Hart & Hickman
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Via E-Mail and FedEx

September 20, 2007

Nicole Comick-Bates, Brownfields Project Manager
U.S. Environmental Protection Agency – Region 4
Waste Management Division
Economic Redevelopment and Community Involvement Branch
61 Forsyth Street, S.W.
Atlanta, GA 30303

and

Margaret Crowe
U.S. Environmental Protection Agency – Region 4
Waste Management Division/ Brownfields Program
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

Re: Analysis of Brownfield Cleanup Alternatives, September 20, 2007
Brownfield Assessment Project, City Of Raleigh
500 E. Davie Street
Raleigh, North Carolina, BF-96416704-0
H&H Job No. RAL-001

Dear Ms. Bates & Ms. Crowe:

On behalf of the City of Raleigh in fulfillment of their obligations under their Brownfield Assessment Grant with the U.S. Environmental Protection Agency (BF-96416704-0), Hart & Hickman is pleased to submit the attached Analysis of Brownfield Cleanup Alternatives for the 500 E. Davie Street Site dated September 20, 2007.

This report has been sent electronically and followed up with a hard copy and CD via FedEx.

We look forward to our continuing work with you. I can be reached on my direct line at 919-847-4241 or via email at seckard@harthickman.com should you have any questions or require additional information regarding this report.

Sincerely,

Hart & Hickman, PC

Sharon Poissant Eckard

Sharon Poissant Eckard, PG
Senior Consultant

Bruce K Hickman

Bruce K. Hickman, PE
Principal Engineer

Attachment: ABCA, 500 E. Davie Street

Copy: Ms. Alysia Bailey-Taylor, City of Raleigh Planner II/Strategic Planner
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Analysis of Brownfields Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina

H&H Job No. RAL-001

September 20, 2007

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Analysis of Brownfields Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
September 20, 2007

H&H Job No. RAL-001

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Analysis of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
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1.0 Introduction and Background

Hart & Hickman, PC (H&H) has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) for the 500 E. Davie Street Site ("the subject site") on behalf of the City of Raleigh under the City's US EPA Region 4 Brownfield Assessment Grant (BF-96416704). This ABCA report was prepared to identify and evaluate cleanup alternatives to mitigate potential risks to future site users.

The City of Raleigh intends to address eligible cleanup activities for the 500 E. Davie Street site under their Brownfield Cleanup Revolving Loan Fund (BCRLF). In order to initiate this process, cleanup cost estimates for the site are provided in this report. They were prepared based on site assessment data gathered by H&H during the Phase II Site Assessment ESA conducted at the property in December 2006 through January 2007 (H&H, March 2, 2007), and assumptions noted herein.

1.1 Site Description

The subject site is a 0.83-acre parcel of land with idle commercial buildings historically divided into four (4) separate parcels referred to as 500, 502-504 and 510 E. Davie Street, and 411 East Street. The combined site is now listed in the county tax roll as 500 East Davie Street. Structural improvements at the site consist of three one-story rectangular brick buildings with adjoining walls and structural steel roofing.

The subject site and associated buildings are currently unoccupied, but were utilized for a variety of commercial and community-based operations from about 1930 through 2005. These included automotive repair and maintenance, laundry and dry cleaning operations, vending machine operations, and a vehicle repossession service.

A site location map is included as Figure 1. This site is located within a mixed commercial and residential neighborhood near, but not within, the Southeast Raleigh Historic District. The subject site is bounded by E. Davie Street to the north, the Rex Senior Health Center (512 E. Davie Street) to the east, a vacant lot and residential area along E. Cabarrus Street to the south, and the new mixed use Carlton Place residential condominium and commercial development that encompasses the entire city block to the west along S. East Street. The Carlton Place site was historically known as the Klyman Estate property and was used for a variety of commercial operations, including auto repair, welding shops, gasoline service stations, auto sales, and dry cleaning.

Redevelopment of the site is still in the conceptual stages, but currently, the site is planned as a future mixed use development with the potential for residential or other sensitive uses. It is presumed for the purposes of this ABCA that the existing buildings will be demolished during redevelopment. The site is currently owned by the City of Raleigh although the City is planning to sell the property.

1.2 Site History

Based upon the information obtained and reviewed from multiple historical City Directories and Sanborn Maps, the subject site was originally developed as residential property from as early as 1909 until about 1930. Some commercial development occurred at the site by 1914. The existing structures appear to have been originally developed in 1930.

On-site use of the building at 510 E. Davie Street has historically been primarily automotive repair from at least the 1940s through the 1970s. The City of Raleigh evidently operated a vehicle maintenance shop at this location from 1945 through 1949. It appears that another site owner, Sanders Motor Co., may have serviced trucks at this facility from 1950 through the 1970s. After the property was purchased by J.W. Stone & Associates in the 1980s, the site was used to store vehicles collected as part of their repossession service operation.

Laundry and dry cleaning operations were conducted at the site initially at 411 S. East Street and then at 500 E. Davie Street from at least 1940 through 1950. Other historic uses for portions of the subject site included an automotive garage for Raleigh Linen Supply, a wine distribution facility, a vending machine operation, and community church-based functions.

2.0 Summary of Site Characterization and Environmental Impacts

2.1 Previous Environmental Investigations

Recent reports and project plans for the site prepared by H&H as part of the Brownfields assessment activities include:

- Hart & Hickman, PC. May 22, 2006. *Phase I Environmental Site Assessment Report, Commercial Buildings, 500 East Davie Street*, Raleigh, NC.
- Hart & Hickman, PC. October 17, 2006. *Quality Assurance Project Plan, Commercial Buildings, 500 East Davie Street, Rev. 1,* Raleigh, NC.
- Hart & Hickman, PC. March 2, 2007. *Brownfield Phase II Site Assessment Report, Commercial Buildings, 500 East Davie Street,* Raleigh, NC.

In addition, three previous reports were prepared by others for the site:

- GeoLogix, April 26, 2000. *Phase I Environmental Site Assessment for John Stone Property, 500 E. Davie Street*, Raleigh, North Carolina.
- Leo F. Campbell, P.E., November 3, 2001. *Structural Inspection Report, 505 E. Davie Street*, Raleigh, North Carolina.
- Leo F. Campbell, P.E, September 29, 2002. *Structural Inspection Report, 505 E. Davie Street,* Raleigh, North Carolina.

2.2 Site Lithology

Fourteen continuous soil cores were collected with a DPT rig during the Phase II Site Assessment activities (H&H, March 2, 2007). Three of the soil borings were converted into monitoring wells (MW-2, MW-3, and MW-5). Borings MW-1 and MW-4 were originally intended as monitoring wells, but were not completed due to shallow DPT refusal. The Phase II soil boring and monitoring well locations are shown on Figure 2 along with the locations of

monitoring wells installed by others (KMW-5 and KMW-6) as part of an off-site investigation for the former Klyman property immediately west of the site.

Logs of soil borings advanced at the site indicate the presence of orange-brown and tan to white, interbedded silty sands, sandy clays, and clayey sands to the depths investigated. Screened intervals in the monitoring wells installed during the Phase II activities intersect primarily silty sands with some variability in grain size from fine to medium silty sands in MW-2, interbedded fine sandy clay to fine silt and medium silty sands in MW-3, and interbedded sandy silts to coarse silty sands in MW-5 (Table 1).

DPT refusal varied across the site and ranged from as shallow as 2.5 to 29 feet below ground surface (bgs). Refusal was encountered at 2.5 feet and 16.5 feet bgs at MW-1 in the northeast area of the site, and 29 ft bgs at MW-5 along the southern property boundary.

2.3 Site Ground Water Elevations and Estimated Flow Direction

Ground water at the site was investigated in late 2006/early 2007 through the installation of three monitoring wells (MW-2, MW-3, and MW-5). In addition, water levels were measured in a nearby existing off-site monitoring well (KMW-6) that was installed by others as part of an off-site investigation. KMW-5, which was also installed by others as part of this same off-site investigation and is reportedly located at the rear (southwest) of the property could not be located during site assessment activities and was, therefore, not included in the site assessment.

Depth-to-ground water measurements were collected from the site monitoring wells on December 13, 2006 and January 19, 2007 to calculate ground water elevations and assess ground water flow direction across the site. Well construction details and calculated ground water elevations are provided in Table 1. Depth-to-ground water in on-site wells ranged from 14.68 ft

beneath the top of casing (btoc) in MW-3 to 21.08 ft btoc in MW-5. Ground water elevations on-site ranged from 277.11 ft to 280.27 ft above mean sea level (MSL).

A ground water elevation contour map was generated from the January 19, 2007 data to evaluate ground water flow direction at the site (Figure 3). Ground water elevations obtained from the site monitoring wells infer a shallow ground water flow direction to the south-southeast. This is consistent with the topographic gradients in the area and with technical reports prepared by others for the former Klyman Estate (Carlton Place) site as discussed in the Phase I ESA report (H&H, May 22, 2006).

2.4 Characterization of Environmental Impacts

Potential sources of contamination that were evaluated during the 2006/2007 Brownfield Phase II Site Assessment include potential petroleum-related impacts from a suspect orphan UST, historic on-site automotive repair, vehicle maintenance, historic off-site operations, and coal storage operations; potential chlorinated solvent impacts from historic on-site and off-site dry cleaning and vending machine operations; and potential metals impacts from former on-site and off-site operations. To evaluate these potential sources, soil, sump sediment, ground water, and standing water samples were collected in selected areas, as described in the *Brownfield Phase II Site Assessment Report* (H&H, March 2, 2007). The Phase II assessment sample locations are provided on Figure 2.

