			
Pyrene	2.03	0.40	mg/kg wet	2.000		101	40-140			
Surrogate: 2-Bromonaphthalene	*55.3*		mg/L	*50.00*		*111*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*55.6*		mg/L	*50.00*		*111*	*40-140*			
Surrogate: O-Terphenyl	*2.20*		mg/kg wet	*2.000*		*110*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS Dup										
C19-C36 Aliphatics1	17.8	15.0	mg/kg wet	16.00		111	40-140	4	25	
C9-C18 Aliphatics1	9.4	15.0	mg/kg wet	12.00		78	40-140	4	25	
Decane (C10)	0.9	0.5	mg/kg wet	2.000		43	40-140	4	25	
Docosane (C22)	1.6	0.5	mg/kg wet	2.000		78	40-140	4	25	
Dodecane (C12)	1.0	0.5	mg/kg wet	2.000		48	40-140	4	25	
Eicosane (C20)	1.5	0.5	mg/kg wet	2.000		76	40-140	5	25	
Hexacosane (C26)	1.5	0.5	mg/kg wet	2.000		76	40-140	4	25	
Hexadecane (C16)	1.5	0.5	mg/kg wet	2.000		75	40-140	5	25	
Hexatriacontane (C36)	1.6	0.5	mg/kg wet	2.000		82	40-140	3	25	
Nonadecane (C19)	1.5	0.5	mg/kg wet	2.000		76	40-140	5	25	
Nonane (C9)	0.7	0.5	mg/kg wet	2.000		34	30-140	3	25	
Octacosane (C28)	1.5	0.5	mg/kg wet	2.000		74	40-140	5	25	
Octadecane (C18)	1.5	0.5	mg/kg wet	2.000		76	40-140	4	25	
Tetracosane (C24)	1.6	0.5	mg/kg wet	2.000		78	40-140	4	25	
Tetradecane (C14)	1.2	0.5	mg/kg wet	2.000		60	40-140	6	25	
Triacontane (C30)	1.5	0.5	mg/kg wet	2.000		74	40-140	5	25	
Surrogate: 1-Chlorooctadecane	*1.60*		mg/kg wet	*2.000*		*80*	*40-140*			
LCS Dup										
2-Methylnaphthalene	1.73	0.20	mg/kg wet	2.000		87	40-140	1	30	
Acenaphthene	1.76	0.40	mg/kg wet	2.000		88	40-140	0.3	30	
Acenaphthylene	2.00	0.20	mg/kg wet	2.000		100	40-140	0.02	30	
Anthracene	1.94	0.40	mg/kg wet	2.000		97	40-140	0.6	30	
Benzo(a)anthracene	2.07	0.40	mg/kg wet	2.000		104	40-140	1	30	
Benzo(a)pyrene	2.03	0.40	mg/kg wet	2.000		101	40-140	2	30	
Benzo(b)fluoranthene	2.15	0.40	mg/kg wet	2.000		107	40-140	1	30	
Benzo(g,h,i)perylene	1.66	0.40	mg/kg wet	2.000		83	40-140	0.3	30	
Benzo(k)fluoranthene	2.11	0.40	mg/kg wet	2.000		106	40-140	0.5	30	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC90405 - 3546										
C11-C22 Unadjusted Aromatics1	33.3	15.0	mg/kg wet	34.00		98	40-140	11	25	
Chrysene	2.07	0.40	mg/kg wet	2.000		104	40-140	1	30	
Dibenzo(a,h)Anthracene	1.90	0.20	mg/kg wet	2.000		95	40-140	1	30	
Fluoranthene	2.00	0.40	mg/kg wet	2.000		100	40-140	2	30	
Fluorene	1.95	0.40	mg/kg wet	2.000		97	40-140	0.7	30	
Indeno(1,2,3-cd)Pyrene	1.95	0.40	mg/kg wet	2.000		97	40-140	1	30	
Naphthalene	1.56	0.40	mg/kg wet	2.000		78	40-140	1	30	
Phenanthrene	1.95	0.40	mg/kg wet	2.000		98	40-140	2	30	
Pyrene	1.99	0.40	mg/kg wet	2.000		100	40-140	2	30	
Surrogate: 2-Bromonaphthalene	*53.9*		mg/L	*50.00*		*108*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*54.0*		mg/L	*50.00*		*108*	*40-140*			
Surrogate: O-Terphenyl	*2.15*		mg/kg wet	*2.000*		*108*	*40-140*			
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: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902617

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
B+	Blank Spike recovery is above upper control limit (B+).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902617

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902617
Date Received: 2/28/2019
Project Due Date: 3/7/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: 2/28/19 Time: 2029 By: [illegible]

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	320316	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	320315	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	320314	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320313	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	320312	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	320311	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	320310	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
08	320309	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
09	320308	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	320307	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
11	320306	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
12	320296	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
12	320305	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
13	320304	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
14	320303	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
15	320302	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
16	320301	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
17	320291	Yes	NA	Yes	VOA Vial - Methanol	MeOH	
17	320292	Yes	NA	Yes	VOA Vial - Other	Other	
17	320293	Yes	NA	Yes	VOA Vial - Other	Other	
17	320295	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
17	320300	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
18	320299	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
19	320294	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

ESS Project ID: 1902617
Date Received: 2/28/2019

19	320298	Yes	NA	Yes	4 oz. Jar - Unpres	NP
20	320297	Yes	NA	Yes	4 oz. Jar - Unpres	NP

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: _____ Date & Time: 2/28/19 2025
Reviewed By: _____ Date & Time: 2/28/19 2029
Delivered By: _____ 2/28/19 2029

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: 5 day Rush:
Regulatory State: MA
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1902617
Reporting Limits S-1/S-2/S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name	Project #	Project Name
Tighe & Bond	S-1758-020	Gallows Hill Park Salem

Contact Person	Address
Todd Kirton	446 Main St.

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
		TDKirton@Tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	PCBs	VOCs	Arsenic	MCP 14 metals	EPH	Cr (total)	Cyanide
1	2/25/19	1140	G	S	B-29 (4-5.5')				X			
2	↓	1145	↓	↓	B-30 (0-2')			X				
3		1150			B-30 (2-4')			X				
4		1200			B-31 (0-2')			X				
5		1205			B-31 (2-4')			X				
6	2/24/19	800			B-32 (0-2')			X				
7		830			B-33 (0-2')			X				
8		845			B-33 (2-4')			X				
9		900			B-34 (0-2')			X				
10	↓	930	↓	↓	B-35 (0-2')			X				

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers:

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 1.1 °C ICE RC

Sampled by: KM
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	R Carlson 2/28/19 1500	R Carlson 2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902617

Turn Time: 5 day Rush:
Regulatory State: MA
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Reporting Limits: S-1/S-2/S-3

Electonic Deliverables: ☑ Limit Checker ☑ Excel ☐ Other (Please Specifiy) → PDF

Company Name	Project #	Project Name
Tighe + Bond	S-1757-020	Gallows Hill LTK System

Contact Person	Address
Todd Kirton	446 Main St

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
		TDKirton@Tighebond.com

Analysis

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	PCBs	VOCs	Arsenic	MCP 14 metals	EPH	Cr (total)	Cyanide
11	2/24/19	940	G	S	B-35 (2-4')			X				
12		945			B-35 (4-5.5)				X	X		
13		1000			B-36 (0-2')			X				
14		1010			B-36 (2-4')			X				
15		1030			B-37 (0-2')			X				
16		1035			B-37 (2-4')			X				
17		1040			B-37 (4-8')	X	X	X		X		
18		1100			B-38 (0-2')			X				
19		1130			B-39 (0-2')			X				
20		1135			B-39 (2-4')			X				

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Number of Containers:

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 1.1 °C ICE RC

Sampled by: KW

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	2/28/19 1500	2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1902618

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 2:57 pm, Mar 08, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

SAMPLE RECEIPT

The following samples were received on February 28, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

Question I: All samples for Metals except 1902618-08 were analyzed for a subset of the required MCP list per the client's request.

