PHASE II REMEDIAL INVESTIGATION WORK PLAN

MILLS GAP ROAD SITE
SKYLAND, NORTH CAROLINA
NCD NUMBER 003149556

Prepared for:

CTS CORPORATION
905 WEST BOULEVARD NORTH
ELKHART, INDIANA 46514

Prepared by:

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APRIL 1, 2010

MACTEC PROJECT 6686-08-1744

MACTEC
engineering and constructing a better tomorrow

April 1, 2010

Ms. Bonnie Ware
North Carolina Department of Environment and Natural Resources
DWM, Superfund Section, Inactive Hazardous Sites Branch
585 Waughtown Street
Winston-Salem, North Carolina 27107

Subject: **Phase II Remedial Investigation Work Plan**
Mills Gap Road Site
Skyland, North Carolina
NCD Number 003149556
MACTEC Project 6686-08-1744

Dear Ms. Ware:

On behalf of CTS Corporation (CTS), MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to provide this Phase II Remedial Investigation Work Plan (Work Plan) for the above-referenced Site. This Plan has been prepared in general accordance with the requirements outlined in letters dated January 6, 2010, and March 1, 2010, from the North Carolina Department of Environment and Natural Resources (NCDENR) Inactive Hazardous Sites Branch (IHSB) to CTS, and the IHSB *Guidelines for Assessment and Cleanup*, dated October 2009.

If you have questions regarding this Work Plan, please contact us at (828) 252-8130.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

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1.0 INTRODUCTION

MACTEC Engineering and Consulting, Inc. (MACTEC) has prepared this Phase II Remedial Investigation Work Plan (Work Plan) for the Mills Gap Road Site (Site) in Skyland, North Carolina, on behalf of CTS Corporation (CTS). This Work Plan addresses requirements presented in letters dated January 6 and March 1, 2010, from the North Carolina Department of Environment and Natural Resources (NCDENR) Inactive Hazardous Sites Branch (IHSB) to CTS, and the IHSB *Guidelines for Assessment and Cleanup*, dated October 2009 (*Guidelines*). Additional information regarding the content of this Work Plan was discussed with the IHSB on March 12 and 15, 2010.

A Conceptual Site Model (CSM), based on available data associated with the Site, is presented in Section 2.0. The CSM presents the current status/understanding of Site conditions relative to potential source areas and contaminant fate and transport. The objective of the Phase II Remedial Investigation (RI) is to collect sufficient data to delineate the extent of contamination associated with former Site operations; therefore, the CSM also identifies data gaps with respect to the extent of contamination. As data is collected, the CSM will be updated and hypotheses presented in the CSM will be evaluated and confirmed, modified, or rejected. The updated CSM will be used to guide the collection of additional data until the extent of contamination has been adequately defined.

As presented to IHSB personnel, the first task of the Phase II RI will be to further investigate three potential source areas associated with former Site operations. Based on the results of the additional source area assessment, and in consideration of the results of the Phase I RI, a list of Site-specific contaminants of concern (COCs) will be developed, in accordance with Section 2.3 of the *Guidelines*. Subsequent Site assessment activities will include analysis of environmental media for the Site-specific COCs. Following the additional source area assessment, non-aqueous phase liquid (NAPL) assessment will commence to determine the distribution of NAPL contamination. Additionally, the downgradient extent of the dissolved phase contaminant plume in the overburden will be determined by iteratively installing monitoring wells until groundwater samples collected from the monitoring wells indicate the plume has been delineated. Following the NAPL assessment and delineation of the dissolved plume in overburden, bedrock wells will be installed. The locations of the bedrock wells will be based on available Site data and will be proposed to IHSB prior to installation. The bedrock wells will be installed using iterative testing procedures to determine the vertical extent of contamination.

2.0 CONCEPTUAL SITE MODEL

The following Conceptual Site Model represents a compilation and evaluation of Site data with respect to adequately determining the extent of contamination resulting from former Site operations. This CSM is intended to function as a "living document" that will be updated as new data becomes available.

2.1 SITE DESCRIPTION

The Site is considered the approximate 8.7-acre property containing a former manufacturing facility on Mills Gap Road in Skyland, Buncombe County, North Carolina (Buncombe County tax parcel 965515623668). However, it is understood that the Site also includes adjacent land containing soil or groundwater that has become adversely impacted by processes/operations conducted at the former manufacturing facility.

The approximate center of the Site is located at north latitude 35°29'36" and west longitude 82°30'25". An approximate 95,000-square foot, single-story brick and metal structure is located in the southern portion of the Site. The northeastern portion of the Site contains an asphalt-paved parking area and asphalt-paved driveways are located parallel to the north (front) of the building and southeast (rear) of the building. A six-foot high chain-link fence surrounds the Site and a locked gate at the north end of the Site controls access to the Site from Mills Gap Road. The Site is unoccupied.

2.2 SITE HISTORY SUMMARY

International Resistance Company owned and operated a manufacturing facility at the Site from 1952 until 1959, when CTS of Asheville, Inc. purchased the real property, building, and equipment. CTS of Asheville, Inc. manufactured electronic components at the facility from 1959 until April 1986. Arden Electroplating, Inc. leased a portion of the building from approximately December 1, 1985 until November 30, 1986, and the Site was conveyed to Mills Gap Road Associates (MGRA) on December 23, 1987. MGRA reportedly leased portions of the facility to various tenants, and otherwise utilized the building for business interests. The Site has been vacant/unoccupied since the mid-1990s.

Electronic components utilized in automotive parts and hearing aids were manufactured at the Site until plant operations ceased in April 1986. Components were electroplated with tin, nickel, zinc, and silver (MACTEC, 2004). Wastes generated from the electroplating process included sludge containing heavy metals and solvents (waste code F006). Solvents, including trichloroethylene (a.k.a. trichloroethene or TCE) and acetone were used in the process to clean and/or degrease metal objects prior to electroplating and the spent solvents were disposed of accordingly (waste code F003 for non-halogenated solvents and F001 for halogenated solvents). Disposal/recycling activities at the site prior to 1959 are unknown. From 1959 to 1986, solvents and metals were reportedly reclaimed whenever possible. Between 1959 and 1980, metal-bearing wastes that could not be reclaimed from the electroplating process were reportedly disposed of through the city sewer system, while solvent wastes were placed in drums for off-site disposal/recycling. After 1980, all wastes were accumulated in drums on-site prior to off-site disposal or recycling. The facility reportedly produced approximately 44,440 pounds of sludge and 8,307 pounds of waste solvent on an annual basis (Tetra Tech EM Inc., 2000).

In accordance with the requirements of the Resource Conservation and Recovery Act of 1976, the Mills Gap Road Site registered as a generator of hazardous waste in 1980. One of the generator requirements of 40 CFR Part 262 was that the facility develop and implement a Contingency Plan. In 1981, the facility constructed a diked containment area, or contingency basin, northwest of the facility's loading dock to prevent a potential spill from migrating to surface water flowing west of the Site. The former contingency basin was also connected to a drain pipe that originated in the area south of the former wastewater treatment building.

2.3 ENVIRONMENTAL SETTING

The area surrounding the Site is considered rural and contains residential and light commercial properties. The Site is situated on a topographic "saddle" between two prominent mountains, Busbee Mountain to the north and Brown Mountain to the south and southwest. Properties northwest and southeast are topographically downgradient of the Site. The majority of the Site is relatively flat and natural surface drainage at the Site is to the northwest. The surrounding area contains mountains and rolling hills, typical of the eastern flank of the Appalachian Mountain range.

2.3.1 Regional Geology and Hydrogeology

The Site is located in the Blue Ridge Physiographic Province, which is characterized by mountainous terrain, relatively high precipitation and a dense network of perennial streams. The Site is underlain by metasedimentary and metavolcanic rocks of the Ashe Metamorphic Suite (NCGS, 2008). Metasedimentary rocks in the Ashe Metamorphic Suite are metamorphosed clastic sediments, such as deepwater sandstone and shale, and are generally described in the area of the Site as schistose metagraywacke, mica schist, and metagraywacke. Amphibolite, formed by the metamorphism of subaqueous volcanic intrusions, is present in isolated deposits in the metasedimentary assemblages.

The bedrock is generally overlain by a mantle of unconsolidated residual soil (overburden) formed by the in-place weathering of bedrock. The typical residual soil profile in areas not disturbed by erosion or human activities consists of silty or clayey soils near the surface where weathering is more advanced, underlain by sandy silt and silty sand. Less weathered rock, commonly termed “partially weathered rock” (PWR), forms a “rind” on the bedrock that ranges in thickness from several feet to tens of feet. The contact between partially weathered rock and competent bedrock rock is irregular, even over short horizontal distances. Alluvial and floodplain deposits (water deposited) are typically found overlying residual soil in areas near streams and drainage features. Soils transported downslope by gravity (mudflows or landslides), termed colluvium, are often found on or near the toe of natural slopes.

Groundwater flow in the Blue Ridge region is typically divided into two, connected but characteristically different, flow regimes - flow through the porous overburden, and flow through discrete fractures in bedrock. The overburden typically acts as an infiltration medium for precipitation, and if sufficiently thick/deep, becomes saturated at some depth and a saturated zone is present above bedrock. Groundwater flows laterally through the overburden toward a discharge zone (surface water feature) or downward into fractures in the underlying bedrock. Positive/downward vertical hydraulic gradients in the overburden are typical in recharge areas and negative/upward vertical hydraulic gradients in the overburden are present in discharge areas. Upward hydraulic gradients are also present in the overburden where fractures in the underlying bedrock extend to the bedrock surface/overburden interface and have an upward hydraulic gradient that transmits groundwater from the bedrock upward to the overburden. The rate and direction of groundwater flow in the overburden is controlled primarily by topographic features, the porosity of the overburden, and structural features that create preferential flow paths (e.g., quartz veins, sandy lenses, etc.).

The majority of groundwater occurrence and flow in crystalline bedrock is through a network of fractures, which are formed by tectonic and deformational forces (e.g. metamorphism and intrusions). Joints are also formed when the overlying overburden is eroded, thus decreasing the weight of the overburden overlying the bedrock. Faults and fault zones create fractures along which movement parallel to the fracture surfaces has occurred. Faults and fault zones range in size and extent. Large fault zones are structural elements that sometimes influence, or control, topographic and/or hydrogeologic features (e.g., forming a barrier to, or preferential path for, groundwater flow).