Screening Levels Used for Evaluation of Data

The following discussion provides the rationale for the selection of regulatory screening levels presented in this ABCA. Future land use decisions for the site have not yet been finalized. Currently, conceptual plans are expected to include future residential or other sensitive population use. The comparison of the site analytical data to the various applicable standards noted below is presented in Table 2 and in Figure 4. If future site redevelopment excludes

residential or sensitive population uses, the less stringent industrial/commercial soil screening levels would apply.

Petroleum Constituents in Soil - Consistent with current UST Section Guidelines (NC DENR, *UST Section Guidelines for Site Checks, Tank Closure and Initial Response and Abatement*, July 1, 2007), concentrations of UST-related petroleum compounds in soil were compared to NC DENR Soil to GW MSCCs. These soil detections are also compared with EPA Region 9 Industrial PRGs and NC DENR SRGs for comparison purposes for use in redevelopment planning.

Consistent with recent UST Section Guidelines (*UST Section Guidelines for the Investigation and Remediation of Contamination from Non-UST Petroleum Releases*, July 1, 2007a), concentrations of petroleum compounds in soil not related to a UST were also compared to NC DENR Soil to GW MSCCs,

Non-Petroleum Constituents in Soil - In the instances where DENR has not specified Soil to GW MSCCs for the compounds detected in site soil, the detections were compared to NC DENR Inactive Hazardous Sites Soil Remedial Goals (SRGs) and EPA Region 9 Residential and Industrial Preliminary Remedial Goals (PRGs). Metals concentrations in site soils are also compared to NC background concentrations in soil (DENR, August 2006).

Constituents in Ground Water - Concentrations of constituents detected in site ground water are compared to NC 2L ground water standards, NC Gross Contaminant Levels (GCLs), and federal MCLs. Metal constituents in site ground water are also compared to reported background concentrations of metals in NC ground water (DENR, August 2006).

Analytical Results

Analytical results for soil and sump sediment samples exceeding regulatory screening levels are summarized on Table 2 and presented on Figure 4. Analytical results for ground water and standing water samples are summarized in Table 3 and depicted on Figure 5. The extent of impacts based on these data is discussed in the following subsections.

2.4.1 Extent of Impact from Suspect UST

As part of site assessment activities, a suspect on-site orphan UST was identified under the sidewalk along the front of the building on an historic Sanborn Map. A ground-penetrating radar (GPR) survey was conducted during the Phase II ESA (H&H, March 2, 2007), which identified one anomaly consistent with the suspected location of the UST from the Sanborn Map.

An up gradient soil boring (SB-1) and a down gradient monitoring well (MW-1) were planned at the UST location. DPT refusal at the planned monitoring well MW-1 location (at depths ranging from 2.5 to 16.6 feet bgs) prior to encountering ground water prohibited collecting a ground water sample.

Target parameters were not detected in the soil sample collected from SB-1 at a depth of 7-8 feet bgs. Constituent detections in the ground water sample collected from nearby MW-2 are less than their respective NC 2L standards. Available ground water elevation data suggest that MW-2 is cross-gradient of the suspect UST. In summary, no soil or ground water impacts have been confirmed relative to the suspect UST location.

2.4.2 Shallow Soil Impacts

Chlorinated and non-chlorinated solvent compounds were not reported above their respective reporting limits in the soil samples submitted for analysis (Table 2). Shallow soil petroleum

impacts were identified in the area of disturbed concrete at the terminus of the pipe trench (SB-9). Samples collected from this location are impacted with petroleum hydrocarbons in excess of NC Soil to GW MSCCs (Figure 4). Concentrations of petroleum hydrocarbons in sample SB-2, although below these regulatory screening levels, suggest that the pipe trench that runs from the area around SB-9 to Sump 2 may be a conduit for contaminant migration.

Concentrations of total chromium and arsenic in excess of regulatory screening levels were reported in site soil samples collected during Phase II assessment activities from SB-2 (0-2 ft bgs), SB-3 (2-4 ft bgs), and SB-10 (6-8 ft bgs). SB-2 and SB-3 were located adjacent to the two interior sumps, and SB-10 was located within an area of disturbed concrete (Table 2 and Figure 4). However, concentrations of chromium and arsenic are consistent with the reported background range of naturally occurring chromium and arsenic in NC soils (NC DENR, August 2006) and do not exceed their respective NC SRGs.

The soil directly beneath the sumps was not sampled as part of this assessment. The integrity of the base of the sumps is unknown. For the purposes of the ABCA, we have assumed that the soil surrounding the two sumps and the pipe trench between Sump 2 and the area around SB-9 may be impacted with petroleum hydrocarbons and elevated metals.

In addition to the identified soil impacts, we have assumed for purposes of this ABCA that impacted soil may also be encountered in other areas during site redevelopment. Contingent impacted soil, if encountered, will be properly managed using cleanup goals developed in accordance with applicable regulations and guidance.

2.4.3 Extent of Ground Water Impacts

Organic constituents were not detected above their respective reporting limits in the ground water samples collected at the site, except at MW-2 (Table 3). Organic constituent detections at MW-2

were below screening levels. Chromium and lead were analyzed (Table 3, Figure 5) based on ground water detections by others at off-site locations and the potential for releases from historic on-site operations. Chromium was reported just under or in excess of the NC 2L ground water standard for chromium of 50 micrograms per liter (ug/L) only in well MW-2 (49 ug/L and 81 ug/L in duplicate). Lead was reported in excess of the NC 2L ground water standard of 15 ug/L in MW-2 (71 ug/L and 170 ug/L in duplicate).

Reported background concentrations of chromium and lead in NC ground water are <25 ug/L and <10 ug/L, respectively (DENR, August 2006). Therefore, the concentrations of chromium and lead in MW-2 also exceed reported background concentrations. It is important to note that the ground water samples were not filtered in the field so that the metals concentrations in these samples may include a contribution from colloidal particles suspended in the sample in addition to that dissolved in the samples.

2.4.4 Extent of Standing Water Impacts

Organic constituents were not detected in the standing water sample collected from the Boiler Room floor (Table 3, Figure 5). Chromium and lead were analyzed for in the standing water sample collected from the Boiler Room. The chromium concentration was below the NC 2L ground water standard, while the lead concentration (25 µg/L) exceeded the NC 2L standard (15 µg/L).

Based on the calculated elevation of the standing water in the Boiler Room relative to the measured elevation of ground water at the time these samples were collected, the standing water does not appear to be hydraulically connected to ground water and is likely to be the result of rainwater flowing into the Boiler Room through leaks in the building. Because this water is not hydraulically connected to ground water, NC 2L ground water standards are not applicable. The

base of the Boiler Room is believed to be concrete. Therefore, the extent of the standing water is limited to the Boiler Room and likely does not affect subsurface soil or ground water.

2.4.5 Extent of Sump Sediment Impacts

One sump sediment sample was collected from within each of the two interior sumps (Figure 4) as part of the Phase II site assessment. No organic constituents were detected in the sediment samples submitted for analysis (Table 2), with the exception of acetone and methyl ethyl ketone (MEK). These compounds are considered to be lab contaminants as explained in the 2007 *Phase II Assessment Report* (H&H, March 2, 2007), and are not discussed further in this ABCA.

Concentrations of arsenic, cadmium, chromium, lead, and mercury in sump sediment samples exceeded one or more regulatory criteria (Table 2, Figure 4). Metals concentrations in sump sediment samples were not compared to natural NC background concentrations because the sediments are not native deposits.

2.4.6 Former Coal Pile Detections

A sample of residual coal material identified as "Coal Bin" was analyzed for polynuclear aromatic hydrocarbon (PAH) compounds. PAH concentrations were detected in this sample below reporting limits and below regulatory screening levels identified on Table 2 for these compounds. A shallow soil sample collected immediately adjacent to the coal bin (SB-8) did not detect VOCs or PAHs above their respective reporting limits.

2.4.7 Summary of Impacts

In summary, based on the Phase II assessment activities, UST-related impacts have not been identified at the site. Further evaluation of potential impacts from the UST should be evaluated

during redevelopment of the site. Identified non-UST soil impacts above screening levels are limited to detections of naphthalene and 2-methylnaphthalene in soil sample SB-9 (0-2 ft). These results suggest that the shallow soil along this pipe trench may also be impacted with petroleum hydrocarbon compounds in excess of regulatory screening criteria.

Sump sediments are impacted with elevated concentrations of metals, including total chromium, lead, arsenic, cadmium, and mercury. Testing for disposal purposes, removal and proper disposal of sump sediment is necessary. Shallow soil directly beneath the sumps may be impacted by petroleum hydrocarbons and metals.

Impacts to ground water above screening levels are limited to metals at one location (MW-2). Standing water in the Boiler Room and residual coal materials do not appear to have impacted the site. Removal and proper disposal of these residual materials from the site should be performed as part of redevelopment operations.

3.0 Cleanup Goals and Objectives

3.1 Cleanup Goals

As discussed in Section 2.0 of this ABCA and presented in Tables 2 and 3, contaminants of concern are present in on-site shallow soil, sump sediment, ground water, and standing water in the subsurface Boiler Room at concentrations exceeding regulatory screening levels.

Currently, the site is planned as a future mixed use development with the potential for residential or other sensitive uses. It has not been decided, although it is presumed for the purposes of this ABCA that the existing buildings will be demolished during redevelopment. Therefore, H&H has established cleanup objectives based on conservative assumptions of future site uses including residential, school, or daycare uses. If only commercial uses are planned for the site, less stringent cleanup goals will likely apply.