Lab Number	Sample Name	Matrix	Analysis
1902618-01	B-45 2-4	Soil	6010C, 9014
1902618-02	B-45 4-8	Soil	6010C
1902618-03	B-46 0-2	Soil	6010C
1902618-04	B-46 2-4	Soil	6010C
1902618-05	B-47 0-2	Soil	6010C
1902618-06	B-48 0-1	Soil	6010C
1902618-07	B-48 1-2	Soil	6010C
1902618-08	B-49 0-1	Soil	6010C, 6020A, 7471B
1902618-09	B-49 1-2	Soil	6010C
1902618-10	B-50 0-1	Soil	6010C
1902618-11	B-50 1-2	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

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
8015C - 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
MADEP 04-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1902618-01 through 1902618-11**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard
Date: March 08, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-45 2-4
Date Sampled: 02/26/19 13:20
Percent Solids: 54

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**12.3** (3.79)		6010C		1	KJK	03/07/19 2:36	2.46	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-45 2-4
Date Sampled: 02/26/19 13:20
Percent Solids: 54

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Total Cyanide	ND (1.72)		9014		1	EEM	03/04/19 13:45	mg/kg dry	CC90419

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-45 4-8
Date Sampled: 02/26/19 13:25
Percent Solids: 77

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.82** (2.98)		6010C		1	KJK	03/07/19 3:08	2.19	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-46 0-2
Date Sampled: 02/26/19 13:30
Percent Solids: 76

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**14.6** (3.09)		6010C		1	KJK	03/07/19 3:28	2.13	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-46 2-4
Date Sampled: 02/26/19 13:45
Percent Solids: 83

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**13.1** (2.80)		6010C		1	KJK	03/07/19 3:32	2.15	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-47 0-2
Date Sampled: 02/26/19 14:00
Percent Solids: 84

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**50.2** (4.30)		6010C		2	KJK	03/07/19 15:31	2.77	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-48 0-1
Date Sampled: 02/26/19 14:30
Percent Solids: 59

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**208** (3.24)		6010C		1	KJK	03/07/19 3:39	2.61	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-48 1-2
Date Sampled: 02/26/19 14:35
Percent Solids: 78

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**203** (3.18)		6010C		1	KJK	03/07/19 3:43	2.01	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-49 0-1
Date Sampled: 02/26/19 14:45
Percent Solids: 61

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-08
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Antimony	**3.00** (0.78)		6020A		1	KJK	03/07/19 18:02	2.11	100	CC90537
Arsenic	**444** (3.91)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Barium	**1060** (3.91)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Beryllium	**0.31** (0.17)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Cadmium	**5.42** (0.78)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Chromium	**1030** (1.56)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Lead	**354** (7.81)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Mercury	**4.20** (0.768)		7471B		20	MKS	03/05/19 13:30	0.85	40	CC90447
Nickel	**18.0** (3.91)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Selenium	ND (7.81)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Silver	ND (0.78)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Thallium	ND (7.81)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Vanadium	**41.2** (1.56)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537
Zinc	**696** (3.91)		6010C		1	KJK	03/07/19 4:00	2.11	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-49 1-2
Date Sampled: 02/26/19 14:50
Percent Solids: 77

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-09
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**990** (3.10)		6010C		1	KJK	03/07/19 15:47	2.09	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-50 0-1
Date Sampled: 02/26/19 15:00
Percent Solids: 56

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-10
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**344** (4.17)		6010C		1	KJK	03/07/19 4:08	2.13	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-50 1-2
Date Sampled: 02/26/19 15:00
Percent Solids: 80

ESS Laboratory Work Order: 1902618
ESS Laboratory Sample ID: 1902618-11
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**528** (2.48)		6010C		1	KJK	03/07/19 4:12	2.51	100	CC90537

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC90447 - 7471B										
Blank										
Mercury	ND	0.033	mg/kg wet							
LCS										
Mercury	3.29	0.347	mg/kg wet	3.710		89	80-120			
LCS Dup										
Mercury	3.51	0.347	mg/kg wet	3.710		95	80-120	6	20	
Batch CC90537 - 3050B										
Blank										
Antimony	ND	0.50	mg/kg wet							
Arsenic	ND	2.50	mg/kg wet							
Barium	ND	2.50	mg/kg wet							
Beryllium	ND	0.11	mg/kg wet							
Cadmium	ND	0.50	mg/kg wet							
Chromium	ND	1.00	mg/kg wet							
Lead	ND	5.00	mg/kg wet							
Nickel	ND	2.50	mg/kg wet							
Selenium	ND	5.00	mg/kg wet							
Silver	ND	0.50	mg/kg wet							
Thallium	ND	5.00	mg/kg wet							
Vanadium	ND	1.00	mg/kg wet							
Zinc	ND	2.50	mg/kg wet							
LCS										
Antimony	42.1	8.62	mg/kg wet	42.40		99	80-120			
Arsenic	130	8.62	mg/kg wet	128.0		101	85-114			
Barium	500	8.62	mg/kg wet	536.0		93	82-118			
Beryllium	206	0.38	mg/kg wet	217.0		95	84-116			
Cadmium	92.0	1.72	mg/kg wet	99.00		93	87-113			
Chromium	114	3.45	mg/kg wet	116.0		99	82-118			
Lead	292	17.2	mg/kg wet	277.0		106	84-116			
Nickel	109	8.62	mg/kg wet	107.0		102	84-117			
Selenium	233	17.2	mg/kg wet	242.0		96	80-120			
Silver	64.6	1.72	mg/kg wet	64.30		100	86-114			
Thallium	179	17.2	mg/kg wet	183.0		98	80-120			
Vanadium	147	3.45	mg/kg wet	146.0		101	86-114			
Zinc	528	8.62	mg/kg wet	561.0		94	86-114			
LCS Dup										
Antimony	44.4	9.80	mg/kg wet	42.40		105	80-120	5	30	
Arsenic	119	9.80	mg/kg wet	128.0		93	85-114	9	20	
Barium	509	9.80	mg/kg wet	536.0		95	82-118	2	20	
Beryllium	199	0.43	mg/kg wet	217.0		92	84-116	3	20	
Cadmium	90.3	1.96	mg/kg wet	99.00		91	87-113	2	20	
Chromium	110	3.92	mg/kg wet	116.0		95	82-118	4	20	
Lead	276	19.6	mg/kg wet	277.0		100	84-116	6	20	
Nickel	100	9.80	mg/kg wet	107.0		94	84-117	9	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CC90537 - 3050B										
Selenium	225	19.6	mg/kg wet	242.0		93	80-120	4	20	
Silver	60.6	1.96	mg/kg wet	64.30		94	86-114	6	20	
Thallium	178	19.6	mg/kg wet	183.0		97	80-120	0.8	20	
Vanadium	141	3.92	mg/kg wet	146.0		96	86-114	5	20	
Zinc	519	9.80	mg/kg wet	561.0		93	86-114	2	20	
Classical Chemistry										
Batch CC90419 - TCN Prep										
Blank										
Total Cyanide	ND	1.00	mg/kg wet							
LCS										
Total Cyanide	5.00	1.00	mg/kg wet	5.015		100	90-110			
Reference										
Total Cyanide	152	9.82	mg/kg wet	157.0		97	24-110			
Reference										
Total Cyanide	152	9.89	mg/kg wet	157.0		97	24-110			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1902618

Notes and Definitions

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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1902618

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1902618
Date Received: 2/28/2019
Project Due Date: 3/7/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 1.1 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / (NA)
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / (No)
    a. 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 608.3 Pesticides)
01	320289	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
01	320290	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	320288	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	320287	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	320286	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	320285	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	320284	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	320283	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
08	320282	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
09	320281	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
10	320280	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
11	320279	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials: ll
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 2/28/19 1011
Reviewed By: Date & Time: 2/28/19 2029
Delivered

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

By: 2/28/19 2029

ESS Project ID: 1902618

Date Received: 2/28/2019

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab #	1902618
Reporting Limits	S-1 / S-2 / S-3
Electonic Deliverables	☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Turn Time: 5 day Rush:
Regulatory State: MA
Is this project for any of the following?: ☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