The orientation (dip angle and strike) and lateral extent of individual fractures in crystalline bedrock is highly variable due to the multiple metamorphic and tectonic events that have deformed the parent rocks. The frequency and aperture of fractures typically decreases with depth (LeGrand, 1988), due to increased overburden pressure with depth. A preliminary fracture trace analysis map prepared by the North Carolina Geological Survey in early 2010 was provided to MACTEC by the IHSB. Fracture trace maps identify lineaments, which are large-scale, linear surface expressions identified on aerial photographs or high-resolution aerial or satellite imagery, and often verified in the field. The lineaments identified on the provided preliminary fracture trace analysis map in the vicinity of the Site are primarily oriented in two northwest-southeast azimuth directions: between 275 and 295 degrees and between 335 and 355 degrees.

2.3.2 Site Geology

Fill material, residual soil (overburden) and bedrock have been identified at the Site. Fill material, consisting of loose silty sand with gravel, has been observed to a depth of approximately 19 feet below ground surface (bgs) in the western portion of the Site where two drainage swales formed by intermittent streams were backfilled for development/grading. Overburden is located below the fill material, where present, and has been observed to a depth of approximately 81 feet bgs at the Site, where the apparent top of bedrock is encountered. The uppermost zone of overburden generally consists of silty sand that coarsens with depth to sand with some/little silt. The overburden “fabric” ranges from massive (i.e., no apparent structure) to strongly foliated. Foliated zones were approximately horizontal to steeply dipping (i.e., greater than 50 degrees). Quartz veins ranging in thickness from less than 0.5 inches to approximately 12 inches, and consisting of sand to gravel-sized fragments, have been observed in the overburden. The PWR zone has been observed to range in thickness from approximately two to 27 feet and typically samples as fine to coarse sand with minor amounts of silt and gravel-sized rock fragments. The fabric of the PWR is similar to the overburden fabric.

The depth to bedrock at the Site ranges from approximately 28 feet bgs to approximately 81 feet bgs. The bedrock surface has been observed to be highly variable within short distances. The bedrock surface is similar to the ground surface in the vicinity of the Site, in that a “saddle” is apparent in the north-central portion of the Site. The bedrock surface northeast and southwest of the saddle has an apparent slope of 10 to 15 percent. The slope west of the saddle is somewhat flatter (approximately eight percent).

The upper 100 feet of bedrock was observed to be metagraywacke in the vicinity of MW-1B and MW-11B and the first apparent water-bearing fracture encountered in MW-1B and MW-11B was approximately 100 and 140 feet below the top of bedrock, respectively. The upper 25 feet of bedrock in the vicinity of MW-4B and MW-9B was observed to be schistose metagraywacke and metagraywacke and the first apparent water-bearing fracture in MW-4B and MW-9B was encountered within 25 feet of the top of bedrock.

Foliation identified in the MW-1B boring is generally dipping 10 to 20 degrees toward the east (dip azimuths ranging from 40 to 130 degrees) and foliation identified in the MW-11B is generally dipping 10 to 16 degrees to the west (dip azimuth of approximately 285 degrees). Dip azimuths of fractures compiled from the four bedrock borings advanced at the Site range from 0 to 360 degrees. However, identified fractures were most frequently oriented with a dip azimuth between 75 and 120 degrees (eighteen fractures). Fracture dip angles identified in the bedrock borings ranged from nearly horizontal to steeply dipping.

2.3.3 Site Hydrogeology

A groundwater divide is present in the overburden in the north-central portion of the Site. As previously discussed, the Site is located on a topographic saddle between significant mountains to the north and south. A portion of groundwater that is flowing from each mountain is toward the saddle. Therefore, a groundwater divide has developed where groundwater in the overburden flows from the mountains and turns east or west to respective discharge zones. The position and shape of the groundwater divide likely changes in response to precipitation.

The direction of shallow groundwater flow (water table) and groundwater flow in the PWR zone are similar. Groundwater flow in the southern portion of the Site appears to flow radially, to the north and east. From the central portion of the Site, groundwater flows northwest toward Spring-05 and east/southeast toward the springs east of the Site. In June 2009, the horizontal hydraulic gradient from the Site toward the springs east of the Site was 0.08 and the horizontal hydraulic gradient from the Site toward Spring-05 west of the Site is approximately 0.04.

Upward and downward hydraulic gradients were measured between overburden shallow and PWR monitoring wells in June 2009. The maximum downward gradient (0.037) was measured at the MW-4/4A well cluster and the maximum upward gradient (-0.050) was measured at the MW-11/11A well cluster. Monitoring well MW-11A, which is installed in the PWR, is a flowing artesian well. Similarly, flowing artesian conditions have been observed in the vicinity of the springs east of the Site, indicating significant upward groundwater flow through the overburden.

The potentiometric elevation of groundwater in the four bedrock monitoring wells installed at the Site represents the hydraulic head of the monitored fracture/fracture zone. The potentiometric elevation of bedrock monitoring wells MW-1B, MW-4B, and MW-9B was similar in June 2009 (i.e., within two feet). However, the bedrock potentiometric elevations were variable with respect to the elevation of the corresponding top of bedrock or overlying water table elevation. The groundwater elevation in monitoring well MW-4B is greater than the top of bedrock elevation, but less than the water table elevation in the adjacent water table well. The potentiometric elevation of groundwater in monitoring well MW-9B is greater than the top of bedrock elevation and the water table elevation in the adjacent water table well. The potentiometric elevation of groundwater in MW-1B is below the top of bedrock elevation.

Bedrock monitoring well MW-11B is a flowing artesian well, with a potentiometric elevation approximately 17 feet above ground surface in July 2009. The flow rate of monitoring well MW-11B was estimated to be three gallons per minute. The fracture isolated with the MW-11B screened interval, which was encountered approximately 140 feet below the top of bedrock, is slightly dipping (dip angle of 21 degrees) toward the northeast (dip azimuth of 55 degrees).

2.3.4 Surface Water

A “seep” area containing isolated springs and seep “zones” is located east of the Site. An unnamed tributary emanates from the seep area and flows east toward Robinson Creek. Several injection points and observation piezometers installed in the seep area related to a pilot study exhibited artesian conditions, indicating that a relatively significant vertical hydraulic gradient is present in this area.

An unnamed tributary also originates west of the Site and flows northwest toward Dingle Creek. Spring-05 emanates from the base of a tree and forms the eastern branch of the unnamed tributary. Water also flows from a culvert located south of Spring-05. The source of the water that flows from the culvert is unclear. A leaking municipal fire hydrant has been identified at the Site, approximately 100 feet from the culvert, and a storm water ditch terminates at the former contingency basin located on the inlet side of the culvert. An intermittent stream was formerly identified in this area. Therefore, the tributary forming the southern branch of the unnamed tributary likely receives a component of groundwater discharge.

2.4 CONTAMINANT CHARACTERIZATION

The primary constituents detected in soil and groundwater samples collected during previous Site investigations include volatile organic compounds (VOCs) related to chlorinated solvents and petroleum constituents related to fuel oil. The physical and chemical properties of chlorinated VOCs and petroleum hydrocarbons influence the migration of the constituents in subsurface in different ways, as described below.

Concentrations of Hazardous Substance List (HSL) metals detected in soil and groundwater samples collected during the Phase I RI, as well as in soil and sediment samples collected during previous investigations at the Site, are considered to be naturally occurring. Concentrations of cyanide detected in soil and groundwater samples collected during the Phase I RI, and soil samples collected during previous investigations at the Site, are well below the associated regulatory limits.

2.4.1 Potential Source Areas

The facility’s electroplating operation was located in the central portion of the building. Therefore, previous investigations focused on the plating room as a potential source area. Significant concentrations of TCE have not been identified in soil samples collected below the building in the vicinity of the plating room. However, elevated concentrations of TCE have been detected in soil samples collected immediately south of the building and in the east-central portion of the building. Additional assessment is necessary to further investigate the potential TCE source area(s) identified in the Phase I RI.

The potential source area for petroleum contamination is believed to be in the vicinity the facility's former fuel oil ASTs, located along the southern exterior wall of the building in the area of the former boiler.

2.4.2 Contaminant Fate and Transport

The fate and transport of contaminants in soil and groundwater is influenced by numerous factors, including: the primary and secondary release mechanisms, the physical and chemical properties of the constituents that were released, and the characteristics of the subsurface medium through which the contaminants will potentially migrate.

2.4.2.1 Primary Release Mechanisms

The manner in which a contaminant is released affects the distribution and migration of contaminants in the subsurface. Many factors affect the distribution of contaminants in a source area, including the release frequency, duration, location (above or below ground), proximity to man-made or natural channels/conduits and/or flow barriers, the nature of the chemical (i.e., in pure form or diluted), and the characteristics of the chemical (e.g., density, viscosity, etc.).

The primary release mechanism(s) associated with the TCE contamination observed at the Site is unknown. There were no known spills or releases of TCE at the facility during its occupancy by CTS. The source of other VOCs detected at the Site, such as 1,1,1-trichloroethane (TCA) and tetrachloroethene (PCE), is not known; however, the relatively low concentrations of TCA and PCE suggest they were released in a diluted mixture.

The petroleum contamination identified at the Site is likely a "pure" fuel oil release associated with one of the storage tanks, or from a diesel fuel release during MGRA's use of the facility. The EPA characterized the petroleum release at the Site in their early studies as being "unweathered, and indicative of a recent spill." There were no known spills or releases of fuel oil at the facility during its occupancy by CTS.

2.4.2.2 Secondary Release Mechanisms

Secondary release mechanisms affect how contaminants migrate in the subsurface. Contaminants in soil are a secondary source for groundwater contamination, as the contaminants leach from the soil to the groundwater. The rate at which contaminants will leach from soil to groundwater depends on the amount of water infiltrating through the contaminated soil, as well as the contaminant characteristics (e.g., solubility). The majority of the Site in the area of the building is overlain with asphalt or concrete preventing significant infiltration of precipitation.