The primary cleanup objective for the site in the context of a Brownfields redevelopment is to reduce or prevent potential risk to future site workers and site users. The identified impacts to soil and ground water pose a potential risk to site construction workers and future site users via direct exposure and ingestion. Because VOCs have not been identified as primary contaminants of concern, vapor intrusion is not a risk pathway of concern.

3.1.1 UST Closure Goals

The cleanup goals pertaining to the suspected UST at the site are based on DENR, *Underground Storage Tank Section Guidelines for Site Checks, Tank Closure, and Initial Response and Abatement*, July 1, 2007. The UST guidelines address UST closure, release response, and abatement activities that would apply to UST closure at the site. The UST guidelines also establish Soil to Ground Water MSCCs, and health-based regulatory threshold levels for

residential and industrial/commercial land uses. Based on available site data, H&H believes that NC DENR UST Section will classify the suspect UST as low risk.

Although no impacts have currently been identified in the vicinity of the suspect UST, soil impacts may be encountered during UST closure. If shallow soil impacts are discovered, the soil will be evaluated using the NC DENR UST Section Guidance (July 1, 2007) and the applicable cleanup goals based on the future use of the property. If the site will include residential or other sensitive uses, the cleanup goals will be the most stringent in effect at that time through the UST Section. If the site will be classified as industrial/commercial, the cleanup goals for UST-impacted soil may be based on industrial/commercial soil cleanup levels specified in the NC DENR UST Section Guidance (July 1, 2007.)

3.1.2 Non-UST Soil Cleanup Goals

Non-UST soil cleanup goals address the remediation of two identified on-site sources: 1) shallow soil underlying the sumps, pipe trench, and area around soil boring SB-9, and 2) contingent soil contamination that may be encountered during redevelopment construction activities.

Cleanup goals for soil impacted with contaminants from these sources, are based on the *UST Section Guidelines for the Investigation and Remediation of Contamination from Non-UST Petroleum Releases* (UST Section, July 1, 2007a). NC DENR background concentrations of metals in soil will also be considered.

3.1.3 Sump Sediment Cleanup Goals

Sump sediment has accumulated in two interior sumps over a period of time. There is no specific regulatory cleanup goal for the sump sediment, other than analytical requirements to determine proper disposal of the material. Because total metals concentration of the sediment

samples exceed the 20:1 rule, Toxic Characteristic Leaching Procedure (TCLP) testing must be performed to determine if the sediment is characteristically hazardous. Results of TCLP analyses will be compared with the threshold regulatory levels in EPA's Maximum Concentration of Contaminants for the Toxicity Characteristic to make the proper disposal determination.

3.1.4 Ground Water Cleanup Goals

Based on the results of the Phase I ESA (H&H, May 22, 2006) and a search of the Wake County Ground Water Information Management System *(http://imaps.co.wake.nc.us/GIMS_INT)* conducted for the Site Receptor Survey, private or public water supply wells are not located within 1,000 feet of the subject site. Municipal water is supplied to the site and the site vicinity.

An urban creek is present approximately 300 feet to the south of the subject site's southern boundary at the intersection of E. Cabarrus Street and S. East Street. Because ground water constituents are not present in excess of NC ground water standards and/or are not reported at the down gradient edge of the property, migration of ground water constituents in significant concentrations from the subject site to the creek is unlikely.

Depth to ground water at the site ranged from approximately 15 to 21 feet bgs in the three on-site monitoring wells gauged in December 2006 and January 2007. Ground water was not encountered in the borings drilled through the building concrete foundation down to a depth of 20 feet in SB-3. Consequently, it is not anticipated that ground water would be encountered during site construction activities. Therefore, with respect to ground water, there is an incomplete pathway for site construction/utility workers and the concentrations of detected VOCs are below screening levels.

Therefore due to the low concentrations and limited distribution of chemical constituents in ground water, and the absence of ground water receptors, remediation of ground water is not considered further within this ABCA and no cleanup goals are developed.

3.2 Summary of Cleanup Goals

Site cleanup goals will address the suspected UST and associated soil impacts; as well as non-UST petroleum constituents in shallow soil, and non-petroleum constituents in shallow soil. Contaminated sump sediment, residual coal material, and standing water will be tested to determine characteristics needed for off-site disposal. Ground water as currently characterized does not require cleanup.

4.0 Cleanup Alternatives Analysis

4.1 Cleanup Alternatives Development

Based on the evaluation of assessment findings presented in this ABCA and our current understanding of future site uses, H&H developed cleanup alternatives for the suspect UST; shallow soil in the vicinity of the sumps, the pipe trench, the soil around SB-9; and contingent soil impacts that may be discovered during site redevelopment. Alternatives for managing these potential sources are discussed below.

4.2 Remedial Alternatives

The alternatives for mitigating the risks associated with contaminated soil at the subject site are summarized and compared in Table 4. A brief discussion of each alternative is provided below.

No Action

A no-action alternative must be considered as part of the ABCA process. Because of the desire to redevelop the subject site, State requirements for UST source removal or closure in place, and the potential for direct exposure risks to future site workers and site users, the no-action alternative was eliminated from further consideration.

Source Removal and Off-Site Disposal

Source removal and off-site disposal can be applied to contaminated sump sediment, residual coal, and contaminated standing water in the Boiler Room, impacted shallow soil, and soil associated with the suspected UST at the site. In addition, excavation and disposal of impacted soil from unidentified sources may be necessary if such soils are encountered during construction activities.

Capping and/or Institutional Controls

Capping of contaminated soil is a viable remedial alternative that mitigates direct exposure risks posed by contaminated soil. Capping can be used on its own or in concert with source removal methods. Remedial capping materials can vary depending upon site considerations, but their design can include asphaltic paving; layers of geotextile materials, clean fill materials with a vegetated layer, or concrete slab building foundations. Capping is often an integral component in Brownfield remedial actions and is often accompanied by land use restrictions (i.e. institutional control) on the capped area(s).

The properties of the existing concrete slab foundation at the subject site, if retained in the redevelopment process, may allow it to be used as a cap for the subject site in lieu of excavating shallow impacted soil from below the existing foundation. Alternatively, a new building foundation could also serve the same purpose.

In-Situ Soil Remedial Methods

In-situ soil remedial methods are not considered applicable due to the limited volume of impacted soil and shallow depth of contaminated soil. Therefore, in-situ soil remedial methods are not considered further in this document.

4.3 Proposed Remedial Actions

On the basis of effectiveness, technical feasibility, and cost, and assuming potential future residential or sensitive use of the subject site, H&H recommends a combination of remedial approaches as described below.

UST and UST-Related Impacted Soil

The suspect orphan UST must be addressed per NC DENR UST Section requirements. Because ground water in the site vicinity is not used for drinking water purposes, municipal water is

supplied to the site by the City of Raleigh, and currently available data do not suggest an identifiable impact from the suspect UST, we anticipate that NC DENR will classify this as a low risk site. However, because sampling was not conducted below the base of the suspect UST, it is prudent to further evaluate this area. Because there are subsurface utility lines, including a fiber optic cable, within approximately one foot of the suspect UST, and it is in close proximity to the building, we do not recommend attempting to remove or further evaluate the suspect UST until the site is actively undergoing construction for redevelopment.

Available options are to 1) close the UST in place, 2) remove the tank and impacted soil prior to redevelopment, or 3) remove the tank and impacted soil during the active construction phase for redevelopment. Excavation options will require relocating subsurface utilities, including the fiber optic cable. Based on currently available data and UST regulations, it is not anticipated that ground water remediation will be required.

If existing subsurface utilities will not be relocated for redevelopment purposes, the existing UST may be closed in place with approval of NC DENR in lieu of excavation. In the event that the UST and associated soil are removed, soil samples will be collected from the sidewalls and base of the excavation for chemical analysis, and the excavation will be backfilled with clean fill. Soil samples will be required to be analyzed for certain VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), and/or selected metals depending upon the type of suspected contaminant. In addition, a Limited Site Assessment (LSA) and associated monitoring well may be required at the UST location if soil excavation does not remove all of the required soil contamination.

Shallow Impacted Soil

Impacted soil has been identified in the vicinity of SB-9 and may also be encountered beneath the two interior sumps, along the associated pipe trench, and in other areas of the site during redevelopment activities. Previously un-assessed impacted soil that may be encountered during

redevelopment will be characterized and compared to appropriate regulatory standards, and managed using either 1) ex-situ techniques such as excavation and off-site disposal, or 2) manage in place with capping and/or institutional controls, as appropriate. H&H has conservatively assumed that excavation will include removal and off-site disposal of the upper two feet of soil beneath the two sumps, the pipe trench, and the area surrounding SB-9 (Figure 6).

Site Ground Water

Due to the anticipation of a low risk classification for this site and limited ground water impact, H&H does not recommend the remediation of contaminated ground water at the site. Contaminated ground water, if encountered during construction activities, will need to be either contained and disposed of off-site, or treated and discharged under local permitting regulations to the local POTW. The appropriate approach will depend upon the volume of ground water that will need to be addressed.

Sump Sediment

The primary objective is to remove the sump sediment from the two sumps, containerize and properly dispose of the sediment off-site. To evaluate whether the sump sediment will be managed and disposed of as a hazardous waste, TCLP analyses will be required.

Upon removal of the sediment, the base of the sumps will be inspected for cracks or other signs of wear that could provide a pathway for metals or other chemical constituents to migrate from within the sump to the subsurface.