Company Name: Tighe & Bond	Project #: S-1758-02	Project Name: Gallows Hill Park Sewer	
Contact Person: Todd Kirton	Address: 446 Main St		
City: Worcester	State: MA	Zip Code: 01608	PO #:
Telephone Number:	FAX Number:	Email Address: TPKirton@Tigheband.com	

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Arsenic	Cyanide	MCP 14 Metals
1	2/26/19	1320	G	S	B-45 (2-4)	X	X	
2		1325			B-45 (4-8)	X		
3		1330			B-46 (0-2)	X		
4		1345			B-46 (2-4)	X		
5		1400			B-47 (0-2)	X		
6		1430			B-48 (0-1)	X		
7		1435			B-48 (1-2)	X		
8		1445			B-49 (0-1)			X
9		1450			B-49 (1-2)	X		
10		1500			B-50 (0-1)	X		

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Number of Containers:

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 1.1 °C ICE RC

Sampled by :
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	2/28/19 1500	2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1902618

Turn Time	5	Days
Regulatory State		

Reporting Limits: S-1 / S-2 / S-3

Is this project for any of the following?: ○ CT RCP ☑ MA MCP ○ RGP

Electonic Deliverables: ☑ Data Checker ☑ Excel ☐ Other (Please Specify →) PDF

Company Name	Project #	Project Name
Tighe & Bond	S-1758-020	Gallows Hill Park Salem

Contact Person	Address
Ted Kirton	446 Main St

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
		TDKirton@Tighebond.com

Analysis: Arsenic

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Arsenic
11	2/26/19	1500	G	S	B-50 (1-2)	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Number of Containers per Sample:

Laboratory Use Only

Cooler Present: ✓ ○ Drop Off
Seals Intact: ☑ Pickup
Cooler Temperature: 1.1 °C ICE RC

Sampled by: KM

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
2/28/19 1230	2/28/19 1500	2/28/19 1624	2/28/19 1900
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1903345

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 4:53 pm, Mar 21, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

SAMPLE RECEIPT

The following samples were received on March 14, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

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

Lab Number	Sample Name	Matrix	Analysis
1903345-01	B-53 0-1	Soil	6010C
1903345-02	B-51 0-1	Soil	6010C
1903345-03	B-52 0-1	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1903345-01 through 1903345-03**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard
Date: March 21, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-53 0-1
Date Sampled: 03/13/19 12:00
Percent Solids: 74

ESS Laboratory Work Order: 1903345
ESS Laboratory Sample ID: 1903345-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**91.2** (2.44)		6010C		1	KJK	03/19/19 15:58	2.78	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-51 0-1
Date Sampled: 03/13/19 12:10
Percent Solids: 66

ESS Laboratory Work Order: 1903345
ESS Laboratory Sample ID: 1903345-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**21.2** (3.65)		6010C		1	KJK	03/19/19 16:02	2.07	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-52 0-1
Date Sampled: 03/13/19 12:20
Percent Solids: 64

ESS Laboratory Work Order: 1903345
ESS Laboratory Sample ID: 1903345-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.78** (2.64)		6010C		1	KJK	03/19/19 16:06	2.94	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC91853 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
LCS										
Arsenic	122	9.43	mg/kg wet	128.0		95	85-114			
LCS Dup										
Arsenic	121	9.43	mg/kg wet	128.0		94	85-114	0.9	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1903345

Notes and Definitions

U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903345

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1903345
Date Received: 3/14/2019
Project Due Date: 3/21/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.2 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	323739	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
02	323738	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	323737	Yes	NA	Yes	8 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 3/14/19 1759
Reviewed By: Date & Time: 3/14/19 1815
Delivered By: 3/14/19 1815

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab #	1903345
Turn Time	5 Days
Regulatory State	MA
Reporting Limits	S-1 / S-2 / S-3
Is this project for any of the following?:	○ CT RCP ⊘ MA MCP ○ RGP
Electonic Deliverables	☑ Data Checker ☐ Excel ☐ Other (Please Specify →)
Company Name	Tighe + Bond
Project #	S-1758-020
Project Name	Gallows Hill Park, Salem
Contact Person	Todd Kirton
Address	446 Main St
City	Worcester
State	MA
Zip Code	01608
PO #	
Telephone Number	
FAX Number	
Email Address	TDKirton@Tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Arsenic
1	3/13/19	1200	G	S	B-53 (0-1)	X
2	↓	1210	↓	↓	B-51 (0-1)	X
3	↓	1220	↓	↓	B-52 (0-1)	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial
Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers per Sample:

Laboratory Use Only
Cooler Present: ✓
Seals Intact: ⊘ Drop Off ☒ Pickup
Cooler Temperature: 0.2 °C

Sampled by: JM

Comments: Please specify "Other" preservative and containers types in this space
Use Gallows Hill Park Pricing

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/14/19 900	3/14/19 12:37	3/14/19 17:09	3/14/19 1750
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1903344

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 4:46 pm, Mar 21, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

SAMPLE RECEIPT

The following samples were received on March 14, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

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

Lab Number	Sample Name	Matrix	Analysis
1903344-01	B-32 2-4	Soil	6010C
1903344-02	B-33 4-6	Soil	6010C
1903344-03	B-34 2-4	Soil	6010C
1903344-04	B-39 4-6	Soil	6010C
1903344-05	B-40 2-4	Soil	6010C
1903344-06	B-35 6-8	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1903344-01 through 1903344-06**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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" 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 (X) No ( )*
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: Laurel Stoddard
Date: March 21, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-32 2-4
Date Sampled: 02/26/19 09:00
Percent Solids: 84

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**7.85** (1.90)		6010C		1	KJK	03/19/19 15:21	3.13	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-33 4-6
Date Sampled: 02/26/19 10:00
Percent Solids: 84

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**13.1** (1.53)		6010C		1	KJK	03/19/19 15:26	3.9	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-34 2-4
Date Sampled: 02/26/19 10:30
Percent Solids: 84

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**5.40** (2.82)		6010C		1	KJK	03/19/19 15:42	2.12	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-39 4-6
Date Sampled: 02/26/19 11:30
Percent Solids: 54

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**3190** (4.23)		6010C		1	KJK	03/19/19 15:46	2.21	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-40 2-4
Date Sampled: 02/26/19 12:00
Percent Solids: 77

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**669** (2.67)		6010C		1	KJK	03/19/19 15:49	2.43	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-35 6-8
Date Sampled: 02/26/19 12:30
Percent Solids: 85

ESS Laboratory Work Order: 1903344
ESS Laboratory Sample ID: 1903344-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**6.04** (2.04)		6010C		1	KJK	03/19/19 15:55	2.87	100	CC91853

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CC91853 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
LCS										
Arsenic	122	9.43	mg/kg wet	128.0		95	85-114			
LCS Dup										
Arsenic	121	9.43	mg/kg wet	128.0		94	85-114	0.9	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1903344

Notes and Definitions

U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903344

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1903344
Date Received: 3/14/2019
Project Due Date: 3/21/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.2 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	323736	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
02	323735	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
03	323734	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
04	323733	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
05	323732	Yes	NA	Yes	8 oz. Jar - Unpres	NP	
06	323731	Yes	NA	Yes	8 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 3/14/19 1758
Reviewed By: Date & Time: 3/14/19 1814
Delivered By: 3/14/19 1814

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab #	1903344
Reporting Limits	S-1/S-2/G-3
Electonic Deliverables	☑ Data Checker ☑ Excel ☐ Other (Please Specify →) PDF ✓