Another secondary release mechanism is the dissolution or vaporization of a constituent from a non-aqueous phase liquid (NAPL). When released into the subsurface NAPL will migrate vertically and horizontally along the path of least resistance. Residual NAPL, in the form of disconnected “ganglia”, will be formed at the trailing end of a NAPL body. If sufficient NAPL is present above a layer of low permeability, the pore space can become saturated, and a NAPL pool will form. The density of a NAPL will typically determine whether the NAPL will migrate below the water table. Light NAPL, or LNAPL, will typically pool on the water table, and dense NAPL, or DNAPL, will migrate below the water table. NAPL in unsaturated soil will vaporize into the air or dissolve into pore water. NAPL in saturated soil (below the water table) will dissolve into groundwater, forming a dissolved groundwater plume. Residual and pooled NAPL will continue to dissolve/vaporize until the NAPL is depleted.

In pure form, chlorinated VOCs, such as TCE, exist as DNAPL. Dye tests performed on soil samples collected from borings at MW-2, MW-3, and MW-3A visually indicated the presence of DNAPL in several samples. However, DNAPL was not indicated in the monitoring wells when tested with an interface probe. These findings indicate that DNAPL in the vicinity of these wells is likely present as residual DNAPL and not pools of DNAPL. Elevated concentrations of TCE (i.e., above 10,000 μg/L) were detected in groundwater samples collected from overburden monitoring wells MW-6, MW-6A, and MW-7A, as well as in historical samples collected from the springs east of the Site, indicating the need for additional assessment for potential DNAPL within proximity of the wells and springs.

Petroleum products are a complex mixture of hydrocarbons with additives that behave as a LNAPL. A LNAPL will migrate in the direction of the slope of the water table and create a “smear zone” of LNAPL ganglia in the zone of the fluctuating water table surface. If sufficient LNAPL is present, the water table can become depressed and the LNAPL will accumulate (i.e., pool) in the depression. LNAPL will dissolve into the underlying groundwater. Due to the numerous constituents present in petroleum and the various constituent properties (e.g., solubility, degradation characteristics, sorption, etc.) the dissolved plume originating from a petroleum release is spatially variable. Evidence of LNAPL was observed in soil samples collected from depths of approximately 25, 30 and 35 feet bgs in the exploratory boring advanced adjacent to monitoring wells MW-3 and MW-3A. However, LNAPL was not indicated in MW-3 or MW-3A when tested with an interface probe. Additional assessment is necessary to determine the extent and distribution of potential LNAPL at the Site.

2.4.2.3 Subsurface Features

Subsurface features will affect the rate and distribution of contaminants in the subsurface. Man-made features, such as storm drains and sewer lines, might provide preferential pathways in the shallow subsurface at the Site. The contact between fill material and residual soil might also act as a preferential pathway at the Site.

The overburden materials were observed to be massive (i.e., little structure) to strongly foliated. The fabric of the overburden is expected to influence the migration of NAPL in the subsurface, as foliation planes might provide preferential pathways or barriers to NAPL migration. Additionally, quartz veins were identified in numerous soil borings, and might act as preferential pathways for groundwater flow and/or the migration of NAPL. Additional investigation is necessary to determine the distribution of NAPL and dissolved phase contamination at the Site with respect to subsurface features.

2.5 CONTAMINANT DISTRIBUTION

2.5.1 Soil

An evaluation of soil samples that have been collected at the Site during previous investigations was compiled and evaluated with respect to identification of source areas and potential data gaps. Analytical results of soil samples that have been collected at the Site since 1990 were presented in a series of tables in the Phase I RI Report. In general, contaminant distribution in soil at the Site was identified to be in the southern portion of the Site building, and to the immediate south of the building, and was determined to be primarily VOCs.

Considering soil samples collected in the vicinity of the building, eighty-three historical soil samples have been collected from forty-one locations. Of the eighty-three soil samples, eighteen samples have been collected from within approximately two feet of ground surface, twenty-three samples have been collected from depths of approximately two and ten feet bgs, and forty-one soil samples have been collected from a depth between ten feet bgs and the water table. Additionally, eight exploratory trenches were excavated at the Site in September of 2000 by an EPA contractor. The trench locations were based on the results of a geophysical survey conducted in August of 2000 which identified areas containing potentially buried debris. The trench locations were also excavated in areas where disturbed soil was identified. Trenches T1 through T7 were approximately 8 to 12 feet in depth, and trench T8 was excavated to a depth of 18 feet bgs. Soil samples were collected from the base of trenches T1 and T8.

Soil samples collected during previous investigations were analyzed for various “suites” of metal constituents – forty-six historical soil samples and six soil samples collected during the Phase I RI have been submitted for analysis of metals. Although the historical analytical suites did not typically contain the fourteen HSL metals (i.e., mercury, selenium, and/or silver were not included in some of the analysis), sufficient analytical data has been collected to identify if a release containing significant metal constituents has occurred. Of the fourteen HSL metals, ten have been detected in one or more soil samples that exceed the IHSB PGWSRG and/or HBSRG. Based on a review of the data, concentrations of metals detected in soil samples are due to naturally occurring metals in the soil. Although “background” soil samples have not been collected to establish concentrations of naturally occurring metals in residual soil and fill soil at the Site, the distribution of the soil samples with concentrations of metals above the PGWRG does not indicate an area of concern related to metals.

Analytical results of soil samples collected below the building and south of the building indicate considerably variable concentrations of VOCs and SVOCs, both vertically and horizontally. Analytical results of soil samples collected at shallow depths (e.g., within four feet of ground surface) generally contain lower concentrations of VOCs and SVOCs (including TPH-DRO), and many of the shallow soil samples do not contain concentration of organic constituents above the MDL.

Surface and subsurface soil samples were collected at the former contingency basin, three samples were collected as sediment samples from the bottom of the basin and three soil samples were collected in the vicinity of the basin. Concentrations of metals detected in the soil/sediment samples are similar to soil samples collected at the Site. Elevated concentrations of VOCs or SVOCs have not been identified in the soil and sediment samples collected in the vicinity of the basin. Therefore, a release to the basin from operations at the facility is not indicated by the reviewed data.

The majority of soil samples have been collected within an approximate 75,000 square-foot area in the southern portion of the property (below the building and within approximately 50 feet of the southern exterior wall of the building). A remediation system located in this area of the Site has removed approximately 6,470 pounds of VOCs (primarily TCE and TCA) as of February 2010, which would correspondingly lower the concentrations of previously detected VOCs in soil in this area. Thus, the VOC contaminate distribution in soil in this portion of the Site is currently in a reducing state of flux. The on-going remediation of vadose zone soil in this area of the Site is discussed further in Section 2.6.

2.5.2 Groundwater

2.5.2.1 Chlorinated VOCs

The dissolved phase TCE plume in overburden generally extends east and west toward groundwater discharge zones. Concentrations of TCE were not identified above the MDL in groundwater samples collected from monitoring wells MW-1, MW-8, MW-9, MW-9A, MW-10 and MW-10A indicating that the horizontal extent of the dissolved phase TCE plume in overburden has been delineated in the northern and southern directions.

Based on concentrations of TCE in groundwater samples collected from downgradient water table wells MW-4 and MW-5, and a surface water sample collected from Spring-05, the downgradient extent of the shallow dissolved phase TCE plume to the west is estimated to be in the vicinity of Spring-05, or to the near-west area of Spring-05. The TCE concentrations detected in groundwater samples collected from the PWR monitoring wells MW-4A and MW-5A were two orders of magnitude less than TCE concentrations in groundwater samples collected from the adjacent water table wells. Downward hydraulic gradients were observed at well clusters MW-4/4A and MW-5/5A, and the horizontal hydraulic gradient from the central portion of the Site to Spring-05 is relatively “flat”. These findings indicate that shallow groundwater is likely the primary contributor to the groundwater discharging at Spring-05 (potentially due to preferential flow paths created along the fill/residual soil interface) and the western downgradient extent of the deeper PWR overburden TCE plume is also in the vicinity of Spring-05. Additional monitoring wells installed downgradient of the MW-4 and MW-5 well clusters, and downgradient of Spring-05, are necessary to delineate the dissolved groundwater plume in overburden west of the Site.

The concentration of TCE in the groundwater sample collected from MW-11A is significantly less than TCE concentrations detected in groundwater samples collected from upgradient monitoring wells in the eastern portion of the Site. Based on the upward hydraulic gradient measured in the area of the MW-11 cluster, the majority of the deep overburden TCE plume (in PWR) from the eastern portion of the Site appears to discharge at the surface water features. The eastern downgradient extent of the deep overburden TCE plume is estimated to be in the vicinity of MW-11A. Similarly, the downgradient extent of the shallow overburden TCE plume is estimated to be in the vicinity of MW-11. Additional monitoring wells installed downgradient of the MW- 11well cluster are necessary to delineate the dissolved groundwater plume in overburden west of the Site.

Concentrations of TCE were not detected above the MDL in groundwater samples collected from bedrock wells MW-1B, MW-4B and MW-9B. However, four VOCs were detected in the groundwater sample collected from MW-11B. The concentration of TCE detected in the groundwater sample collected from MW-11B is similar to concentrations of TCE detected in groundwater samples collected from PWR monitoring wells at the Site. Additional bedrock monitoring wells are necessary to determine the extent of contamination in bedrock.

2.5.2.2 <u>Petroleum Constituents</u>

Petroleum constituents have been detected in spring and surface water samples collected east of the Site since 1999. In general, the number of detected constituents, as well as the concentration of the detected constituents, was highest in samples collected from Spring-02. Petroleum constituents were not detected above the MDL in groundwater samples collected from MW-2, MW-6, MW-6A, MW-11 or MW-11A. Therefore, a relatively narrow dissolved-phase plume of petroleum constituents appears to extend from the eastern portion of the Site and terminate at the seep area east of the Site. Petroleum constituents were not detected in the groundwater samples collected from bedrock monitoring wells.

2.5.3 Surface Water

Analytical results of surface water samples collected from springs and tributaries east and west of the Site were evaluated with respect to constituents detected in soil and groundwater samples collected during the Phase I RI. Concentrations of constituents detected in surface water samples were compared to the North Carolina Surface Waters and Wetlands Standards (Surface Water Standards), dated May 1, 2007, established under 15A NCAC 2B, for aquatic life and human health (not including water consumption). The Surface Water Standards adopt values established by the Environmental Protection Agency (EPA) National Criteria when a standard has not been established by North Carolina.