Residual Coal Removal

The site was formerly heated with one coal-fired boiler. The coal storage shed for the boiler is located on the south side of the building adjacent to the Boiler Room. The base of the coal shed is about 6.5 feet bgs and is assumed to be concrete.

The coal shed constitutes a confined space with limited ingress and egress, and the potential for engulfment. Due to limited access to the interior of the shed, coal removal will require dismantling the storage shed to obtain access to the coal. Costs for dismantling the shed are excluded from this analysis.

Once accessible, the residual coal materials in the coal storage shed will be excavated, and transported off-site for proper disposal. H&H estimates that residual coal and coal dust account for approximately 25% to 30% of the volume of the coal shed, approximately one truck load of material.

Upon removal of the residual coal, the base of the coal shed will be inspected for cracks and other signs of wear that may allow for the migration of materials to leach from the coal into the subsurface beneath the coal shed. If this is the case, additional soil sampling for PAH constituents in the soil beneath the coal shed will be undertaken. However, the presence of a roof on the coal shed prevents rain water from percolating through the coal. Therefore, leachate containing chemical constituents from the coal, such as PAHs, and subsequent migration of contaminated leachate from the coal is considered unlikely. Shallow soil in the area surrounding the coal shed was not found to contain PAHs in excess of method reporting limits.

Standing Water Removal

Target chemical constituents reported above regulatory criteria in the standing water sample from the Boiler Room were limited to lead in excess of NC 2L ground water standards. The source of the lead is unknown.

If standing water is found in the Boiler Room upon cleanup activities, the water will be pumped out and containerized for transportation and proper off-site disposal. It is anticipated that the existing buildings will be demolished for redevelopment. However, if the Boiler Room will be maintained after site redevelopment than the root cause of the flooding should be evaluated and addressed.

4.4 Institutional and Engineering Controls

If residual impacted materials are left in place, institutional and engineering controls may be required. Engineering controls can include the placement of barriers such as asphalt paving or building foundations over these areas. Institutional controls are implemented when residual contaminants in excess of regulatory threshold cleanup values remain at a site. This may include a Notice of Residual Petroleum (NORP) through the NC DENR UST Section, which identifies that petroleum constituents remain at a site and prohibits use of the site for residential purposes and the use of site ground water.

4.5 Cost Estimate for Proposed Cleanup Alternative

Cost estimates have been prepared for implementing remedial activities presented in this ABCA. As presented in Table 5 and using the assumptions noted below, the estimated range in costs for the recommended alternative is approximately $96,000 to $146,500, with an in place UST closure, or $115,000 to $192,500, with the UST removal alternative. The ranges in costs are

attributable to assumptions regarding the work to be performed, which are presented below. A 30% contingency item for unknown factors has been applied to the base estimate for the site.

UST Closure

An area of approximately 60 square feet (12 ft x 5 ft) identified via a remote ground-penetrating radar (GPR) survey under the sidewalk along E. Davie Street coincides with the suspect UST location first noted on an historic Sanborn Map. It is located within approximately two feet of the exterior wall of the former warehouse building and within one foot of a subsurface fiber optics line. We presume that only one UST is located within this area. Two options for addressing the UST are estimated herein: 1) closure in place and 2) closure by removal of UST and contaminated soil.

UST activity assumptions include that the UST does not exceed a 2,000-gallon capacity and contains no more than 500 gallons residual water and petroleum sludge; fluids in excess of 500 gallons would be removed and disposed of at an additional cost at a unit rate of $0.40/gallon for water about $1.00/gallon for sludge, and $100/hr for portal-to-portal vacuum truck service.

The closure in place low cost alternative assumes that the UST is accessible, the residual fluids in the UST are within the volume limits noted above, and the UST would be filled with a foam fill material. The high range cost closure in place alternative assumes that fluids and sludge are in excess of 500 gallons with an upper limit of 2,000 gallons.

The low range cost for the UST removal alternative assumes that excavated contaminated soil from UST removal will not exceed 30 tons (1.5 tons/cy). Soil samples include up to two closure samples and six confirmatory samples for analytical testing in accordance with NC DENR UST Section Guidelines (July 1, 2007). The higher range cost assumes an additional 15 tons of soil excavation, transportation, and disposal costs at a rate of $50/ton with additional backfill replacement estimated at $20/ton, four additional soil samples for confirmatory analysis in

accordance with DENR requirements. In addition there is the possibility that the UST was previously closed in place and will require the removal, transportation and disposal of 10 cy of contaminated tank fill sand. This cost is also included in the higher range estimate.

Other assumptions include that subsurface utilities will be relocated during redevelopment activities rendering the UST accessible without damaging structures and utilities during excavation; geotechnical consultation, if necessary, to address issues related to tank removal (if building not demolished) does not exceed $5,000; and ground water will not be encountered during the excavation and closure of the UST. If impacts to ground water are suspected at the time of tank removal or if all residual contaminated soil can not be removed, DENR may require a LSA at the tank pit. Costs for an LSA have been included in the high range estimate for the UST removal scenario only.

Sump Sediment/Sump Closure

Sump sediment removal costs assume TCLP testing and manual excavation of a total of 16 cubic feet of sediment from the two interior (2 ft x 2ft x 2ft) sumps. We have assumed that excavated sediment will be contained in one 55-gallon drum pending analysis and disposed of as a hazardous waste.

For the purposes of this estimate, we have assumed that the base of each of the sumps has been compromised and constituents have leached into the underlying sub-soils. The cost estimate includes the removal of three feet of soil (one bucket width) from the perimeter of each sump and two feet of soil below the base of each sump. Actual excavation depths may vary based on field screening and observations.

Shallow Impacted Soil

Non-UST related shallow impacted soil cleanup assumes the excavation, transportation, and non-hazardous disposal of 85 cubic yards (cy) or 128 tons of contaminated soil (1.5 tons/cy),

including three feet of soil laterally around each sump, SB-9 and the pipe trench (3-ft wide backhoe bucket), and two feet of soil vertically based on field screening. Actual excavation depths may vary based on field screening and observations during excavation. Excavated material will be replaced with clean fill and mechanically compacted with the backhoe bucket. Costs exclude compaction testing.

The low and high cost estimates for this task assume a range of from 100 tons (low estimate) to 250 tons (high estimate) of soil will be excavated, and from 25 to 38 post-excavation confirmatory soil samples will be collected from the non-UST soil excavation areas and analyzed for VOCs, SVOCs, and metals.

Residual Coal

Costs for removing residual coal material assumes 15 tons of residual coal at $62/ton loading, transportation and disposal. The coal shed represents a confined space hazard as it has limited ingress and egress, is not designed as inhabitable space, and presents an engulfment hazard and will need to be demolished prior to residual coal removal. Costs exclude those necessary to dismantle the shed to provide access to the coal.

Boiling Room Standing Water

Standing water in the Boiler Room, if encountered during the site cleanup activities, will be pumped out, containerized, profiled and properly disposed of assuming one 55-gallon drum and non-hazardous disposal. Costs exclude an evaluation of the root cause and remedy to prevent standing water from accumulating in the Boiler Room.

Closure Report

Costs assume that there will be one Closure Report for all the tasks listed above.

Contingent Areas of Impacted Soil

A contingency for encountering currently unidentified areas of impacted soil at the site has been estimated based on excavating and disposing of 100 to 200 tons of non-hazardous soil plus associated confirmation sampling and disposal sampling.

Table 1
Monitoring Well Construction and Water Level Summary
Analysis of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

							December 13, 2006		January 19, 2007	
Well ID	TOC Elevation (ft amsl)	Date Installed	Lithology	Total Depth (ft)	Screen Length (ft)	Effective Screened Interval (ft)	Depth to Water from TOC (ft)	GW Elevation (ft amsl)	Depth to Water from TOC (ft)	GW Elevation (ft amsl)
MW-1[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	295.9	12/05/06	Silty Sand	20	10	8-20	15.89	280.01	15.63	280.27
MW-3	293.61	12/05/06	Interbedded Silt & Sand	20	10	8-20	14.96	278.65	14.68	278.93
MW-4[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-5	298.19	12/05/06	Interbedded Silt & Sand	28.5	20	6.5-28.5	20.98	277.21	21.08	277.11
KMW-6	291.66	Unknown	Interbedded Silt & Sand	20	10	10-20	NM	NM	14.22	277.44

Notes:

1. TOC = Top of Casing; GW = Ground Water; ft amsl - feet above mean sea level
2. NA - Attempts to install MW-1 & MW-4 were made in the proposed areas but met refusal prior to encountering ground water at depths of 2.5 ft, 3 ft, and 16.5 ft bgs (MW-1) and 16.5 ft bgs (MW-4).
3. Triangle Aerial Surveys, Inc. February 2007; TOC measured at west edge of perimeter of each well plug at top of well casing.
4. Monitoring well KMW-6 is an existing well associated with an off-site release, and was not installed as a part of Hart & Hickman's December 2006 500 E. Davie Street Phase II investigation. An available Well Construction Record indicates that this well intersects the shallow water table and is 20 feet deep.