Turn Time	5	Days
Regulatory State	MA	

Is this project for any of the following?: ○ CT RCP ○ MA MCP ○ RGP

Company Name	Tighe & Bond
Contact Person	Todd Kirton / c.c. Kerri Lewis
Project #	S-1738-020
Project Name	Gallows Hill Park, Salem
Address	446 Main St
City	Worcester
State	MA
Zip Code	01608
PO #	
Telephone Number	
FAX Number	
Email Address	TDKirton@Tighebond.com / c.c. klewis@TB.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Arsenic
1	2/26/19	900	G	S	B-32 (2-4)	X
2	↓	1000	↓	↓	B-33 (4-6)	X
3		1030			B-34 (2-4)	X
4		1130			B-39 (4-6)	X
5		1200			B-40 (2-4)	X
6	↓	1230	↓	↓	B-35 (6-8)	X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Number of Containers per Sample:

Laboratory Use Only

Cooler Present: ✓
Seals Intact:
Cooler Temperature: 0.2 °C

○ Drop Off
● Pickup

Sampled by : KM

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/11/19 1430	3/14/19 12:37	3/14/19 17:09	3/14/19 1750
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1903343

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 4:43 pm, Mar 21, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

SAMPLE RECEIPT

The following samples were received on March 14, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

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

Lab Number	Sample Name	Matrix	Analysis
1903343-01	MW-4	Ground Water	6010C, 6020A, 7196A, 7470A, 9014, EPH8270, EPH8270SIM, MADEP-EPH
1903343-02	MW-3	Ground Water	6010C, 6020A, 7010, 7470A
1903343-03	MW-2	Ground Water	6010C, 6020A, 7470A
1903343-04	MW-1	Ground Water	6010C, 6020A, 7470A

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

PROJECT NARRATIVE

Classical Chemistry

1903343-01 **Estimated value. Sample hold times were exceeded (H).**
Hexavalent Chromium

MADEP-EPH Extractable Petroleum Hydrocarbons

C9C0213-CCV2 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
Hexatriacontane (C36) (32% @ 25%)

C9C0213-CCV3 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
Hexatriacontane (C36) (36% @ 25%)

C9C0213-CCV4 **Continuing Calibration %Diff/Drift is below control limit (CD-).**
Hexatriacontane (C36) (32% @ 25%)

No other observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1903343-01 through 1903343-04**

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

CAM Protocol (check all that apply below):

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

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 ( ) No (X)
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	VPH, EPH, APH and TO-15 only: a. 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" 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" 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: _____ Date: March 21, 2019

Printed Name: Laurel Stoddard Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-4
Date Sampled: 03/13/19 10:10
Percent Solids: N/A

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-01
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 200.7/6010BNoDigest

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (5.0)		6020A		1	BJV	03/15/19 17:50	10	10	CC91523
Barium	**101** (50.0)		6010C		1	KJK	03/15/19 15:09	10	10	CC91523
Cadmium	**1.2** (1.0)		6020A		1	KJK	03/20/19 14:09	10	10	CC91523
Chromium	ND (10.0)		6010C		1	KJK	03/15/19 15:09	10	10	CC91523
Lead	ND (1.0)		6020A		1	BJV	03/15/19 17:50	10	10	CC91523
Mercury	ND (0.20)		7470A		1	MKS	03/18/19 10:30	20	40	CC91537
Selenium	ND (5.0)		6020A		1	BJV	03/15/19 17:50	10	10	CC91523
Silver	ND (5.0)		6010C		1	KJK	03/15/19 15:09	10	10	CC91523

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-4
Date Sampled: 03/13/19 10:10
Percent Solids: N/A

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-01
Sample Matrix: Ground Water

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Hexavalent Chromium	**H** ND (10)		7196A		1	CCP	03/14/19 19:00	ug/L	CC91433
Total Cyanide	ND (5.00)		9014		1	EEM	03/15/19 14:15	ug/L	CC91505

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-4
Date Sampled: 03/13/19 10:10
Percent Solids: N/A
Initial Volume: 1070
Final Volume: 1
Extraction Method: 3510C

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-01
Sample Matrix: Ground Water
Units: ug/L

Prepared: 3/15/19 10:11

MADEP-EPH Extractable Petroleum Hydrocarbons

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
C9-C18 Aliphatics1	ND (93)		MADEP-EPH		1	CAD	03/15/19 23:58	C9C0213	CC91403
C19-C36 Aliphatics1	ND (93)		MADEP-EPH		1	CAD	03/15/19 23:58	C9C0213	CC91403
C11-C22 Unadjusted Aromatics1	ND (93.5)		EPH8270		1	VSC	03/15/19 17:52	C9C0228	CC91403
C11-C22 Aromatics1,2	ND (93.5)		EPH8270			VSC	03/15/19 17:52		[CALC]
2-Methylnaphthalene	ND (0.47)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Acenaphthene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Naphthalene	ND (0.47)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Phenanthrene	ND (0.47)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Acenaphthylene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Anthracene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Benzo(a)anthracene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Benzo(a)pyrene	ND (0.09)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Benzo(b)fluoranthene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Benzo(g,h,i)perylene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Benzo(k)fluoranthene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Chrysene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Dibenzo(a,h)Anthracene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Fluoranthene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Fluorene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Indeno(1,2,3-cd)Pyrene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Pyrene	ND (0.19)		EPH8270SIM		1	VSC	03/15/19 15:04	C9C0240	CC91403
Preservative:	**pH <= 2**		MADEP-EPH			CAD			CC91403

	%Recovery	*Qualifier*	*Limits*
Surrogate: 1-Chlorooctadecane	*65 %*		*40-140*
Surrogate: 2-Bromonaphthalene	*86 %*		*40-140*
Surrogate: 2-Fluorobiphenyl	*83 %*		*40-140*
Surrogate: O-Terphenyl	*83 %*		*40-140*

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-3
Date Sampled: 03/13/19 11:05
Percent Solids: N/A

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-02
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 200.7/6010BNoDigest

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**20.1** (5.0)		7010		1	KJK	03/19/19 18:37	10	10	CC91523
Barium	ND (50.0)		6010C		1	KJK	03/15/19 15:14	10	10	CC91523
Cadmium	ND (1.0)		6020A		1	BJV	03/15/19 17:56	10	10	CC91523
Chromium	ND (10.0)		6010C		1	KJK	03/15/19 15:14	10	10	CC91523
Lead	ND (1.0)		6020A		1	BJV	03/15/19 17:56	10	10	CC91523
Mercury	ND (0.20)		7470A		1	MKS	03/18/19 10:32	20	40	CC91537
Selenium	ND (5.0)		6020A		1	BJV	03/15/19 17:56	10	10	CC91523
Silver	ND (5.0)		6010C		1	KJK	03/15/19 15:14	10	10	CC91523

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-2
Date Sampled: 03/13/19 11:35
Percent Solids: N/A

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-03
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 200.7/6010BNoDigest

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (5.0)		6020A		1	BJV	03/15/19 18:13	10	10	CC91523
Barium	ND (50.0)		6010C		1	KJK	03/15/19 15:31	10	10	CC91523
Cadmium	ND (1.0)		6020A		1	BJV	03/15/19 18:13	10	10	CC91523
Chromium	ND (20.0)		6010C		1	KJK	03/15/19 15:31	10	10	CC91523
Lead	**1.9** (1.0)		6020A		1	BJV	03/15/19 18:13	10	10	CC91523
Mercury	ND (0.20)		7470A		1	MKS	03/18/19 10:34	20	40	CC91537
Selenium	ND (5.0)		6020A		1	BJV	03/15/19 18:13	10	10	CC91523
Silver	ND (5.0)		6010C		1	KJK	03/15/19 15:31	10	10	CC91523

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: MW-1
Date Sampled: 03/13/19 12:05
Percent Solids: N/A

ESS Laboratory Work Order: 1903343
ESS Laboratory Sample ID: 1903343-04
Sample Matrix: Ground Water
Units: ug/L