In general, constituents detected in groundwater samples collected from monitoring wells at the Site have been detected in the springs and tributary east of the Site. The most prevalent constituents (i.e., constituents detected in more than one sample at more than one of the sampling locations) are benzene, naphthalene, 2-methylnaphthalene,1,1-DCE, cis-DCE, TCA and TCE. Based on data collected since 2004, reported concentrations of TCE and TCA in one or more samples are greater than the Surface Water Standards of 30 μg/L and 4.4 μg/L, respectively.

Surface water samples were collected west of the Site in three locations: Spring-05, the "south branch" of the unnamed tributary that is formed by water emanating at a culvert, and the unnamed tributary downstream of the confluence of the branches formed by Spring-05 and the water flowing from the culvert. Analytical results of surface water samples collected west of the Site have reported concentrations of cis-DCE, TCE and vinyl chloride. Reported concentrations of TCE detected in two water samples collected from Spring-05 are greater than the Surface Water Standard.

The reported concentration of TCE in a surface water sample collected in the south branch of the unnamed tributary in December of 2007 was greater than the Surface Water Standards. However, TCE was not detected in a surface water sample collected from the same location in April 2008. Similarly, vinyl chloride was detected in the December 2007 surface water sample from the south branch of the tributary at a concentration 2.8 μg/L, which is slightly greater than the Surface Water Standard (2.4 μg/L). However, vinyl chloride was not detected in a surface water sample collected from the same location in April of 2008.

The reported concentrations of TCE and vinyl chloride in a surface water sample collected in the unnamed tributary below the convergence of the two branches in June of 1990 were 50 μg/L and 47 μg/L, respectively. The reported concentration of TCE in a November 2007 sample collected from the unnamed tributary was 12.1 μg/L. Vinyl chloride was not detected in the November 2007 sample. The reported detection of acetone in the June 1990 sample is considered a probable laboratory contaminant/artifact.

With the exception of the 2004 *Sampling and Analysis Plan Report* prepared by MACTEC, analytical methods used to analyze the surface water samples were not indicated in previous analytical reports or investigation reports. Furthermore, the collection technique and climatic conditions are not indicated. Therefore, comparison of absolute values for identifying trends is not appropriate.

2.5.4 Sediment

Analytical results of sediment samples collected from tributaries east and west of the Site, including the former contingency basin west of the Site, were evaluated with respect to constituents detected in soil and groundwater samples collected during the Phase I RI. Concentrations of VOCs detected in sediment samples were compared to the IHSB HBSRG and concentrations of SVOCs and HSL metals were compared to the EPA Region 4 Waste Management Division Sediment Screening Values for Hazardous Waste Sites, last updated November 30, 2001 (EPA Screening values). Analytical results of a “background” sediment sample that was collected in the vicinity of the contingency basin are also used for comparison to some of the HSL metals detected in the sediment samples (the background sample was analyzed for seven of the HSL metals). The analytical methods utilized to analyze the sediment samples were not reported in the analytical reports or investigation reports. Therefore, comparison of absolute values is not appropriate.

Constituents detected in sediment samples collected from the tributary east of the Site are similar to constituents detected in surface water samples collected from the springs and tributary east of the Site. Concentrations of reported VOCs are less than their respective HBSRG (EPA Screening Values are not established for VOCs). Concentrations of five SVOCs are greater than their respective EPA Screening Value, but below their respective HBSRG.

Reported concentrations of metals detected in sediment samples collected east of the Site are consistently less than the concentrations of metals detected in soil samples collected at the Site (e.g., the manganese concentrations in the sediment samples ranges from 20 to 27 mg/kg and manganese concentrations in soil samples collected from borings advanced at the Site during the Phase I RI range from 560 to 1,300 mg/kg). Based on observation of the "tributaries" that emanate from the springs east of the Site, sediment in the tributaries consists of washed, or "clean", sand (primarily quartz), with minimal silt/clay or organic material. Clean sands have less metal-adsorbing capacity than organic-rich soils. Although the specific location of the sediment samples collected east of the Site was not indicated in the referenced materials, it is likely that the sediment samples were collected from the sandy streambed(s) of the tributaries in this area.

In accordance with the requirements of the Resource Conservation and Recovery Act of 1976, the Mills Gap Road Site registered as a generator of hazardous waste in 1980. One of the generator requirements of 40 CFR Part 262 was that the facility develop and implement a Contingency Plan meeting the requirements of 40 CFR Part 265, Subpart D. During development of the Contingency Plan, facility personnel decided there was a potential for a spill in the area of the loading dock to be released to surface water flowing to the west of the Site, and that there was no containment to keep a spill on the Site. In 1981, the facility constructed the diked containment area, or contingency basin, to address that need. The former contingency basin was also connected to a drain pipe that originated in the area south of the former wastewater treatment building. A storm water ditch located adjacent to the Site's southwest property line and fence conveys storm water from the Southside Village development and discharges into the former contingency basin. TCE was detected at an estimated concentration of 12 μg/kg in the November 1999 sediment sample collected from the former contingency basin. Vinyl chloride and 1,2-dichloroethene (total) were detected at concentrations of 84 μg/kg and 29 μg/kg in the June 1990 sediment sample collected from the unnamed tributary in the area. The reported detections of acetone are considered probable laboratory contaminants/artifacts.

Reported concentrations of metals in the sediment samples collected from the former contingency basin in June of 1990 and November of 1999 are slightly higher than concentrations of metals detected in soil samples collected at the Site. However, reported concentrations of metals in the sediment sample collected from the former contingency basin by NCDENR personnel in December of 2007 are similar to concentrations of metals detected in soil samples collected at the Site, as well as the background sample collected at another location in the Southside Village residential development.

2.6 ON-GOING SITE REMEDIATION ACTIVITIES

Under the direction of the EPA's Emergency Response and Removal Branch (ERRB), and pursuant to the Administrative Order on Consent (AOC) for Removal Action between the EPA and CTS/MGRA (effective date of January 22, 2004), a soil vapor extraction (SVE) system, consisting of 15 vapor extraction wells and blower equipment, began operation at the Site in July of 2006. The SVE system is located in the southern portion of the Site building and the area south of the building, and removes previously detected organic compounds (primarily trichloroethylene, or TCE) from the unsaturated soil. Maintenance and monitoring of the SVE system is on-going, and testing of the system's air discharge is conducted on a monthly basis. Reports describing the status of the removal activities, including the pilot study, are submitted to the ERRB on a monthly basis, as required by the AOC.

3.0 PROPOSED SCOPE OF WORK

The proposed scope of work includes methods and procedures to further assess three potential source areas associated with former operations at the Site and to determine the horizontal and vertical extent of contamination. MACTEC will update the Site Health and Safety Plan to address assessment activities proposed in this Plan.

3.1 SOURCE AREA ADDITIONAL ASSESSMENT

The following three potential source areas require additional assessment: 1) the former waste water pretreatment system (WWPS), including a potential gravel filter reportedly located at the same location as the WWPS, and the Site's sanitary sewer lines, 2) the former contingency basin, and 3) the area located south of the Site building and north of the gravel road. Soil samples will be collected from the potential source areas in accordance with Appendix A of the IHSB *Guidelines*.

3.1.1 WWPS and Sanitary Sewer

The former WWPS building, including a reported gravel filter in the same location, is located adjacent to the southwestern portion of the Site building. The building contains a below-grade concrete equalization basin that is sloped from six to eight feet deep, and extends nearly to the interior walls of the building. Waste water was historically pumped from the basin to elevated treatment tanks, where the water would gravity-flow from one treatment tank to the next, until the clarified water was discharged under permit to the Metropolitan Sewerage District of Buncombe County Wastewater Treatment Plant. Based on the configuration of the WWPS inside the building, four soil sampling locations are proposed along the exterior of the building, as shown in Figure 1. Two of the proposed sampling locations are inaccessible by mechanical drilling equipment, so the soil borings will be advanced with a decontaminated stainless steel hand auger. The remaining two soil borings will be advanced with direct-push technology (DPT) drilling equipment, such as a Geoprobe®.

The soil borings will be advanced to the depth of the apparent water table, which is assumed to be approximately 10 to 15 feet below ground surface (bgs) in the area of the WWPS. During advancement of the soil borings, soil samples will be continuously collected and described by a field geologist. The soil core, or soil cuttings from the hand auger borings, will be scanned at an approximate one-foot interval with a photoionization detector (PID) for the presence of organic vapors. One soil sample with the highest PID reading will be collected from each five-foot interval of unsaturated soil. If elevated PID readings are not indicated (i.e., not above background levels), a soil sample will be collected from the bottom one-foot of the five-foot interval. Soil samples will be collected at least two vertical feet apart within the soil boring. The soil borings will be backfilled with hydrated bentonite after completion. The soil samples will be submitted for the full suite of analyses described in Section 3.9.

A sanitary sewer line extends from the WWPS to Mills Gap Road, as shown in Figure 1. The southern portion of the sewer line is located in the vicinity, or within the influence of, the Site's soil vapor extraction remediation system currently in operation. Additionally, numerous soil samples have been collected in the vicinity of the southern portion of the sewer line. Therefore, ten soil samples will be collected at an approximate 50-foot interval along the eastern and northern portions of the sewer line, as indicated in Figure 1. A utility locator will attempt to determine the location and depth of the sewer line prior to soil sampling activities. Soil borings will be advanced using DPT equipment or a hand auger within one to five horizontal feet of the reported or suspected location of the sewer line. The borings will be advanced to a depth of within two feet of the approximate bottom of the sewer line and a soil sample will be collected. The soil borings will be backfilled with hydrated bentonite after completion. The soil samples will be submitted for the full suite of analyses described in Section 3.9.

3.1.2 Former Contingency Basin

The former contingency basin is located off the Site adjacent to the west property boundary, as depicted in Figure 1. As discussed in the *Report of Phase I Remedial Investigation* (MACTEC, July, 27, 2009), the former Contingency Basin was previously investigated by both EPA and NCDENR. To augment and complete the investigation of the former contingency basin, two soil borings will be advanced within the former contingency basin using a decontaminated stainless steel hand auger. The borings will be advanced to a depth of at least one foot into residual soil, and a soil sample will be collected from within the top one foot of residual soil. The soil borings will be backfilled with hydrated bentonite after completion. The soil samples will be submitted for analysis of HSL metals and hexavalent chromium, as described in Section 3.9.