Table 2
Summary of Soil and Sediment Analytical Results
Analysis of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

Boring Location	Suspect UST	Adjacent to Sumps		Interior Soil Borings			Adjacent to Coal Bin	Interior Soil Borings		Sump Sediment		Regulatory Screening Levels			NC DENR Background NC Soils - Range[7]
Sample ID	SB-1 (7-8')	SB-2 (0-2')	SB-3 (2-4')	SB-5 (8-10')	SB-6 (4-6')	SB-7 (2-4')	SB-8 (0-2')	SB-9 (0-2')	SB-10 (6-8')	Sump-2 [8]	Sump-3	NC DENR Soil to GW MSCC[3]	EPA Region 9 Industrial PRG[5]	NC DENR SRG[6]	
Sample Depth (ft)	7-8'	0-2'	2-4'	8-10'	4-6'	2-4'	0-2'	0-2'	6-8'	2'	2'				
Lithology	Silty Sand	Silt w/Mica	Sandy Clay	Sandy Clay/Sand	Sandy Clay	Sandy Clay	Sandy Clay	Clayey Sand	Sandy Clay	Sediment	Sediment				
Date Collected	12/5/2006	12/4/2006	12/4/2006	12/4/2006	12/4/2006	12/4/2006	12/5/2006	12/4/2006	12/5/2006	12/4/2006	12/4/2006				
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
VOCs 8260B															
1,2,4-Trimethylbenzene	<0.011	2.5	<0.010	<0.011	<0.012	<0.0084	<0.0093	<0.011	<0.011	<0.020	<0.02	7.5	170	NS	-----
1,3,5-Trimethylbenzene	<0.011	0.98	<0.010	<0.011	<0.012	<0.0084	<0.0093	<0.011	<0.011	<0.020	<0.02	7.3	70	NS	-----
Acetone	<0.022	0.028	0.024	<0.022	<0.024	0.052	0.18	0.051	<0.022	0.36	1.7 E	2.8	54,000	2,800	-----
Ethylbenzene	<0.0054	0.26	<0.0052	<0.0055	<0.006	<0.0042	<0.0047	<0.0053	<0.0056	<0.01	<0.01	4.6	400	380	-----
Isopropylbenzene (cumene)	<0.011	0.18	<0.010	<0.011	<0.012	<0.0084	<0.0093	<0.011	<0.011	<0.02	<0.02	1.7	2,000	114	-----
Methyl ethyl ketone (MEK)	<0.022	<0.025	<0.021	<0.022	<0.024	<0.017	<0.019	<0.021	<0.022	0.069	0.23	17	110,000	4,400	-----
Naphthalene	<0.0054	0.19	<0.0052	<0.0055	<0.006	<0.0042	<0.0047	0.0078	<0.0056	<0.01	<0.01	0.58	190	11.2	-----
p-isopropyltoluene	<0.016	0.58	<0.015	<0.016	<0.018	<0.013	<0.014	<0.016	<0.017	<0.031	<0.03	NS	NS	NS	-----
Toluene	<0.0054	<0.0062	<0.0052	0.01	<0.006	<0.0042	<0.0047	<0.0053	<0.0056	<0.01	<0.01	7.3	520	132	-----
Xylenes, total	<0.011	0.22	<0.010	0.0026	<0.012	<0.0084	<0.0093	<0.0053	<0.0056	<0.02	<0.02	5	420	54	-----
SVOCs 8270C															
2-Methylnaphthalene	<0.39	<0.41	<0.38	<0.40	<0.41	<0.36	<0.390	28	<0.44	<4.5	<5.6	1.7	NS	11.2	-----
Naphthalene	<0.39	<0.41	<0.38	<0.40	<0.41	<0.36	<0.390	60	<0.44	<4.5	<5.6	0.58	190	11.2	-----
Phenanthrene	<0.39	0.11 J	<0.38	<0.40	<0.41	<0.36	<0.390	<2.0	<0.44	<4.5	<5.6	60	NS	NS	-----
Pyrene	<0.39	0.17 J	<0.38	<0.40	<0.41	<0.36	<0.390	<2.0	<0.44	<4.5	<5.6	290	29,000	460	-----
Bis (2-ethylhexyl) phthalate	<0.39	<0.41	<0.38	<0.40	<0.41	<0.36	<0.390	1.0 J	<0.44	<4.5	<5.6	5.6	120	35	-----
Butyl benzyl phthalate	<0.39	<0.41	<0.38	<0.40	<0.41	<0.36	<0.390	1.5 J	<0.44	<4.5	<5.6	NS/12,000[4]	100,000	2,400	-----
Di-n-butyl phthalate	<0.39	<0.41	<0.38	<0.40	<0.41	<0.36	<0.390	1.5 J	<0.44	<4.5	<5.6	NS	NS	1,220	-----
Metals 6010B															
Chromium (total)	8.7	48	7	8.7	16	10	13	10	72	78	110	27	450	24,000	2 - 150
Lead	19	34	61	16	18	12	17	15	21	810	3,000	270	800	400	7.2 - 52
Arsenic	NA	1.5 J	2.6	NA	NA	NA	NA	NA	NA	18	29	NS/0.39[4]	1.6	4.4	1.6-180
Barium	NA	110	68	NA	NA	NA	NA	NA	NA	390	380	848	67,000	NS	4.1-420
Cadmium	NA	4.7	0.15 J	NA	NA	NA	NA	NA	NA	22	27	NS/37[4]	450	7.4	0.54-5.8
Selenium	NA	< 1.8	< 1.7	NA	NA	NA	NA	NA	NA	< 2.5	< 2.5	NS/390[4]	5,100	78	NS
Silver	NA	< 0.92	< 0.84	NA	NA	NA	NA	NA	NA	< 1.2	< 1.2	0.23	5,100	78	NS
Metals 7471A															
Mercury	NA	0.086	0.12	NA	NA	NA	NA	NA	NA	9.5	1.1	NS/23[4]	310	4.6	0.02-0.16

1. Bold indicates compound exceeds either the NC Soil to Ground Water Maximum Soil Contaminant Concentration or EPA Region 9 Residential PRG.
2. Shading indicates the value exceeds either NC SRG or EPA Region 9 industrial standards.
3. The more stringent NC DENR Maximum Soil to Ground Water Contaminant Concentrations (NC DENR, UST Section Guidelines, July 1, 2007, and non-UST Petroleum Guidelines July 1, 2007a) are used as the primary screening levels for chemical constituents as residential or other sensitive population uses are currently anticipated at the site.
4. EPA Region 9 Residential Preliminary Remediation Goals (October 2004) are provided for comparison purposes when a NC Soil to Ground Water MSCC has not been specified.
5. EPA Region 9 Industrial Preliminary Remediation Goals (October 2004) are provided for comparison purposes for use in redevelopment planning should non-residential uses be incorporated into the final redevelopment plans for the site.
6. NC DENR Inactive Hazardous Sites Branch "Health-Based" Soil Remediation Goals (August 2006) are provided for comparison purposes should non-residential uses be incorporated into the final redevelopment plan for the site.
7. NC DENR Data Table, Background Metals in NC Soils and Groundwater, August 31, 2006
8. Reporting limits increased due to sample matrix interference and/or higher final extract volume
9. VOCs= Volatile Organic Compounds; SVOCs - Semi-Volatile Organic Compounds; PAHs - Polynuclear Aromatic Hydrocarbons; NA - Not Analyzed; NS - Not Specified
   J = Estimated value - analyte detected at a concentration less than the reporting limit and greater than or equal to the method detection limit.
   E= Estimated concentration greater than the instrument calibration range. The concentration is less than the reporting limit for a medium level analysis.
10. Only those compounds detected in at least one sample are shown.
11. There is no soil boring SB-4.

Table 2
Summary of Soil and Sediment Analytical Results
Analysis of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

Boring Location	S. East Street		S. East Street	Rear Yard		Interior Coal Bin	Regulatory Screening Levels			NC DENR Background NC Soils - Range[7]
Sample ID	MW-2 (9-10')	MW-2 Dup	MW-3 (8-10')	MW-4 (6-8')	MW-5 (8-10')	Coal Bin	NC DENR Soil to GW MSCCs[3]	EPA Region 9 Industrial PRG[5]	NCDENR SRG[6]	
Sample Depth (ft)	9-10'	9-10'	8-10'	6-8'	8-10'	-----				
Lithology	Sandy Clay	Sandy Clay	Sandy Silt	Silty Sand	Silty Sand	-----				
Date Collected	12/5/2006	12/5/2006	12/5/2006	12/5/2006	12/5/2006	12/5/2006				
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
VOCs 8260B										
1,2,4-Trimethylbenzene	<0.011	<0.011	<0.013	<0.012	<0.016	NA	7.5	170	NS	-----
1,3,5-Trimethylbenzene	<0.011	<0.011	<0.013	<0.012	<0.016	NA	7.3	70	NS	-----
Acetone	<0.021	<0.023	<0.027	<0.024	<0.032	NA	2.8	54,000	2,800	-----
Ethylbenzene	<0.0053	<0057	<0.0067	<0.006	<0.008	NA	4.6	400	380	-----
Isopropylbenzene (cumene)	<0.011	<0.011	<0.013	<0.012	<0.016	NA	1.7	2,000	114	-----
Methyl ethyl ketone (MEK)	<0.021	<0.023	<0.027	<0.024	<0.032	NA	17	110,000	4,400	-----
Naphthalene	<0.0053	<0.0057	<0.067	<0.006	<0.008	NA	0.58	190	11.2	-----
p-isopropyltoluene	<0.016	<0.017	<0.020	<0.018	<0.024	NA	NS	NS	NS	-----
Toluene	<0.0053	<0.0057	<0.0067	<0.006	<0.008	NA	7.3	520	132	-----
Xylenes, total	<0.011	<0.011	<0.013	<0.012	<0.016	NA	5	420	54	-----
SVOCs 8270C										
2-Methylnaphthalene	<0.39	<0.4	<0.45	<0.39	<0.42	0.25 J	1.7	NS	11.2	-----
Naphthalene	<0.39	<0.4	<0.45	<0.39	<0.42	0.19 J	0.58	190	11.2	-----
Phenanthrene	<0.39	<0.4	<0.45	<0.39	<0.42	0.20 J	60	NS	NS	-----
Pyrene	<0.39	<0.4	<0.45	<0.39	<0.42	< 0.34	290	29,000	460	-----
Bis (2-ethylhexyl) phthalate	<0.39	<0.4	<0.45	<0.39	<0.42	NA	5.6	120	35	-----
Butyl benzyl phthalate	<0.39	<0.4	<0.45	<0.39	<0.42	NA	NS/12000[4]	100,000	2,400	-----
Di-n-butyl phthalate	<0.39	<0.4	<0.45	<0.39	<0.42	NA	NS	NS	1,220	-----
Metals 6010B										
Chromium	0.9	1	20	6.2	13	NA	27	450	24,000	2 - 150
Lead	5.6	4.4	11	22	16	NA	270	800	400	7.2 - 52
Arsenic	NA	NA	NA	NA	NA	NA	NS/0.39[4]	1.6	4.4	1.6-180
Barium	NA	NA	NA	NA	NA	NA	848	67,000	NS	4.1-420
Cadmium	NA	NA	NA	NA	NA	NA	NS/37[4]	450	7.4	0.54-5.8
Selenium	NA	NA	NA	NA	NA	NA	NS/390[4]	5,100	78	NS
Silver	NA	NA	NA	NA	NA	NA	0.23	5,100	78	NS
Metals 7471A										
Mercury	NA	NA	NA	NA	NA	NA	NS/23[4]	310	4.6	0.02-0.16