Extraction Method: 200.7/6010BNoDigest

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (5.0)		6020A		1	BJV	03/15/19 18:19	10	10	CC91523
Barium	ND (50.0)		6010C		1	KJK	03/15/19 15:35	10	10	CC91523
Cadmium	ND (1.0)		6020A		1	BJV	03/15/19 18:19	10	10	CC91523
Chromium	ND (20.0)		6010C		1	KJK	03/15/19 15:35	10	10	CC91523
Lead	ND (1.0)		6020A		1	BJV	03/15/19 18:19	10	10	CC91523
Mercury	ND (0.20)		7470A		1	MKS	03/18/19 10:40	20	40	CC91537
Selenium	ND (5.0)		6020A		1	BJV	03/15/19 18:19	10	10	CC91523
Silver	ND (5.0)		6010C		1	KJK	03/15/19 15:35	10	10	CC91523

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Dissolved Metals										
Batch CC91523 - 200.7/6010BNoDigest										
Blank										
Arsenic	ND	1.0	ug/L							
Arsenic	ND	5.0	ug/L							
Barium	ND	50.0	ug/L							
Cadmium	ND	1.0	ug/L							
Chromium	ND	10.0	ug/L							
Lead	ND	1.0	ug/L							
Selenium	ND	5.0	ug/L							
Silver	ND	5.0	ug/L							
LCS										
Barium	0.5		mg/L	0.5000		99	80-120			
Chromium	0.5		mg/L	0.5000		98	80-120			
Silver	0.2		mg/L	0.2500		98	80-120			
LCS										
Arsenic	20.7		ug/L	20.00		104	80-120			
Cadmium	20.8		ug/L	20.10		104	80-120			
Lead	20.2		ug/L	19.98		101	80-120			
Selenium	20.5		ug/L	19.98		103	80-120			
LCS										
Arsenic	25.7		ug/L	25.00		103	80-120			
Batch CC91537 - 245.1/7470A										
Blank										
Mercury	ND	0.20	ug/L							
LCS										
Mercury	6.17	0.20	ug/L	6.042		102	80-120			
LCS Dup										
Mercury	6.21	0.20	ug/L	6.042		103	80-120	0.7	20	
Classical Chemistry										
Batch CC91433 - General Preparation										
Blank										
Hexavalent Chromium	ND	10	ug/L							
LCS										
Hexavalent Chromium	0.5		mg/L	0.4998		100	90-110			
LCS Dup										
Hexavalent Chromium	0.5		mg/L	0.4998		99	90-110	0.6	20	
Batch CC91505 - TCN Prep										
Blank										
Total Cyanide	ND	5.00	ug/L							
LCS										
Total Cyanide	19.8	5.00	ug/L	20.06		99	90-110			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CC91505 - TCN Prep										
LCS										
Total Cyanide	148	5.00	ug/L	150.4		99	90-110			
LCS Dup										
Total Cyanide	147	5.00	ug/L	150.4		98	90-110	0.6	20	
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC91403 - 3510C										
Blank										
C19-C36 Aliphatics1	ND	100	ug/L							
C9-C18 Aliphatics1	ND	100	ug/L							
Decane (C10)	ND	5	ug/L							
Docosane (C22)	ND	5	ug/L							
Dodecane (C12)	ND	5	ug/L							
Eicosane (C20)	ND	5	ug/L							
Hexacosane (C26)	ND	5	ug/L							
Hexadecane (C16)	ND	5	ug/L							
Hexatriacontane (C36)	ND	5	ug/L							
Nonadecane (C19)	ND	5	ug/L							
Nonane (C9)	ND	5	ug/L							
Octacosane (C28)	ND	5	ug/L							
Octadecane (C18)	ND	5	ug/L							
Tetracosane (C24)	ND	5	ug/L							
Tetradecane (C14)	ND	5	ug/L							
Triacontane (C30)	ND	5	ug/L							
Surrogate: 1-Chlorooctadecane	*40.8*		ug/L	*50.00*		*82*	*40-140*			
Blank										
C11-C22 Unadjusted Aromatics1	ND	100	ug/L							
Surrogate: 2-Bromonaphthalene	*44.4*		mg/L	*50.00*		*89*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*43.9*		mg/L	*50.00*		*88*	*40-140*			
Surrogate: O-Terphenyl	*44.5*		ug/L	*50.00*		*89*	*40-140*			
Blank										
2-Methylnaphthalene	ND	0.50	ug/L							
Acenaphthene	ND	0.20	ug/L							
Acenaphthylene	ND	0.20	ug/L							
Anthracene	ND	0.20	ug/L							
Benzo(a)anthracene	ND	0.20	ug/L							
Benzo(a)pyrene	ND	0.10	ug/L							
Benzo(b)fluoranthene	ND	0.20	ug/L							
Benzo(g,h,i)perylene	ND	0.20	ug/L							
Benzo(k)fluoranthene	ND	0.20	ug/L							
Chrysene	ND	0.20	ug/L							
Dibenzo(a,h)Anthracene	ND	0.20	ug/L							
Fluoranthene	ND	0.20	ug/L							