Two background soil samples will also be collected from borings advanced to a similar geologic strata as the bottom of the contingency basin. The background soil samples will be submitted for analysis of HSL metals and hexavalent chromium. The proposed locations of the soil borings are shown on Figure 1.

3.1.3 Area South of On-Site Building

Twelve soil borings will be advanced using DPT equipment in the area north of the Site's gravel road, and south of the building, as depicted in Figure 1. The soil borings will be advanced to the depth of the apparent surficial water table which is assumed to be a depth of approximately 20 to 30 feet bgs. During advancement of the soil borings, soil samples will be continuously collected and described by a field geologist. One soil sample with the highest PID reading will be collected from each five-foot interval of unsaturated soil. If elevated PID readings are not indicated (i.e., not above background levels), a soil sample will be collected from the bottom one-foot of the five-foot interval. Soil samples will be collected at least two vertical feet apart within the soil boring. The soil borings will be backfilled with hydrated bentonite after completion. The soil samples will be submitted for the full suite of analyses described in Section 3.9.

3.1.4 Site-Specific Contaminants of Concern (COCs)

Based on the results of the additional potential source area assessment, as well as the results of the Phase I RI, a list of Site-specific COCs will be compiled in accordance with Section 2.3 of the IHSB *Guidelines*.

3.2 NON-AQUEOUS PHASE LIQUID (NAPL) ASSESSMENT

As described in the CSM, residual LNAPL and DNAPL have been identified in overburden at the Site. This information, along with additional data collected during the continued assessment of potential source areas as described in Section 3.1, will be taken into consideration in planning the proposed NAPL assessment. The distribution of NAPL is typically highly variable in subsurface media; therefore, multiple lines of evidence are required to identify the potential presence or absence of NAPL. Direct and indirect methods will be employed in an attempt to determine the distribution of potential NAPL in overburden at the Site.

3.2.1 NAPL Measurements in Existing Monitoring Wells

The following monitoring wells will be gauged for the presence of NAPL (light and dense) using an oil-water interface probe: MW-2, MW-3, MW-3A, MW-5, MW-5A, MW-6, MW-6A, MW-7, and MW-7A. If NAPL is indicated, the thickness of the NAPL will be recorded.

3.2.2 NAPL Assessment Using DPT Equipment

Several techniques will be used with DPT equipment to assess the potential presence and distribution of NAPL in overburden at the Site. In the event that the DPT equipment is unable to advance to the top of bedrock, alternative methods will be used, as described in Section 3.2.3.

3.2.2.1 Membrane Interface Probe

The membrane interface probe (MIP) allows for the real-time semi-quantitative analysis of VOCs in the subsurface. The MIP tool consists of a semi-permeable membrane mounted on the outside of a stainless steel drive point, which is attached to DPT equipment/rods. The membrane is heated to 100 to 120 degrees Celsius and a constant flow of non-reactive carrier gas sweeps behind the membrane. VOCs present in the subsurface (soil or groundwater) diffuse across the membrane and are carried to gas phase detectors at ground surface via the carrier gas. Different gas phase detectors are available for identifying VOCs, and most commonly include: photoionization detector (PID), electron capture detector (ECD), and flame ionization detector (FID). The detectors provide a “screening” response rather than a concentration. The PID and FID are responsive to VOCs; however, the ECD responds only to chlorinated VOCs, such as TCE, with a detection limit as low as 250 parts per million. Significant PID/FID responses, in combination with the ECD response, indicate the presence of potential NAPL at a particular depth. The drive point also contains a device for measuring the electrical conductivity of the formation (soil and groundwater), which provides real-time lithology information. The lithology information, in combination with the MIP results, can be used to potentially identify preferential pathways for contaminants.

The MIP system will be used to provide real-time VOC and conductivity profiling to delineate and characterize the distribution of potential NAPL and the dissolved phase plume. Borings will be located along transects perpendicular to groundwater flow. The spacing of borings along the transects, and between transects, will be based on the results of previously conducted borings, and in consideration of other relevant data (e.g., locations where NAPL was identified using dye tests or elevated concentrations have been identified in groundwater/soil samples).

3.2.2.2 Laser-Induced Fluorescence

Laser-induced fluorescence (LIF) detectors identify NAPL that contains polycyclic aromatic hydrocarbons (PAHs), such as diesel and fuel oil. Similar to the MIP system, a LIF detector can be advanced via DPT equipment. Excitation light is transmitted to a window in the side of the drive point via a fiber optic cable. If PAH compounds are present in the subsurface, a light will be emitted and the signal sent to a detector at ground surface. The type of NAPL (i.e., diesel, fuel oil, kerosene, etc.) is also indicated, as each have unique waveforms that can be evaluated with the LIF detector.

In addition to the LIF detector results, the MIP results can also be evaluated to identify ‘zones’ of non-chlorinated VOC dissolved phase constituents (i.e., likely dissolved phase petroleum constituents, such as benzene), if such zones are detected.

3.2.2.3 Hydraulic Profiling

A hydraulic profiling tool (HPT) is used to provide real-time subsurface hydraulic data. The HPT is a sensitive pressure transducer housed in a drive point that is attached to DPT equipment. The drive point is advanced at approximately two centimeters per second and clean water is injected through a screen in the drive point at a constant rate, usually less than 0.3 liters per minute. The injection pressure is monitored and plotted with depth. The injection pressure is an indication of the formation’s relative permeability. That is, a high pressure reading indicates low permeability, such as a clay lens, and a low pressure indicates high permeability, such as a quartz seam.

The HPT can also collect depth-discrete hydraulic head measurements. The probe and injection water are stopped, and the formation is allowed to equilibrate. Once equilibrated, the pressure transducer measures the static pressure, or hydraulic head. The HPT can also be used to collect depth-discrete groundwater samples, as described in Section 3.2.4.

3.2.3 NAPL Assessment Using Non-Direct Push Methods

In areas where DPT equipment is unable to advance to the top of bedrock using direct push methods, the DPT equipment will be used to advance the borehole with hollow stem augers for the collection of split spoon samples. The split spoon samples will be collected from the depth of refusal by the DPT equipment to the top of bedrock. The soil samples will be scanned with a PID and intervals exhibiting PID readings greater than 500 ppm will be evaluated using the ColorTec method and/or a hydrophobic dye test. Selected soil samples exhibiting NAPL will be collected, as described in Section 3.2.4.

3.2.4 Soil and Groundwater Sampling

Up to 15 soil and groundwater samples will be collected in areas/zones where potential NAPL is indicated and submitted for analysis of site-specific VOCs according to EPA Method 8260. Where LNAPL is indicated, the samples will also be submitted for analysis of site-specific SVOCs according to EPA Method 8270. If NAPL is indicated using DPT methods, the soil and groundwater samples will be collected from a boring advanced adjacent to the boring where NAPL was indicated. Groundwater samples will be collected using the HPT and soil samples will be collected using industry-standard DPT soil collection techniques. If NAPL is indicated in a split spoon sample using a dye test or the ColorTec method, a soil sample will be collected from the split spoon sampler. A “grab” groundwater sample will be collected from the boring using Hydropunch®, or similar, sampling equipment.

The laboratory analytical results will be evaluated to determine if NAPL is present in the samples. The presence of NAPL in soil samples will be calculated using constituent concentrations, constituent properties (e.g., solubility), and estimated soil properties (e.g., dry soil bulk density, porosity, etc.). The presence of NAPL in groundwater samples will be based on the one-percent rule of thumb by comparing the constituent concentrations and effective solubility of the constituents detected.

3.3 GROUNDWATER PLUME DELINEATION - OVERBURDEN

As described in Section 2.5.2.1, additional monitoring wells are necessary to delineate the downgradient extent of the overburden groundwater plume to the east and west of the Site. Six monitoring well pairs, consisting of a water table well and a PWR well, will be installed and sampled during an initial mobilization. The location of the six proposed overburden monitoring well pairs is depicted in Figure 2. The laboratory analytical results of groundwater samples collected from the newly installed monitoring wells will be evaluated to determine if the downgradient extent of the overburden plume has been delineated. Delineation will be considered complete when detected site-specific constituent concentrations are equal to or lower than the following levels: the permanent and interim groundwater standards established under 15A NCAC 2L; 2) the EPA maximum contaminant level; and 3) the EPA non-zero maximum contaminant level goal. If delineation is not achieved after the first iteration of well installations, another iteration of monitoring wells will be installed, and so forth, until delineation is completed. The following sections describe the monitoring well installation and sampling methods.

3.3.1 Monitoring Well Installation

A soil boring will be advanced using nominal 4.25-inch diameter hollow-stem augers until auger refusal is encountered. Soil samples will be collected with a split-spoon sampler at approximate five-foot intervals. If the vertical distance between the apparent water table and auger refusal (i.e., top of apparent competent bedrock) is greater than ten feet, a PWR well with a five-foot screened interval will be installed with the bottom of the well at the contact between PWR and bedrock. A "nested" water table well, constructed with a ten-foot screened interval across the water table, will be installed adjacent to the PWR well. If the distance between the apparent water table and top of bedrock is less than ten feet, then one well with a ten-foot screened interval will be installed with the bottom of the well at the contact between PWR and bedrock. The proposed off-site monitoring wells are located in areas where contamination from an overlying source area is not anticipated; therefore, the proposed off-site water table and PWR wells will be installed as Type II monitoring wells (i.e., cross-contamination from an overlying aquifer or source area is not known; therefore installation of an outer casing is not warranted). We do not propose to collect soil samples for laboratory analyses during installation of these off-site monitoring wells, unless there is evidence of chemical staining, or elevated photo-ionization detector readings, that may indicate a need for further assessment.

Monitoring wells will be constructed using two-inch diameter schedule 40 PVC riser pipe and 0.010-inch slotted screen. The borehole annulus of will be filled with filter sand and topped with a bentonite seal and grout in accordance with the North Carolina Well Construction Standards. Monitoring well grout seals will be allowed to cure for at least 24 hours prior to well development, or the monitoring well will be developed prior to placing the grout seal. Each well will be developed by the pump and surge method using a submersible pump. Water quality parameters (pH, temperature and conductivity) will be monitored during development. Each well will be developed until the development water is relatively clear of silt and sand particles, or until the water quality parameters have stabilized, whichever occurs first.