Notes:

1. Bold indicates compound exceeds either the NC Soil to Ground Water Maximum Soil Contaminant Concentration or EPA Region 9 Residential PRG.
2. Shading indicates the value exceeds either NC SRG or EPA Region 9 industrial standards.
3. The more stringent NC DENR Maximum Soil to Ground Water Contaminant Concentrations (NC DENR, UST Section Guidelines, July 1, 2007, and non-UST Petroleum Guidelines July 1, 2007a) are used as the primary screening levels for chemical constituents as residential or other sensitive population uses are currently anticipated at the site.
4. EPA Region 9 Residential Preliminary Remediation Goals (October 2004) are provided for comparison purposes when a NC Soil to Ground Water MSCC has not been specified.
5. EPA Region 9 Industrial Preliminary Remediation Goals (October 2004) are provided for comparison purposes for use in redevelopment planning if non-residential uses be incorporated into the final redevelopment plans for the site.
6. NC DENR Inactive Hazardous Sites Branch "Health-Based" Soil Remediation Goals (August 2006) are provided for comparison purposes should non-residential uses be incorporated into the final redevelopment plan for the site.
7. NC DENR Data Table, Background Metals in NC Soils and Groundwater, August 31, 2006
8. Reporting limits increased due to sample matrix interference and/or higher final extract volume
9. VOCs= Volatile Organic Compounds; SVOCs - Semi-Volatile Organic Compounds; PAHs - Polynuclear Aromatic Hydrocarbons; NA - Not Analyzed; NS - Not Specified
   J = Estimated value - analyte detected at a concentration less than the reporting limit and greater than or equal to the method detection limit.
   E= Estimated concentration greater than the instrument calibration range. The concentration is less than the reporting limit for a medium level analysis.
10. Only those compounds detected in at least one sample are shown.
11. There is no soil boring SB-4.

Table 3
Summary of Ground Water Analytical Results
Analysis of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

							Regulatory Screening Levels			NC DENR Background NC GW - Range [6]
Sample ID	**MW-2** [7]	**Duplicate MW-2** [7]	**MW-3** [7]	**MW-5**	**Boiler Room**	**Trip Blank**	**NC 2L GW Standards** [3]	**NC GCL Standards** [4]	**Federal MCLs** [5]	
Date Collected	12/13/2006	12/13/2006	12/13/2006	12/13/2006	12/13/2006	12/13/2006				
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
VOCs (SM6210D)										
1, 2, 4 Trimethylbenzene	0.82	1.1	< 0.5	<0.5	<0.5	< 0.5	350	28,500	NS	-----
1, 3, 5 Trimethylbenzene	0.64	0.84	< 0.5	< 0.5	< 0.5	< 0.5	350	28,500	NS	-----
Isopropylbenzene	1.3	1.4	< 0.5	< 0.5	< 0.5	< 0.5	70	25,000	NS	-----
n-Butylbenzene	0.72	0.73	< 0.5	< 0.5	< 0.5	< 0.5	70	6,900	NS	-----
n-Propylbenzene	0.58	0.73	< 0.5	< 0.5	< 0.5	< 0.5	70	30,000	NS	-----
p-Isopropyltoluene	1.4	1.6	< 0.5	< 0.5	< 0.5	< 0.5	NS	NS	NS	-----
sec-Butylbenzene	1.8	2.1	< 0.5	< 0.5	< 0.5	< 0.5	70	8,500	NS	-----
tert-Butylbenzene	1.5	1.6	< 0.5	< 0.5	< 0.5	< 0.5	70	15,000	NS	-----
SVOCs (625)										
All Compounds	<11 to <56	NA	<11 to <56	<11 to <56	<11 to <56	NA	-----	-----	-----	-----
TICs (625)										
Unknown	ND	NA	22	ND	ND	NA	-----	-----	-----	-----
Metals (6010B)										
Chromium (total)	**49**	**81**	1.4 J	2.7 J	1.3 J	NA	50	50,000	100	<25
Lead	**71**	**170**	1.2 J	4.3 J	**25**	NA	15	15,000	15 (tap)	<10
Field Readings										
pH (Standard Units)	6.48	NM	6.71	5.35	NM	NM	6.5-8.5	NS	NS	-----
Temperature (°C)	20.8	NM	20.7	18.3	NM	NM	NS	NS	NS	-----
Specific Conductance (uS/cm)	212.1	NM	451.4	378.9	NM	NM	NS	NS	NS	-----
Dissolved Oxygen (mg/L)	1.32	NM	1.16	0.92	NM	NM	NS	NS	NS	-----

Notes:
1. Bold indicates compound exceeds the NC 2L Ground Water Standards; shading indicates compound exceeds reported background concentrations.
2. NC Gross Contaminant Levels, EPA MCLs and reported NC metals background concentrations in ground water are provided for comparison purposes.
3. NC 2L Ground Water Quality Standards (February 1, 2006)
4. NC Gross Contamination Levels for Ground Water (February 1, 2006)
5. MCL = EPA Maximum Contaminant Level in drinking water (2006)
6. NC DENR Data Table, Background Metals in NC Soil and Ground Water (August 31, 2006)
7. Severe emulsions were noted during sample extraction.
8. NA - Not Analyzed; NS - Not Specified; NM - Not Measured; ND- Not detected; VOCs - Volatile Organic Compounds; SVOCs - Semi-Volatile Organic Compounds; GW = Ground Water.
   J = Estimated value - analyte detected at a level less than the reporting limit and greater than or equal to the method detection limit.
9. Only compounds detected in at least one sample are shown.

Table 4
Comparison of Brownfield Cleanup Alternatives
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

Cleanup Alternative	Effectiveness	Long-Term Reliability	Implementation/ Implementation Risk	Cost Implications
1. No Action	Does not address source removal concerns.	Does not allow for meeting more conservative residential soil cleanup standards in localized areas.	No implementation risk.	No cost implications.
2. Source Removal and Off-site Disposal	Source removal and proper off-site disposal will result in contaminant mass being removed from the site in accordance with state and federal regulations.	High. Once source effectively removed, the area is not subjected to continued releases from the source.	Implementation risk is low. Source removal methods will entail contaminated sump sediment, residual coal, contaminated shallow soil removal and potential excavation of the suspect UST and associated impacted soil using standard operating practices in accordance with state and federal regulations.	Estimated costs range from approximately $96,000 to $193,000 for the site (including 30% contingency).
3. Capping and/or Institutional Controls (IC)	Capping effectively minimizes surface exposure to contaminated soil and prevents the generation of contaminated leachate to ground water. ICs minimize exposure risks by preventing site uses that would allow contact with contaminants.	High. The risk of exposure is minimized when contaminated soil is capped by asphalt or building foundations. Requires some maintenance and proper public notification of Ics.	Implementation risk is low. Capping methods are widely used and proven to be effective. Existing building foundation may qualify for site cap. Risks of using IC minimal if site properly maintained and IC communicated to future owners.	Modest cost implications. Capping costs generally absorbed by site redevelopment construction. Preparation and filing of ICs require moderate amount of coordination with state and county agencies, public notification and administrative labor costs.
4. In-situ Remedies	Effectively remediates VOCs from subsurface soil.	Moderate. Effectiveness drops off as VOC concentrations are reduced through time. Systems require active operations, maintenance and monitoring.	Limited distribution of VOCs in subsurface soil do not drive the need for the installation and operation of in-situ remedial system.	Estimated capital costs are about $50,000, plus yearly costs for operation, maintenance, monitoring, and reporting; expensive option based on limited distribution of VOCs in soil.