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC91403 - 3510C										
Fluorene	ND	0.20	ug/L							
Indeno(1,2,3-cd)Pyrene	ND	0.20	ug/L							
Naphthalene	ND	0.50	ug/L							
Phenanthrene	ND	0.50	ug/L							
Pyrene	ND	0.20	ug/L							
LCS										
C19-C36 Aliphatics1	361	100	ug/L	400.0		90	40-140			
C9-C18 Aliphatics1	205	100	ug/L	300.0		68	40-140			
Decane (C10)	24	5	ug/L	50.00		48	40-140			
Docosane (C22)	43	5	ug/L	50.00		86	40-140			
Dodecane (C12)	29	5	ug/L	50.00		58	40-140			
Eicosane (C20)	42	5	ug/L	50.00		85	40-140			
Hexacosane (C26)	43	5	ug/L	50.00		86	40-140			
Hexadecane (C16)	41	5	ug/L	50.00		82	40-140			
Hexatriacontane (C36)	51	5	ug/L	50.00		103	40-140			
Nonadecane (C19)	42	5	ug/L	50.00		85	40-140			
Nonane (C9)	18	5	ug/L	50.00		36	30-140			
Octacosane (C28)	43	5	ug/L	50.00		85	40-140			
Octadecane (C18)	42	5	ug/L	50.00		83	40-140			
Tetracosane (C24)	43	5	ug/L	50.00		86	40-140			
Tetradecane (C14)	36	5	ug/L	50.00		72	40-140			
Triacontane (C30)	43	5	ug/L	50.00		86	40-140			
Surrogate: 1-Chlorooctadecane	*38.6*		ug/L	*50.00*		*77*	*40-140*			
LCS										
C11-C22 Unadjusted Aromatics1	821	100	ug/L	850.0		97	40-140			
Surrogate: 2-Bromonaphthalene	*47.1*		mg/L	*50.00*		*94*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*45.3*		mg/L	*50.00*		*91*	*40-140*			
Surrogate: O-Terphenyl	*43.8*		ug/L	*50.00*		*88*	*40-140*			
LCS										
2-Methylnaphthalene Breakthrough	0.0		%				0-5			
Naphthalene Breakthrough	0.0		%				0-5			
LCS										
2-Methylnaphthalene	3.69	0.50	ug/L	5.000		74	40-140			
Acenaphthene	4.65	0.20	ug/L	5.000		93	40-140			
Acenaphthylene	4.83	0.20	ug/L	5.000		97	40-140			
Anthracene	4.61	0.20	ug/L	5.000		92	40-140			
Benzo(a)anthracene	4.56	0.20	ug/L	5.000		91	40-140			
Benzo(a)pyrene	4.46	0.10	ug/L	5.000		89	40-140			
Benzo(b)fluoranthene	4.33	0.20	ug/L	5.000		87	40-140			
Benzo(g,h,i)perylene	4.11	0.20	ug/L	5.000		82	40-140			
Benzo(k)fluoranthene	5.06	0.20	ug/L	5.000		101	40-140			
Chrysene	5.17	0.20	ug/L	5.000		103	40-140			
Dibenzo(a,h)Anthracene	4.67	0.20	ug/L	5.000		93	40-140			
Fluoranthene	4.65	0.20	ug/L	5.000		93	40-140			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC91403 - 3510C										
Fluorene	4.66	0.20	ug/L	5.000		93	40-140			
Indeno(1,2,3-cd)Pyrene	4.36	0.20	ug/L	5.000		87	40-140			
Naphthalene	3.51	0.50	ug/L	5.000		70	40-140			
Phenanthrene	4.12	0.50	ug/L	5.000		82	40-140			
Pyrene	5.01	0.20	ug/L	5.000		100	40-140			
LCS Dup										
C19-C36 Aliphatics1	370	100	ug/L	400.0		93	40-140	2	25	
C9-C18 Aliphatics1	207	100	ug/L	300.0		69	40-140	1	25	
Decane (C10)	23	5	ug/L	50.00		47	40-140	2	25	
Docosane (C22)	44	5	ug/L	50.00		89	40-140	3	25	
Dodecane (C12)	29	5	ug/L	50.00		58	40-140	0.6	25	
Eicosane (C20)	44	5	ug/L	50.00		87	40-140	3	25	
Hexacosane (C26)	44	5	ug/L	50.00		88	40-140	3	25	
Hexadecane (C16)	42	5	ug/L	50.00		85	40-140	3	25	
Hexatriacontane (C36)	53	5	ug/L	50.00		105	40-140	3	25	
Nonadecane (C19)	44	5	ug/L	50.00		87	40-140	3	25	
Nonane (C9)	18	5	ug/L	50.00		35	30-140	3	25	
Octacosane (C28)	44	5	ug/L	50.00		88	40-140	3	25	
Octadecane (C18)	43	5	ug/L	50.00		86	40-140	3	25	
Tetracosane (C24)	44	5	ug/L	50.00		89	40-140	3	25	
Tetradecane (C14)	37	5	ug/L	50.00		74	40-140	3	25	
Triacontane (C30)	44	5	ug/L	50.00		88	40-140	3	25	
Surrogate: 1-Chlorooctadecane	*40.3*		ug/L	*50.00*		*81*	*40-140*			
LCS Dup										
C11-C22 Unadjusted Aromatics1	857	100	ug/L	850.0		101	40-140	4	25	
Surrogate: 2-Bromonaphthalene	*45.8*		mg/L	*50.00*		*92*	*40-140*			
Surrogate: 2-Fluorobiphenyl	*44.5*		mg/L	*50.00*		*89*	*40-140*			
Surrogate: O-Terphenyl	*45.4*		ug/L	*50.00*		*91*	*40-140*			
LCS Dup										
2-Methylnaphthalene Breakthrough	0.0		%				0-5		200	
Naphthalene Breakthrough	0.0		%				0-5		200	
LCS Dup										
2-Methylnaphthalene	3.37	0.50	ug/L	5.000		67	40-140	9	20	
Acenaphthene	4.21	0.20	ug/L	5.000		84	40-140	10	20	
Acenaphthylene	4.48	0.20	ug/L	5.000		90	40-140	7	20	
Anthracene	4.29	0.20	ug/L	5.000		86	40-140	7	20	
Benzo(a)anthracene	4.25	0.20	ug/L	5.000		85	40-140	7	20	
Benzo(a)pyrene	4.34	0.10	ug/L	5.000		87	40-140	3	20	
Benzo(b)fluoranthene	4.24	0.20	ug/L	5.000		85	40-140	2	20	
Benzo(g,h,i)perylene	4.01	0.20	ug/L	5.000		80	40-140	3	20	
Benzo(k)fluoranthene	4.94	0.20	ug/L	5.000		99	40-140	2	20	
Chrysene	4.80	0.20	ug/L	5.000		96	40-140	8	20	
Dibenzo(a,h)Anthracene	4.51	0.20	ug/L	5.000		90	40-140	3	20	
Fluoranthene	4.37	0.20	ug/L	5.000		87	40-140	6	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
MADEP-EPH Extractable Petroleum Hydrocarbons										
Batch CC91403 - 3510C										
Fluorene	4.37	0.20	ug/L	5.000		87	40-140	7	20	
Indeno(1,2,3-cd)Pyrene	4.16	0.20	ug/L	5.000		83	40-140	5	20	
Naphthalene	3.34	0.50	ug/L	5.000		67	40-140	5	20	
Phenanthrene	3.82	0.50	ug/L	5.000		76	40-140	8	20	
Pyrene	4.64	0.20	ug/L	5.000		93	40-140	8	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1903343

Notes and Definitions

Z-06	pH <= 2
U	Analyte included in the analysis, but not detected
H	Estimated value. Sample hold times were exceeded (H).
CD-	Continuing Calibration %Diff/Drift is below control limit (CD-).
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1903343

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1903343
Date Received: 3/14/2019
Project Due Date: 3/21/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.2 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No
    HEX Cr

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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	323476	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	
01	323477	Yes	NA	Yes	1L Amber - HCl	HCl	
01	323478	Yes	NA	Yes	1L Amber - HCl	HCl	
01	323479	Yes	NA	Yes	250 mL Poly - NaOH	NaOH	pH>12
01	323480	Yes	NA	Yes	250 mL Poly - Unpres	NP	
02	323475	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	
03	323474	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	
04	323473	Yes	NA	Yes	250 mL Poly - HNO3	HNO3	

2nd Review
All containers scanned into storage/lab
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Initials:

Completed By: Date & Time: 3/14/19 1747
Reviewed By: Date & Time: 3/14/19 1757
Delivered By: 3/14/19 1757

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab #	1903343
Turn Time	5 Days
Regulatory State	MA
Reporting Limits	RCGW-1 / GW-1 / GW-2 / GW-3 / RCS-2
Is this project for any of the following?:	○ CT RCP ☑ MA MCP ○ RGP
Electonic Deliverables	☑ Data Checker ☑ Excel ☐ Other (Please Specify →)

Company Name: Tighe + Bond	Project #: S-1759-020	Project Name: Gallows Hill Park, Salem	
Contact Person: Todd Kirton	Address: 446 Main Street		
City: Worcester	State: MA	Zip Code: 01608	PO #:
Telephone Number:	FAX Number:	Email Address: TDKirton@Tighebond.com	

Analysis: Dissolved RCRA metals; EPH; total cyanide; Hex Cr

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Dissolved RCRA metals	EPH	total cyanide	Hex Cr
1	3/13/19	1010	G	GW	MW-4	X	X	X	X
2	↓	1105	↓	↓	MW-3	X			
3		1135			MW-2	X			
4		1205			MW-1	X			

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial
Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers per Sample:

Laboratory Use Only
Cooler Present: ✓ ○ Drop Off
Seals Intact: ○ Pickup
Cooler Temperature: 0.2 Ice

Sampled by: KW

Comments: Please specify "Other" preservative and containers types in this space
Please use Gallows Hill Park Pricing
Metals samples were filtered in the field

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/14/19 900	3/14/19 12:37	3/14/19 17:09	3/14/19 1730
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1904368

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 1:07 pm, Apr 18, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904368

SAMPLE RECEIPT

The following samples were received on April 11, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

The client did not deliver the samples in a cooler.