The monitoring wells will be completed with a flush-mount wellhead and equipped with a locking well cap and an approximate four square-foot concrete pad will be placed around each wellhead, in a manner that precludes surface runoff towards the well. A permanent well identification label that includes well construction details will be placed inside the flush-mount wellheads.

3.3.2 Water Level Measurements

After an iteration of overburden monitoring well installation activities, depth to water measurements will be collected from the newly installed monitoring wells once the wells have been allowed to stabilize for at least 24 hours. Depth to water measurements will be collected from existing Site monitoring wells and piezometers and the water level in the springs east of the Site will be measured and referenced to an applicable datum. The monitoring well water level measurements will be collected using an electronic water level meter and reference to the top of casing. The water level measurements will be collected within a 24-hour period.

3.3.3 Groundwater Sampling

Groundwater samples will be collected from newly installed overburden monitoring wells once the wells have been allowed to stabilize for at least 24 hours. The monitoring wells will be purged using low-flow purging techniques, in general accordance with the American Society of Testing and Materials (ASTM) Standard Practice D-6771-02 *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations*. In general, low-flow purging will be implemented using a submersible or peristaltic pump, with the intake lowered to within the screened interval of the monitoring well. The pumping rate will be minimized in an attempt to prevent excessive drawdown in the well, which will be monitored using an electronic water level indicator. Water quality parameters (dissolved oxygen, turbidity, oxidation-reduction potential, temperature, pH, and specific conductance) will be measured using a flow-through cell. Groundwater samples will be collected when the water quality parameters have stabilized, as described in the ASTM Standard Practice.

3.4 BEDROCK INVESTIGATION

As described in Section 2.5.2.1, additional monitoring wells are necessary to determine the extent of groundwater contamination in bedrock. Installation of bedrock wells will commence after completion of the source area investigation, the NAPL assessment, and the overburden groundwater plume delineation. The locations of the bedrock wells will be based on the results of the aforementioned assessments, as well as previously collected Site data, and other relevant data available at the time of the bedrock investigation (e.g., geologic mapping information, geophysical investigations, etc. performed by others in the vicinity of the Site). The following sections describe the anticipated procedures for investigation of bedrock.

3.4.1 Bedrock Drilling and Progressive Packer Testing

A surface casing will be set to a minimum of five feet below the top of competent bedrock in each boring. The casing will be grouted into place and allowed to cure a minimum of 24 hours. The bedrock boring will be advanced below the surface casing using air rotary drilling techniques. The boring will be advanced approximately 20 feet and allowed to sit for at least 15 minutes to determine if a water bearing fracture has been encountered. If a water bearing fracture is evidenced by the production of water in the boring, the water will be airlifted from the boring, and the boring allowed to recharge until a sufficient amount of water is produced for sample collection. A sample of the water from the initial 20-foot interval will be collected using a submersible pump. If a water bearing fracture is not evident, the boring will be advanced another 20 feet. The boring will be advanced in 20-foot intervals until a water bearing fracture/zone is evidenced, prior to continuing to be advanced in 20-foot intervals.

Upon encountering the second productive water-bearing zone, utilization of packers will be required to seal off the upper water bearing fracture/zone from the second deeper water bearing zone. Water in the boring will be air lifted, and the drill rods removed from the boring. A single packer assembly, with pressure transducers positioned above and below the packer, will be suspended within two feet of the bottom of the boring. The packer will be inflated using nitrogen gas and the pressure transducers monitored to ensure that the packer is adequately seated, and to determine if water is being produced in the isolated interval. If water is produced within 15 minutes, the water in the isolated interval will be purged using a submersible pump. A groundwater sample will be collected after three purge volumes have been removed. If a slow recharge rate is indicated, a sample will be collected after one purge volume has been removed and sufficient water has been produced for collection of a groundwater sample.

The groundwater sample will be field screened for the presence of chlorinated VOCs using the ColorTec method. If chlorinated VOCs are indicated, the boring will be advanced another 20 feet, or to another water bearing fracture, whichever occurs first. This progressive testing/sampling method will be continued until VOCs are not indicated using the ColorTec method. A groundwater sample will be collected from the deepest water bearing fracture encountered and submitted for site-specific VOCs according to EPA Method 8260 on a 24-hour turnaround. If VOCs are detected above the delineation standard (as defined in Section 3.3), the boring will be advanced to the next interval and the field screening/sampling process repeated until VOCs are not detected in a groundwater sample above the delineation standard.

If VOCs are not indicated in a water bearing fracture within 200 feet into bedrock, the boring will be terminated.

3.4.2 Geophysical Borehole Logging

The bedrock borings will be logged using a suite of geophysical techniques including: caliper, fluid properties (temperature and resistivity), optical televiewer, acoustic televiewer, and heat-pulse flowmeter.

3.4.3 Monitoring Well Installation and Groundwater Sampling

Multi-level monitoring wells will be constructed in the bedrock borings. The geophysical logs and the packer testing results will be evaluated to determine the placement of sampling ports in a well. Sample ports will be positioned adjacent to selected fractures that have been identified as producing groundwater and/or fractures that have high relative hydraulic conductivity. Groundwater samples and hydraulic head measurements will be made at the sample ports after installation and sufficient equilibration of a well. The groundwater sampling technique will depend on the type of multi-level monitoring well installed. Groundwater samples will be collected and submitted for site-specific COCs.

3.4.4 Prevention of Open Borehole Cross Contamination

There will be a lag time between evaluation of the geophysical logs/packer testing data and design/procurement/manufacturing/installation of the multi-level monitoring wells. There might also be lag time between packer testing and geophysical logging in a boring. In an attempt to prevent cross contamination between potentially contaminated and uncontaminated fractures, a flexible blank liner will be installed in the borings if a significant lag time is anticipated and in consideration of the field screening results.

3.5 OFF-SITE ACCESS

Access to off-site drilling locations must be granted by the property owners prior to commencement of the proposed activity. MACTEC proposes to send a letter, including NCDENR form GW-22M, to each owner of property on which a monitoring well is proposed, requesting access for drilling and sampling activities and a response within a reasonable timeframe. In the event the property owner is non-responsive, or denies access, MACTEC will notify the NCDENR for assistance in obtaining access to drilling locations.

3.6 SURVEYING

The locations of DPT borings will be surveyed using global positioning system (GPS) equipment with a horizontal accuracy of one meter. The coordinates system used with the GPS equipment will be the same as the coordinate system used during previous Site surveys. A North Carolina Professional Land Surveyor will survey the locations and elevations of newly installed monitoring wells. The surveyor will also locate prominent features and topography within a 100-foot radius of off-site monitoring wells. The surveyor will use benchmarks that have been established at the Site during previous surveys.

3.7 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW), such as soil cuttings and decontamination water, will be stored in DOT-approved 55-gallon drums. Liquid IDW will be accumulated separately from soil IDW and each drum will be labeled as to the drum’s contents. If significant quantities of water are anticipated during a particular activity, a fracture (frac) tank will be utilized. Drums or tanks filled during off-site drilling/sampling activities will be transferred to the Site for accumulation. The drums will be transported off the Site for disposal at an approved disposal facility based on the laboratory analytical results of the submitted samples and waste characterization samples (if necessary).

3.8 PROPOSED FIELD AND LABORATORY QA/QC PROCEDURES

Field and laboratory procedures will be performed in accordance with the quality assurance/quality control (QA/QC) procedures described in the most current version of the IHSB *Guidelines* and the U.S. EPA Region IV Science and Ecosystem Support Division (SESD) *Field Branches Quality System and Technical Procedures*. Documentation of field activities will be completed using a combination of logbooks, field data records (FDRs), real-time reporting, and sample custody records. Field logbooks will be completed to provide a general record of activities and events that occur during each field task. FDRs are designed for exploration and sample collection tasks to provide a complete record of data obtained during the activity. Deviations from the approved Plan will be documented in the field logbooks and applicable FDRs. Equipment and personnel decontamination procedures are described in Section 3.11.

3.8.1 Field Logbooks

Field logbooks will be used to provide a daily hand-written account of field activities. Logbooks will be permanently-bound with a hardcover. Entries will be made in indelible ink and corrections made with a single line with the author's initials and date. The pages of the logbook will be dated and signed by the person completing the log. Partially completed pages will have a line drawn through the unused portion at the end of each field day. The following information will generally be entered into the project field logbook:

- Project name and number;
- Date and time of each entry;
- Weather conditions anticipated for the day, or as weather conditions change;
- Site personnel and their responsibilities;
- Descriptions of important tasks or subtasks;
- A description of samples collected (if not documented on a FDR);
- Documentation of equipment maintenance and calibration activities (if not documented on a FDR);
- Documentation of equipment decontamination procedures; and
- A summary of problems encountered during the day, including cause of problem and corrective actions implemented, if appropriate.

3.8.2 Field Data Records

Field data records will be used to document sample collection and/or exploration details (e.g., soil borings, ground-water sampling, etc.). We anticipate using the following FDRs for this scope of work:

- Boring record – contains a description of the drilling method(s), the features encountered in the boring, including a description of lithologic/geologic features/observations, depth to water, environmental conditions (e.g., odor) and drilling conditions (one per boring);
- Monitoring well construction record – contains the boring record information, as well as well construction details.
- Sample record – contains sample name, date, time, depth, sample collector, and laboratory analyses (one per sample, more than one can be combined on a page); and
- Calibration record – contains results of equipment calibration (daily).

3.8.3 Real-Time Reporting

Reporting on a real-time basis will be provided during the NAPL assessment (MIP, LIF, and HPT) and the geophysical logging. The results of the real-time reports will be documented as necessary in the field logbook.

3.8.4 Sample Containers and Preservation

Sample containers for samples to be analyzed at the laboratory will be supplied by the analytical laboratory. Certification documentation will be obtained for each lot of sample containers and filed by the laboratory.

3.8.5 Sample Identification and Labeling

Each sample submitted for analysis at the laboratory will be identified with a unique identification number (sample ID). The sample ID will consist of a two-digit prefix to designate the type of sample (e.g., "SS" for soil samples), the location number, and depth bgs (if more than one soil sample is collected from the same boring).