Table 5
Summary of Estimated Cleanup Costs
Proposed Cleanup Alternative
500 E. Davie Street
Raleigh, North Carolina
H&H Job No. RAL-001

Task	UST Closure in Place Estimated Costs Low Range		UST Closure in Place Estimated Costs High Range		UST Removal Estimated Costs Low Range		UST Removal Estimated Costs High Range	
Cleanup Plan & H&S Plan	**$ 4,500**	**to**	**$ 6,000**		**$ 4,500**	**to**	**$ 6,000**	
Source Removal & Off-site Disposal:								
Sump Sediment & Sump Closure	$ 5,000	to	$ 7,000		$ 5,000	to	$ 7,000	
Shallow Impacted Soil	$ 25,000	to	$ 35,000		$ 25,000	to	$ 35,000	
Suspect UST Options:								
A. Closure in Place	$ 7,800	to	$ 9,500		$ -	to	$ -	
B. Removal	$ -	to	$ -		$ 22,000	to	$ 30,000	
Limited Site Assessment	$ -	to	$ -		$ -	to	$ 15,000	
Residual Coal	$ 2,500	to	$ 3,500		$ 2,500	to	$ 3,500	
Standing Water - Boiler Room	$ 700	to	$ 1,500		$ 700	to	$ 1,500	
Subtotal - Source Removal & Off-Site Disposal:	**$ 45,500**	**to**	**$ 62,500**		**$ 59,700**	**to**	**$ 98,000**	
Closure Report	**$ 8,500**	**to**	**$ 10,000**		**$ 8,500**	**to**	**$ 10,000**	
Contingent Unidentified Areas of Impacted Soil	**$ 20,000**	**to**	**$ 40,000**		**$ 20,000**	**to**	**$ 40,000**	
Total Tasks:	**$ 74,000**	**to**	**$ 112,500**		**$ 88,200**	**to**	**$ 148,000**	
Contingency (30%):	$ 22,000	to	$ 34,000		$ 26,800	to	$ 44,500	
Total Estimated Cost:	**$ 96,000**	**to**	**$ 146,500**		**$ 115,000**	**to**	**$ 192,500**	

Notes:

1. Cleanup cost estimate assumptions are provided in Section 4.5.
2. Source removal and off-site disposal will be performed according to NC and federal regulations.
3. Impacted sump sediment will be excavated, profiled and transported off-site for proper disposal.
4. Shallow impacted soil will be removed from below the base of the sumps, pipe trench and area around SB-9.
5. Access to the UST is complicated by the presence of a communications line, including a fiber optic cable within one to two feet of the suspect UST location, and by the proximity to the site building.
6. Options for UST closure include closure in place (with NC DENR approval) or removal either before or during redevelopment activities.
7. The costs for the removal of the coal assume the dismantling of the coal shed to provide access; dismantling costs are excluded from this estimate.
8. Standing water in the Boiler Room if encountered during redevelopment activities will be containerized, profiled and transported off-site for proper disposal.
9. Reporting costs for the Closure in Place and low range in the UST removal scenarios assume the existing Phase II SAR will be accepted in lieu of an Initial Assessment Report and LSA. An LSA is included in the high range cost for the UST removal scenario.

N

APPROXIMATE

0 2000 4000

SCALE IN FEET

U.S.G.S. QUADRANGLE MAP

RALEIGH WEST, NC 1968
REVISED 1988

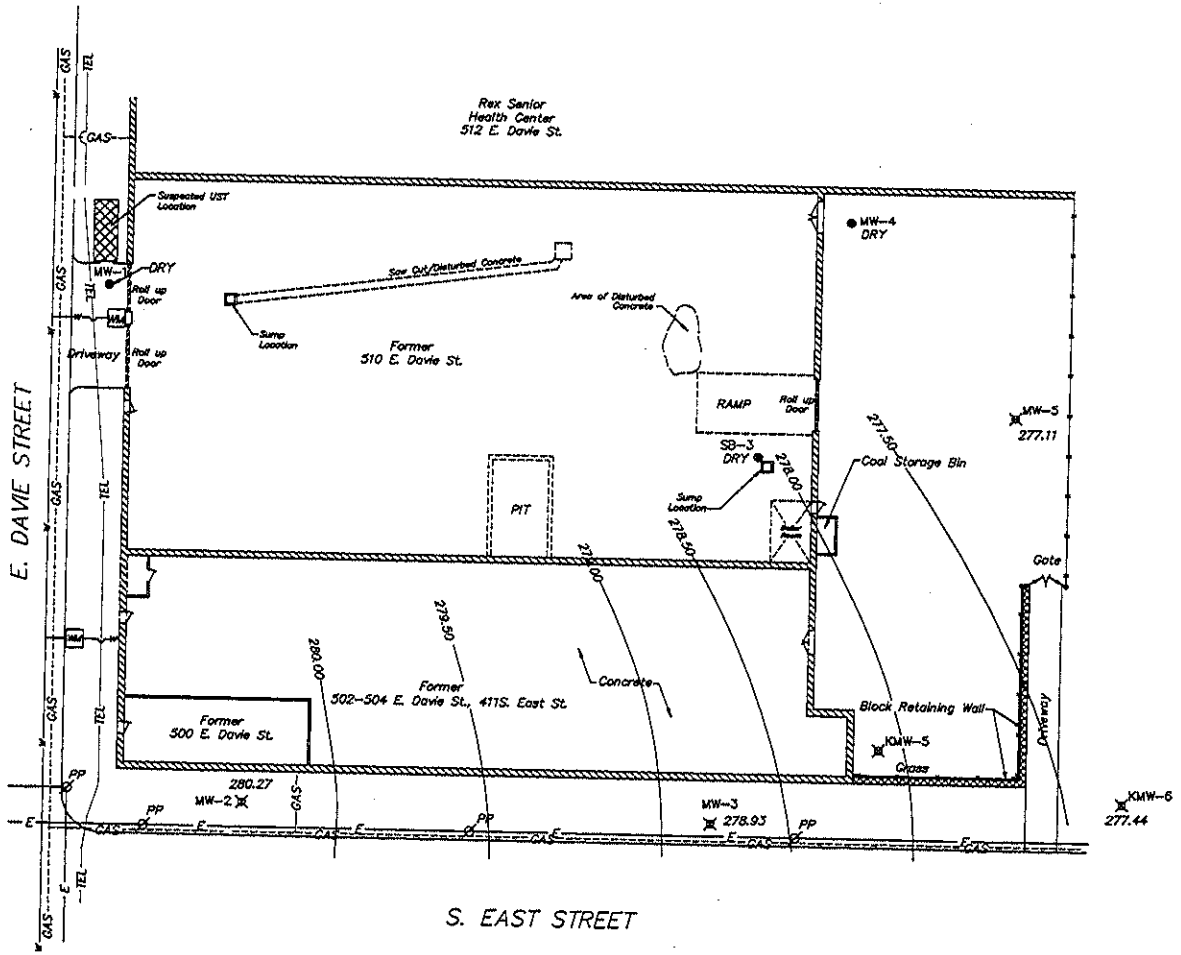
QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

TITLE
SITE LOCATION MAP

PROJECT
500 E. DAVIE STREET SITE
CITY OF RALEIGH BROWNFIELDS ASSESSMENT PROJECT
RALEIGH, NORTH CAROLINA

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007 (p) 704-586-0373 (f)

DATE:	06/15/07	REVISION NO:	0
JOB NO:	RAL-001	FIGURE NO:	1



LEGEND

- GAS — Natural Gas Line
- TEL — Fiber Optic Phone Line
- Fenceline
- E — Power Line
- PP — Power Pole
- W — Water Line
- WM — Water Meter
- SB-3 — Soil Boring Location
- MW-5 — Monitoring Well Location
- KMW-6 — Monitoring Well Location (Klyman)
- 278.50 — Groundwater Elevation (ft., amsl)

NOTES

Ground water was not encountered in well and boring locations noted as "DRY", prior to DPT refusal.

Klyman well MW-5, located at the rear of the property, could not be located via visual observation or electromagnetic equipment.

Well locations and elevations surveyed by Triangle Aerial Surveyors on January 19, 2007. Elevations shown in feet above mean sea level (amsl).