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

Lab Number	Sample Name	Matrix	Analysis
1904368-01	B-101 2-3	Soil	6010C
1904368-02	B-102 0-2	Soil	6010C
1904368-03	B-103 0-2	Soil	6010C
1904368-04	B-104 0-5.2	Soil	6010C
1904368-05	B-105 0.5-2	Soil	6010C
1904368-06	B-106 0-2	Soil	6010C
1904368-07	B-107 0-2	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904368

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904368

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904368

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1904368-01 through 1904368-07**

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

CAM Protocol (check all that apply below):

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

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 ( ) No (X)
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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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" 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 (X) No ( )*
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: Laurel Stoddard
Date: April 18, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-101 2-3
Date Sampled: 04/11/19 10:45
Percent Solids: 77

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**4.84** (2.66)		6010C		1	KJK	04/13/19 1:51	2.45	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-102 0-2
Date Sampled: 04/11/19 11:00
Percent Solids: 81

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**7.93** (3.00)		6010C		1	KJK	04/13/19 1:55	2.05	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-103 0-2
Date Sampled: 04/11/19 11:30
Percent Solids: 72

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-03
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.31** (3.17)		6010C		1	KJK	04/13/19 1:59	2.2	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-104 0-5.2
Date Sampled: 04/11/19 11:40
Percent Solids: 81

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-04
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.13** (2.84)		6010C		1	KJK	04/16/19 13:16	2.17	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-105 0.5-2
Date Sampled: 04/11/19 11:45
Percent Solids: 79

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-05
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**13.7** (2.85)		6010C		1	KJK	04/16/19 13:20	2.22	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-106 0-2
Date Sampled: 04/11/19 12:00
Percent Solids: 76

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-06
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**29.5** (2.84)		6010C		1	KJK	04/16/19 13:24	2.31	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-107 0-2
Date Sampled: 04/11/19 12:30
Percent Solids: 78

ESS Laboratory Work Order: 1904368
ESS Laboratory Sample ID: 1904368-07
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.58** (2.69)		6010C		1	KJK	04/16/19 13:28	2.39	100	CD91238

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1904368

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CD91238 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
LCS										
Arsenic	130	9.26	mg/kg wet	128.0		101	85-114			
LCS Dup										
Arsenic	136	9.26	mg/kg wet	128.0		106	85-114	5	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1904368

Notes and Definitions

U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904368

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ~~ESS Courier~~ Client

ESS Project ID: 1904368
Date Received: 4/11/2019
Project Due Date: 4/18/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? No
   Temp: 22.3 Iced with: None
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	333465	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	333464	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
03	333463	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
04	333462	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
05	333461	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
06	333460	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
07	333459	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 4/11/19 14:11
Reviewed By: Date & Time: 4/11/19 1442
Delivered By: 4/11/19 1442

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 _____
If faster than 5 days, prior approval by laboratory is required # _____

State where samples were collected from:
(MA) RI CT NH NJ NY ME Other _____

Is this project for any of the following:
(MA-MCP) Navy USACE Other _____

Reporting Limits: RCS-1/S-1/S-2/S-3

ESS LAB PROJECT ID: 1904368

Electronic Deliverable Yes ✓ No ____

Format: Excel ✓ Access ____ PDF ✓ Other _____

Co. Name	Project #	Project Name (20 Char. or less)
Tighe + Bond	S-1754-020	Gallows Hill Park, Salem

Contact Person	Address
Todd Kirton	446 Main St

City	State	Zip	PO#
Worcester	MA	01608	

Telephone #	Fax #	Email Address
		TDKirton@Tighebond.com

Circle and/or Write Required Analysis

ESS LAB Sample #	Date	Collection Time	COMP	GRAB	MATRIX	Sample Identification (20 Char. or less)	Pres Code	Number of Containers	Type of Containers	8260 VOA / 624 / 524.2	8021 MTBE/BTEX / 8015 GRO / VPH w/targets	8100 TPH / 8015 DRO	EPH w/o PAHs / EPH w/PAHs / EPH 4 Diesel	8081 Pesticides / 8082 PCB / 608 Pesticides / 608 PCB	8270 SVOA / 625 / PAH 8270	RCRA5 / RCRA8 / PP13 / TAL23	TCLP-RCRA8 / NBC7	MCP-METALS (13) / MCP-METALS (13) w/Hg	Arsenic				
1	4/11/19	1045		X	S	B-101 (2-7)													X				
2	↓	1100		X	↓	B-102 (0-2)													X				
3		1130		X		B-103 (0-2)													X				
4		1140		X		B-104 (0.5-2)													X				
5		1145		X		B-105 (0.5-2)													X				
6		1200		X		B-106 (0-2)													X				
7	↓	1230		X		B-107 (0-2)													X				

Container Type: P-Poly G-Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ____ Yes ✓ No

Seals Intact ____ Yes ____ No NA: ____

Cooler Temp: 10 I 22.3

Internal Use Only
[ ] Pickup
[ ] Technicians _____

Preservation Code 1- NP, 2- HCl, 3- H_2SO_4, 4- HNO_3, 5- NaOH, 6- MeOH, 7- Asorbic Acid, 8- ZnAct, 9- _____

Sampled by: KC

Comments:

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	4/11/19 1330		4/11/19 13:16				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

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

Please fax all changes to Chain of Custody in writing.

1 (White) Lab Copy 2 (Yellow) Client Receipt

10/26/04 A

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1904825

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.

REVIEWED
By ESS Laboratory at 12:42 pm, Apr 30, 2019

Laurel Stoddard
Laboratory Director

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

SAMPLE RECEIPT

The following samples were received on April 26, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

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

Lab Number	Sample Name	Matrix	Analysis
1904825-01	B-102 2-3ft	Soil	6010C
1904825-02	B-107 2-2.5ft	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1904825-01 through 1904825-02**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard
Date: April 30, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-102 2-3ft
Date Sampled: 04/11/19 11:15
Percent Solids: 82

ESS Laboratory Work Order: 1904825
ESS Laboratory Sample ID: 1904825-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**7.40** (5.03)		6010C		2	BJV	04/29/19 18:21	2.42	100	CD92649

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-107 2-2.5ft
Date Sampled: 04/11/19 12:45
Percent Solids: 80

ESS Laboratory Work Order: 1904825
ESS Laboratory Sample ID: 1904825-02
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**8.36** (5.38)		6010C		2	BJV	04/29/19 18:24	2.32	100	CD92649

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Total Metals										
Batch CD92649 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
LCS										
Arsenic	121	9.62	mg/kg wet	128.0		95	85-114			
LCS Dup										
Arsenic	124	8.93	mg/kg wet	128.0		97	85-114	2	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1904825

Notes and Definitions

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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904825

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1904825
Date Received: 4/26/2019
Project Due Date: 4/30/2019
Days for Project: 2 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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	338606	Yes	NA	Yes	4 oz. Jar - Unpres	NP	
02	338605	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review

Were all containers scanned into storage/lab? Initials: [illegible]
Are barcode labels on correct containers? Yes / No
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: [signature] Date & Time: 4/26/19 1853
Reviewed By: [signature] Date & Time: 4/26/19 1942
Delivered By: [signature] 4/26/19 1942

ESS Laboratory

Division of Thielsch Engineering, Inc.
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Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: **Rush:** 48 hr
Regulatory State: MA
Is this project for any of the following?:
☒ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1904825
Reporting Limits S-1 / S-2 / S-3
Electonic Deliverables ☒ Limit Checker ☒ Excel ☐ Other (Please Specifiy) → PDF

Company Name	Tighe + Bond
Project #	S-1759-020
Project Name	Gallows Hill Park, Salem
Contact Person	Todd Kirton
Address	446 Main St
City	Worcester
State	MA
Zip Code	01608
PO #	
Telephone Number	
FAX Number	
Email Address	TDKirton@Tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Arsenic
1	4/11/19	11:15	G	S	B-102 (2-3')	X
2	↓	12:45	G	S	B-107 (2-2.5')	X

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag | ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: 2

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 0.8 Ice °C

Sampled by : MU
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
4/26/19 1130	4/26/19 13:15	4/26/19 18:26	4/26/19 1841
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Todd Kirton
Tighe & Bond
446 Main Street #23
Worcester, MA 01608

RE: Gallows Hill Park Salem (S-1758-020)
ESS Laboratory Work Order Number: 1904648

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 8:39 am, Apr 25, 2019

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 TNI and relative state standards, 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

SAMPLE RECEIPT

The following samples were received on April 19, 2019 for the analyses specified on the enclosed Chain of Custody Record.

To achieve CAM compliance for MCP data, ESS Laboratory has 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 performed and 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 Limit Checker (regulatory standard comparison spreadsheet) electronic deliverable which will highlight these exceedances.