The QC samples will be cross-referenced on the sample FDRs. The QC samples will have a prefix identifying their purpose, followed by a sequential number, as follows:

- FD-01 (field duplicate)
- EB-01 (equipment rinse blank)
- FB-01 (field blank)
- MB-01 (material blank)
- TB-01 (trip blank)

Sample labels will be completed for each sample with an indelible pen and will be consistent with the chain of custody. The sample labels will contain the following information:

- Site name
- Date and time
- Sample ID
- Initials of sample collector
- Preservative (if required)
- Analysis requested

3.8.6 Quality Assurance and Quality Control Samples

The following QA/QC samples will be collected, in accordance with SESC Operating Procedure, *Field Sampling Quality Control*, dated November 1, 2007:

- Matrix Spike/Matrix Spike Duplicate samples (one per 20 primary samples per analysis per medium);
- Equipment rinse blanks;
- Field duplicates (one per 20 primary samples per analysis per medium);
- Material blank (one per mobilization); and
- Trip blanks (one per cooler of samples to be submitted for analysis of VOCs).

Where duplicate samples are to be collected, the sampler will fill the containers for a given analytical parameter before starting on filling the containers for the next parameter.

3.8.7 Sample Custody

A program of sample custody will be followed during sample handling activities in both field and laboratory operations. This program is designed to account for each sample at all times. The sampling personnel will complete sample FDRs and chain-of-custody records, and the laboratory personnel will complete laboratory receipt sheets. The primary objective of sample custody procedures is to obtain a written record that can trace the handling of samples during the sample collection process, through analysis, until final disposition.

3.8.8 Sample Shipment

Sample containers will be packed in plastic coolers chilled with ice for shipment to the laboratory. The contents of the cooler will be placed in a plastic bag to minimize leakage of water from ice melt inside the cooler. Containers for a particular sample will also be packed in sealable bags to prevent cross-contamination with other samples in the cooler. Containers will be packed tightly so that movement of the containers in the cooler is minimized. Appropriate packaging materials (e.g., Styrofoam, “bubble wrap”) will be used as needed. Ice will be placed in the cooler, generally around the sample containers, so that the samples are maintained at a temperature of four degrees Centigrade (^{o}C) [+/- 2^{o}C]. The cooler will be securely closed with packaging tape to prevent the cooler from opening during transport. Custody seals will be placed on the cooler prior to shipment. Each custody seal will be signed and dated before leaving MACTEC’s possession.

Samples will be shipped via overnight delivery to the laboratory. Upon receipt by the laboratory, the sample custodian will confirm that the seals on coolers are intact or notify MACTEC if any custody seals have been broken.

3.8.9 Laboratory Receipt and Custody

Once the samples are received at the analytical laboratory, the chain-of-custody record will be completed and signed by the sample custodian. The sample custodian will then initiate laboratory chain-of-custody protocols (comparing the sample container labels to the chain-of-custody record and noting any discrepancies, checking the cooler temperature upon receipt, and noting the laboratory project manager if any issues are identified). After sample receipt information is checked and recorded, the sample analysis information is entered into the laboratory's information system. The laboratory provides a unique sample identification number to each environmental sample for internal laboratory sample tracking. The signed chain-of-custody records will be provided with the laboratory deliverables for the project.

3.9 PROPOSED ANALYTICAL PARAMETERS AND METHODS

The full suite of analytical procedures includes:

- Volatile organic compounds, according to EPA Method 8260B (plus tentatively identified compounds);
- Semi-volatile compounds, according to EPA Method 8270C (plus tentatively identified compounds);
- Hazardous Substance List metals, according to EPA Methods 6010B and 7471A (mercury, soil) or 7470A (mercury, aqueous);
- Hexavalent chromium, according to EPA Method 7196 and,
- Cyanide, according to EPA Method 9014.

3.10 PROPOSED PROJECT PERSONNEL

Experienced and qualified professionals with appropriate licensure or certification will be responsible for the coordination and implementation of the investigation. Subcontractors utilized during this investigation will be required to be in compliance with appropriate licenses or certifications required by their applicable regulatory agency.

Personnel conducting fieldwork at the Site will be required to have obtained at a minimum, the 40-hour hazardous waste site worker training program course, with an annual eight-hour refresher course conducted in the past year, in compliance with regulations set forth in 29 CFR Part 1910.120. MACTEC will verify and document that personnel have the necessary training and certifications prior to the implementation of the project.

3.10.1 Proposed Drilling Subcontractor

Drilling services are proposed to be provided by A.E. Drilling Services, LLC and/or Parratt Wolff, Inc. The address and telephone number for these subcontractors are as follows:

A.E. Drilling Services, LLC
Two United Way
Greenville, South Carolina 29607
(864) 288-1986

Parratt Wolff, Inc.
501 Millstone Drive
Hillsborough, North Carolina 27278
(919) 644-2814

3.10.2 Proposed MIP/LIF/HPT Subcontractor

The MIP, LIF, and HPT activities are proposed to be provided by Zebra Environmental Corporation. The address and telephone number for Zebra Environmental is as follows:

Zebra Environmental Corporation
4205 Newington Hills Way
Cary, North Carolina 27513
(919) 424-6122

3.10.3 Proposed Analytical Laboratory

Samples collected for laboratory analysis are proposed to be submitted for analysis to Prism Laboratories, Inc. (Prism) in Charlotte, North Carolina. The address and telephone number for Prism are as follows:

Prism Laboratories, Inc.
Post Office Box 240543
Charlotte, North Carolina 28224
(800) 529-6364

3.11 EQUIPMENT AND PERSONNEL DECONTAMINATION PROCEDURES

Sampling, drilling and other field equipment will be decontaminated in general accordance with SESD Operating Procedure *Field Equipment Cleaning and Decontamination*, effective November 1, 2007, to assure sample integrity. Personnel decontamination procedures are described in the HASP. We anticipate conducting field activities in Level D personal protective equipment (PPE). However, Site personnel will be prepared to don Level C PPE if warranted by Site conditions.

3.11.1 Specifications for Cleaning Materials

Specifications for standard cleaning materials referred to in this section are as follows:

- Soap will be a standard brand of phosphate-free laboratory detergent such as Liquinox®.
- Distilled water will be used as a water source for decontamination of hand-held equipment.
- Potable water will used as a water source for decontamination of the downhole mechanical drilling equipment.

3.11.2 Disposal of Equipment/Personnel Decontamination IDW

IDW generated during equipment and/or personnel decontamination activities, such as Tyvek® suits, gloves, and paper towels, will be bagged and placed in a commercial dumpster for disposal at a permitted landfill.

3.11.3 Safety Procedures for Field Cleaning Operations

Some of the materials used to implement the cleaning procedures outlined in this section can be harmful if used improperly. Field personnel will exercise caution and applicable safety procedures contained in the HASP will be followed when handling cleaning materials. At a minimum, the following precautions will be taken in the field during these cleaning operations:

- Safety glasses with splash shields or goggles, and nitrile gloves will be worn during cleaning operations.
- Eating, smoking, drinking, chewing, or hand to mouth contact will not be permitted during cleaning operations.

3.11.4 Drilling Equipment

The drilling contractor will construct a bermed, plastic-lined decontamination pit. Drilling equipment will be decontaminated prior to use with a steam cleaner. Brushes will be used to remove soil from the equipment, as necessary. Fluids and solids from decontamination procedures will be containerized as IDW, according to the procedures described in Section 3.7.

4.0 REPORTING

Upon completion of the additional source area assessment (Section 3.1), a Remedial Investigation report will be prepared in accordance with the IHSB *Guidelines*. After a Site-specific list of COCs is established, the NAPL assessment (Section 3.2) and groundwater plume delineation in overburden (Section 3.3) will be conducted. The results of the NAPL assessment and overburden groundwater plume delineation will be communicated with the IHSB for the purpose of determining placement of bedrock wells. Future reporting milestones will be provided in future submittals, and will be dependent on the scope of the next mobilization or phase of work. We do not anticipate submittal of Remedial Investigation reports upon completion of each mobilization or phase of work. Rather, we propose to provide a report(s) upon completion of significant phases or milestones of assessment, which will be communicated to NCDENR.

5.0 ANTICIPATED SCHEDULE

The following is a tentative schedule for implementation of the activities described and anticipated in this Work Plan:

- Submittal of Phase II RI Work Plan to IHSB – April 2, 2010
- IHSB approval of Phase II RI Work Plan (4 weeks) – May 3, 2010
- Prepare and send access agreements for off-site overburden monitoring wells and DPT borings – May 10, 2010
- Additional source area assessment (field activities; 1 week) – mid to late May 2010
- Receipt of laboratory analytical results (2 weeks) – mid June 2010
- Source area assessment report including NAPL investigation plan submitted to IHSB – July 23, 2010
- Progress meeting with IHSB – early August 2010
- List of Site-specific COCs established and approval of NAPL investigation plan (4 weeks) – early September 2010
- NAPL investigation and overburden plume delineation (field activities; 8 weeks) – late September 2010 through late November 2010
- Receipt of laboratory analytical results (2 weeks) – mid December 2010
- Determine location of bedrock wells (correspondence with IHSB; 2 weeks) – early January 2011
- Bedrock investigation (12 weeks) – mid January 2011 through mid April 2011
- Remedial investigation report (8 weeks) – mid June 2011

This schedule is dependent upon regulatory review periods (each assumed to be four weeks, where applicable), obtaining access agreements, weather, and subcontractor availability. If additional monitoring wells are necessary to delineate the overburden groundwater plume, the schedule for the subsequent Phase II RI components will be extended. Modifications to the schedule will be documented in written correspondence (letter or email) to the IHSB.

6.0 CERTIFICATIONS

I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate and complete.

Matthew E. Wallace

SEAL 24933 4/2/10

Matthew E. Wallace, P.E.
North Carolina P.E. #24933
Principal Engineer
MACTEC Engineering and Consulting, Inc.

Before me personally appeared Matthew E. Wallace to me known and known to me the person described in and who executed the foregoing instrument, and acknowledge to and before me that he executed said instrument for the purposes therein expressed.

CHRISTINA G. GAULDIN
My Comm. Exp. August 24, 2013

WITNESS my hand and official seal this 2 day of April A.D., 2010.
Notary Public Christina G Gauldin
My commission expires 8-24-2013.
STATE OF North Carolina, COUNTY OF Buncombe

I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate and complete.