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

Lab Number	Sample Name	Matrix	Analysis
1904648-01	B-106 2-2.5	Soil	6010C

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

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
8015C - 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
MADEP 18-2.1 - 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
5035A - 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: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

MassDEP Analytical Protocol Certification Form

MADEP RTN: _____

This form provides certification for the following data set: **1904648-01**

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

CAM Protocol (check all that apply below):

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

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 (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	VPH, EPH, APH and TO-15 only: a. Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	Yes ( ) 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" 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 (X) No ( )*
H	Were **all** QC performance standards specified in the CAM protocol(s) achieved?	Yes (X) No ( )*
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: Laurel Stoddard
Date: April 25, 2019
Printed Name: Laurel Stoddard
Position: Laboratory Director

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
Client Sample ID: B-106 2-2.5
Date Sampled: 04/11/19 12:15
Percent Solids: 81

ESS Laboratory Work Order: 1904648
ESS Laboratory Sample ID: 1904648-01
Sample Matrix: Soil
Units: mg/kg dry

Extraction Method: 3050B

Total Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**31.4** (2.79)		6010C		1	KJK	04/24/19 17:06	2.2	100	CD92267

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
				Total Metals						
Batch CD92267 - 3050B										
Blank										
Arsenic	ND	2.50	mg/kg wet							
LCS										
Arsenic	122	9.09	mg/kg wet	128.0		95	85-114			
LCS Dup										
Arsenic	125	9.26	mg/kg wet	128.0		98	85-114	3	20	

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem
ESS Laboratory Work Order: 1904648

Notes and Definitions

U	Analyte included in the analysis, but not detected
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
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Gallows Hill Park Salem

ESS Laboratory Work Order: 1904648

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/dwp/partners/labCert.shtml

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.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: Tighe & Bond - KPB/TB/MM

Shipped/Delivered Via: ESS Courier

ESS Project ID: 1904648
Date Received: 4/19/2019
Project Due Date: 4/26/2019
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 0.8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
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 upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. 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 608.3 Pesticides)
01	336443	Yes	NA	Yes	4 oz. Jar - Unpres	NP	

2nd Review
All containers scanned into storage/lab Initials:
Are barcode labels on correct containers? Yes / No
Are all necessary stickers attached? Yes / No

Completed By: Date & Time: 4/19/19 1654
Reviewed By: Date & Time: 4/19/19 1703
Delivered By: 4/19/19 1703

ESS Laboratory

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185 Frances Avenue, Cranston RI 02910
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www.esslaboratory.com

CHAIN OF CUSTODY 3-DAY

Turn Time: ~~Standard~~ Rush:
Regulatory State: MA
Is this project for any of the following?:
☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1904648
Reporting Limits RCS-1 / RCS-2
Electonic Deliverables ☐ Limit Checker ☑ Excel ☑ Other (Please Specifiy) → PDF

Company Name	Project #	Project Name
Tighe & Bond	S-1758.020	Gallows Hill Park, Salem

Contact Person	Address
Todd Kirton, Kerri Lewis	446 Main Street

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
(508) 340-1607	klewis@tighebond.com	TDkirton@tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Arsenic
1	4/11/19	12:15	Composite	Soil	B-106 (2-2.5)	✓

Container Type: AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other — ag ag
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*
Number of Containers: 1

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 0.8 °C Ice

Sampled by: KCL
Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
4/19/19 16:05	4/19/19 14:05	4/19/19 15:35	4/19/19 1652
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

TAT updated 4/23/19 - PRB

ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY

Turn Time: Standard **Rush:**
Regulatory State: MA
Is this project for any of the following?:
☑ MA-MCP ☐ CT-RCP ☐ RGP ☐ Remediation

ESS Lab # 1904648
Reporting Limits RCS-1 / RCS-2
Electonic Deliverables ☐ Limit Checker ☑ Excel ☑ Other (Please Specifiy) → PDF

Company Name	Project #	Project Name
Tighe & Bond	S-1758.020	Gallows Hill Park, Salem

Contact Person	Address
Todd Kirton, Kerri Lewis	446 Main Street

City	State	Zip Code	PO #
Worcester	MA	01608	

Telephone Number	FAX Number	Email Address
(508) 340-1607	klewis@tighebond.com	TDkirton@tighebond.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: Arsenic													
1	4/11/19	12:15	Composite	Soil	B-106 (2-2.5)	✓													
Container Type:			AG-Amber Glass B-BOD Bottle G-Glass P-Poly S-Sterile V-Vial O-Other			ag	ag												
Preservation Code:			1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*																
					Number of Containers:	1													

Laboratory Use Only
Cooler Present: ✓
Seals Intact:
Cooler Temperature: 0.8 °C

Sampled by: KCL
Comments: **Please specify "Other" preservative and containers types in this space**

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
4/19/19 16:05	4/19/19 14:05	4/19/19 15:35	4/19/19 1652
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

Tighe&Bond

APPENDIX H

NOTICE OF TIER CLASSIFICATION
50 PROCOTR STREET
SALEM, MASSACHUSETTS
RTN 3-35355

A release of oil and/or hazardous materials has occurred at this location, which is a disposal site as defined by M.G.L. c. 21E, § 2 and the Massachusetts Contingency Plan, 310 CMR 40.0000. The site has been classified as **TIER I** pursuant to 310 CMR 40.0500. **On September 9, 2019**, the City of Salem filed a **TIER I** Classification Submittal with the Department of Environmental Protection (MassDEP). To obtain more information on this disposal site, please contact **Todd Kirton, LSP of Tighe & Bond, at 413-572-3222.** The Tier Submittal and the disposal site file can be viewed at MassDEP website using Release Tracking Number (RTN) **3-35355** at https://eeaonline.eea.state.ma.us/portal#!/search/wastesite
or at **MassDEP, Northeast Region, 205 Lowell Street, Wilmington, Massachusetts, 978-694-3200**. Additional public involvement opportunities are available under 310 CMR 40.1403(9) and 310 CMR 40.1404.

Tighe&Bond
Engineers | Environmental Specialists

S-1758-020
September 9, 2019

Mayor Kimberly Driscoll
Salem City Hall
93 Washington Street
Salem, MA 01970

Re: Tier Classification
Gallows Hill Park (Portion of)
50 Proctor Street, Salem, MA
RTN 3-35355

Dear Mayor Driscoll:

In accordance with the Public Notification Procedures of the Massachusetts Contingency Plan (MCP 310 CMR 40.1403(3)(f)), we are hereby notifying you of the submittal to Massachusetts Department of Environmental Protection (MassDEP) of a Phase I - Tier Classification report for the above-referenced disposal site.

As you are aware, elevated levels of arsenic were detected in shallow soils in a grass covered area near a playground on the eastern portion of the park during due diligence investigations that were being completed at the site in late 2018 in preparation for future park renovation work. In accordance with MCP, this is a condition that could pose an Imminent Hazard (IH) to human health.

On December 19, 2018, the Massachusetts Department of Environmental Protection (MassDEP) issued Release Tracking Number (RTN) 3-35355 to the site release, and the City has subsequently closed the affected portion of the park to the general public until further notice. Under an Immediate Response Action (IRA) Plan, a six-foot high chain link construction fence was installed around the area of potential concern (with warning signs posted), and that fence system is being monitored and maintained by the City under the on-going IRA. The fence serves a "temporary measure" to restrict access for the general public to this portion of the park.

Based on investigations completed to date, the delineation of site contamination on the subject parcel at 50 Proctor Street have been completed. However, further site evaluation is warranted within a drainage swale to the rear of a neighboring resident at 37 Proctor Street (i.e., east of the park across Proctor Street) which may be impacted by former tannery operations at the subject site. This additional "off-site" assessment is being coordinated with MassDEP. In the interim, a Phase I Initial Site Investigation has been completed, and the release is classified as a Tier I site due to the IH condition.

The Tier Submittal and the disposal site file can be viewed at MassDEP website using RTN 3-35355 at https://eeaonline.eea.state.ma.us/portal#!/search/wastesite and entering the above referenced RTN. A copy of the report is also available at the Salem Department of Planning and Community Development. For more information about file reviews, please call MassDEP at 978-694-3200.

Very truly yours,

TIGHE & BOND, INC.

Todd D. Kirton, LSP
Senior Hydrogeologist

cc: Salem Health Department
MassDEP – Northeast Regional Office
Salem Department of Planning and Community Development.