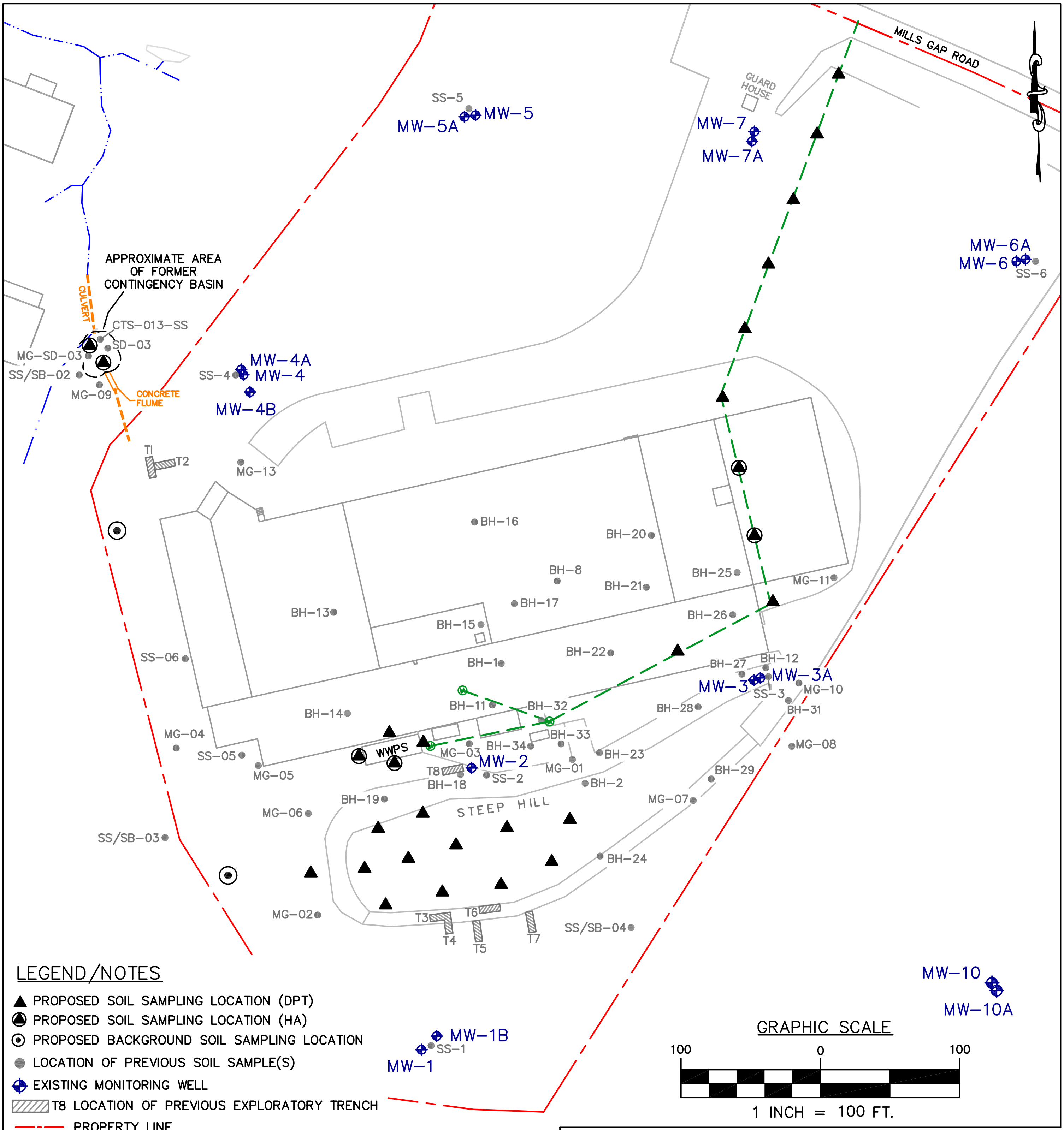
CTS Corporation
Richard G. Cutter
VicePresident, Secretary and General Counsel

Before me personally appeared Richard G. Cutter to me known and known to me the person described in and who executed the foregoing instrument, and acknowledge to and before me that he executed said instrument for the purposes therein expressed.

WITNESS my hand and official seal this 1st day of April A.D., 2010.
Notary Public Lucinda A Bullock
My commission expires Aug 25, 2012.
STATE OF Indiana, COUNTY OF Elkhart.

LUCINDA A. BULLOCK
Elkhart County
My Commission Expires
August 25, 2012

FIGURES



LEGEND/NOTES

- ▲ PROPOSED SOIL SAMPLING LOCATION (DPT)
- ⏶ PROPOSED SOIL SAMPLING LOCATION (HA)
- ⊙ PROPOSED BACKGROUND SOIL SAMPLING LOCATION
- ● LOCATION OF PREVIOUS SOIL SAMPLE(S)
- ⊕ EXISTING MONITORING WELL
- ▨ T8 LOCATION OF PREVIOUS EXPLORATORY TRENCH
- –·– PROPERTY LINE
- – – – APPROXIMATE LOCATION OF SANITARY SEWER

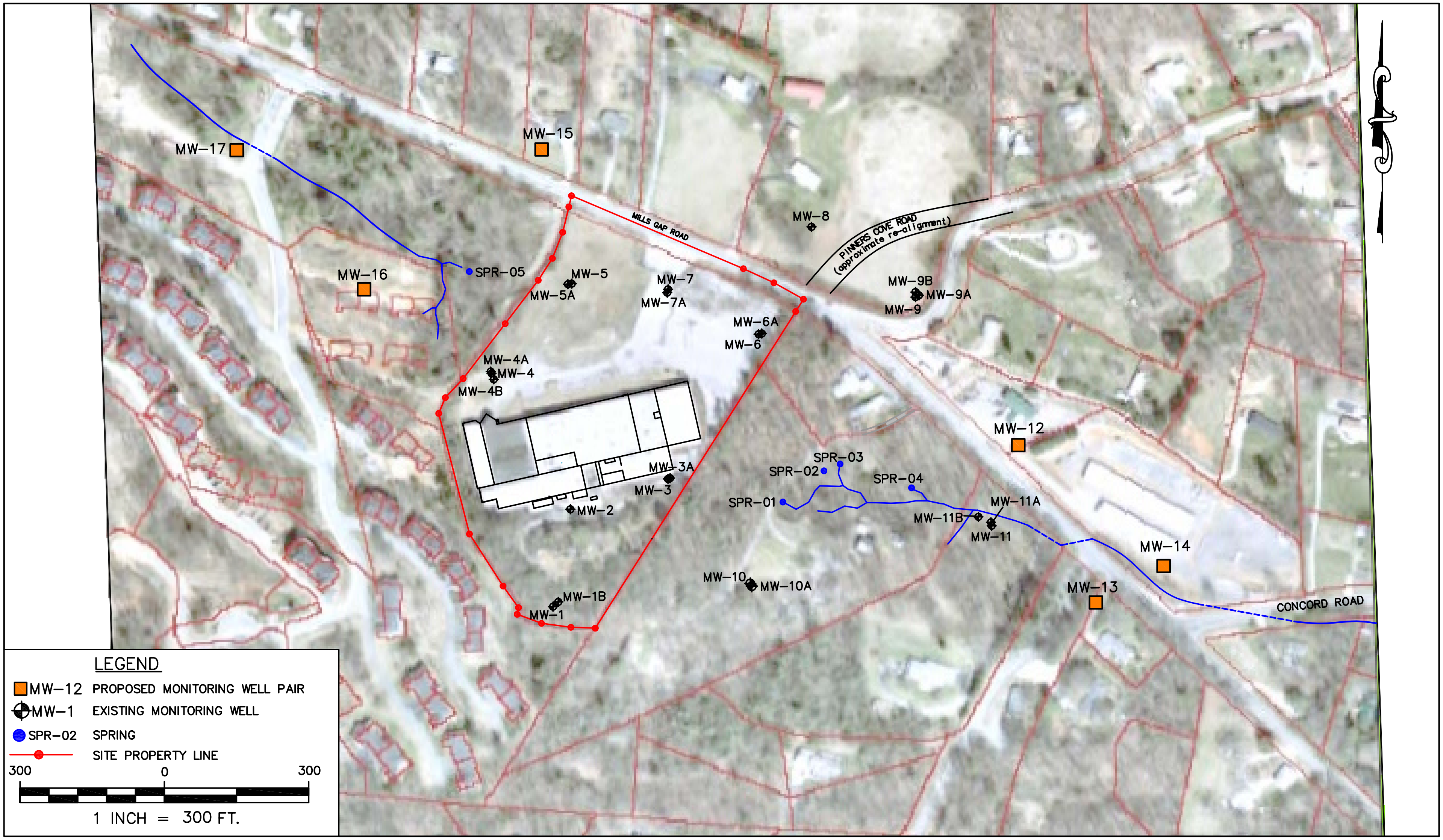
- "MG", "SS/SB", "SD", and CTS−013−SS sample locations are approximate.
- "BH" sample locations have been surveyed, with the exception of BH−2 and BH−12.
- DPT − direct−push technology (Geoprobe); HA − hand auger
- WWPS − waste water pre−treatment system

MACTEC
ENGINEERING AND CONSULTING, INC.

PROPOSED SOIL SAMPLE LOCATIONS
MILLS GAP ROAD SITE
SKYLAND, NORTH CAROLINA

DRAWN: SEK	DATE: APRIL 2010
DFT CHECK: MEW	SCALE: 1" = 100'
ENG CHECK: −−	PROJ: 6686081744
APPROVAL: MEW	FIG: 1

REFERENCE:



PROPOSED MONITORING WELL LOCATIONS
MILLS GAP ROAD SITE
SKYLAND, NORTH CAROLINA

MACTEC
ENGINEERING AND CONSULTING, INC.

DRAWN: SEK	ENG CHECK: --	DATE: APRIL 2010	PROJECT: 6686-08-1744
DFT CHECK: MEW	APPROVAL: MEW	SCALE: 1" = 300'	FIGURE: 2

REFERENCE: 2006 AERIAL PHOTOGRAPH FROM BUNCOMBE COUNTY GIS WEBSITE.