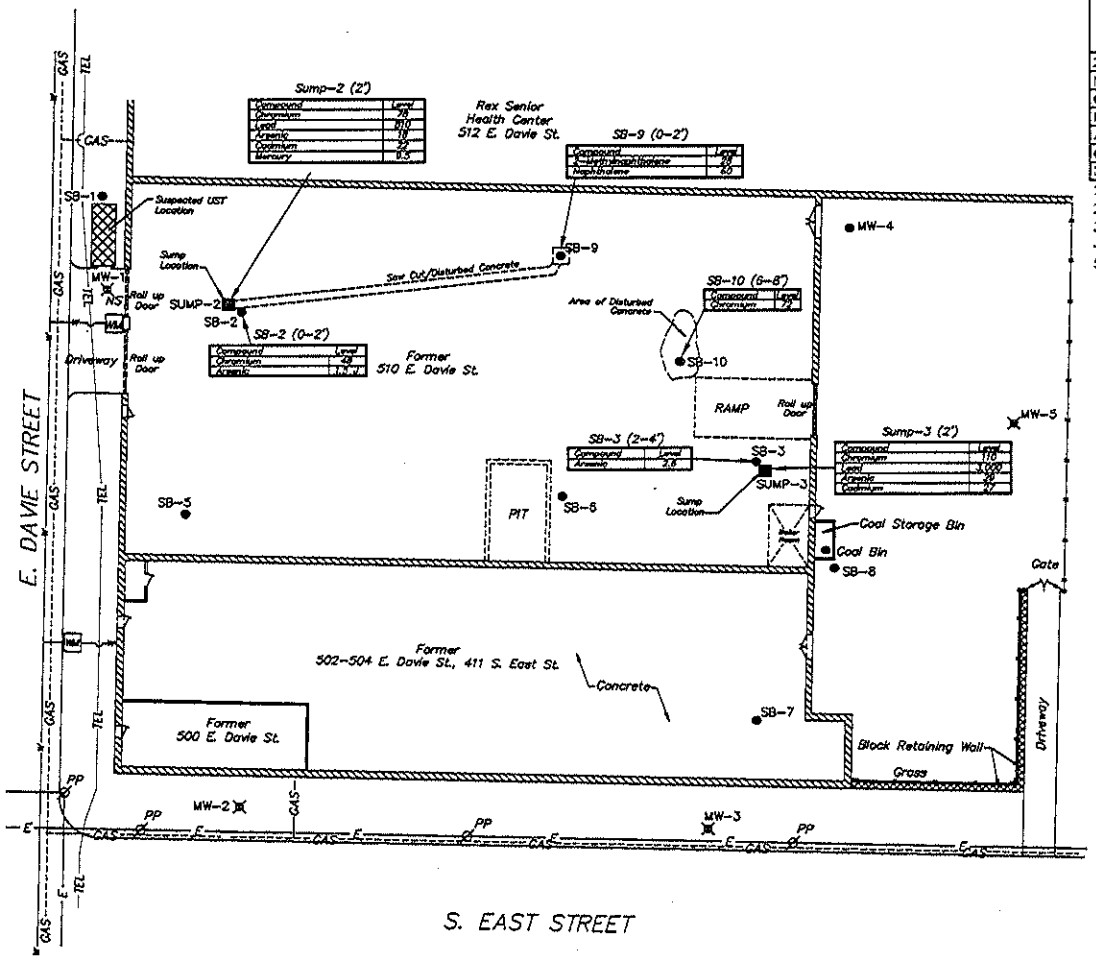
APPROXIMATE
0 30 60
SCALE IN FEET

TITLE
GROUND WATER ELEVATION CONTOUR MAP
JANUARY 19, 2007

PROJECT
500 EAST DAVIE STREET
RALEIGH, WAKE COUNTY, NORTH CAROLINA

Hart & Hickman
A PROFESSIONAL CORPORATION
8601 Six Forks Road-Suite 400
Raleigh, North Carolina 27615
919-847-42417(p) 919-847-4261(f)

DATE: 03/01/07	REVISION NO. 0
JOB NO: RAL-001	FIGURE NO. 3



Constituent	Regulatory Screening Levels: NC DENR Soil to GW MSCC[1] mg/kg	EPA Region 9 Industrial PRG[2] mg/kg	NC DENR SRG[3] mg/kg	NC DENR Background NC Soils - Range[4] mg/kg
2-Methylnaphthalene	1.7	NS	11.2	—
Naphthalene	0.58	190	11.2	—
Chromium (total)	27	450	24,000	2 - 150
Lead	270	800	400	7.2 - 52
Arsenic	NS/0.39[5]	1.6	4.4	1.6-180
Cadmium	NS/37[5]	450	7.4	0.54-5.8
Mercury	NS/23[5]	310	4.6	0.02-0.16

1. NC DENR Soil to Ground Water Maximum Soil Contaminant Concentration (UST Section, July 1, 2007)
2. EPA Region 9 Industrial Preliminary Remediation Goal (October 2004)
3. NC DENR Site Remediation Goals (August 2006)
4. NC DENR Background Metals in NC Soil and Water (August 2006)
5. EPA Region 9 Residential PRG provided when MSCC not specified.

LEGEND

SB-9 — Soil Boring Location

Sump-2 — Sediment Sample

MW-5 — Monitoring Well Location

NS — Not Specified

J — Estimated Concentration (Less than reporting limit but greater than detection limit)

NOTES

1. Chemical data shown hereon represent only those compounds detected at concentrations in excess of one or more state or federal regulatory screening criteria. See Table 2 for a full list of analytes detected in site soils and sediments.
2. Metals concentrations in soil samples did not exceed NC background concentrations (DENR August, 2006)

APPROXIMATE SCALE IN FEET 0 30 60

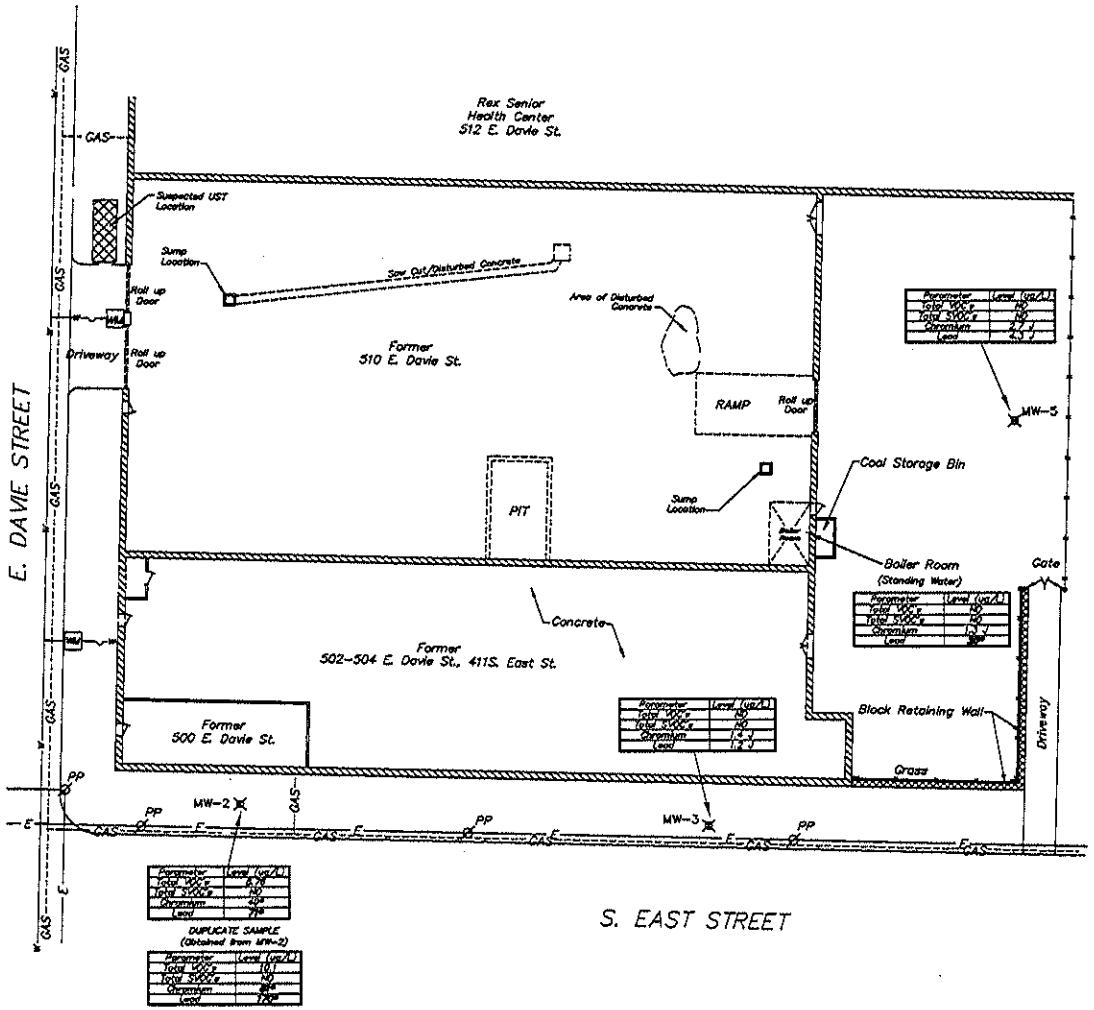
MAP OF SELECTED CHEMICAL CONSTITUENTS IN SOIL & SEDIMENT (mg/kg)

500 EAST DAVIE STREET
RALEIGH, WAKE COUNTY, NORTH CAROLINA

Hart & Hickman
A PROFESSIONAL CORPORATION
8601 Six Forks Road-Suite 400
Raleigh, North Carolina 27615
919-847-42417(p) 919-847-4261(f)

DATE: 9-14-07 | REVISION NO. 0

JOB NO: RAL-001 | FIGURE NO. 4



Constituents	Regulatory Screening Levels			NC DENR Background NC Soils - Range [4]
	NC 2L GW Standards [1] ug/L	NC GCLs Standards [2] ug/L	Federal MCLs [3] ug/L	mg/kg
Trimethylbenzenes (1,2,4- & 1,3,5-)	350	28,500	NS	----
Other VOCs	70	>6,900	NS	----
Chromium (total)	50	50,000	100	<25
Lead	15	15,000	15 (tap)	<10

1. NC 2L Ground Water Quality Standards (February 1, 2006)
2. NC Gross Contamination Levels for Ground Water (February 1, 2006)
3. MCL = EPA Maximum Contaminant Level in drinking water (2006)
4. NC DENR Data Table, Background Metals in NC Soil and Ground Water (August 31, 2006)

LEGEND

—GAS— Natural Gas Line

Fenceline

—E— Power Line

PP Power Pole

—W— Water Line

WM Water Meter

MW-5 Monitoring Well Location

ND Not Detected – See Table 3 for reporting limits

J Estimated Concentration (Less than reporting limit but greater than method detection limit)

Concentrations shown in bold exceed NC 2L groundwater standard (DENR February 2006)

* Concentration exceeds background range in NC ground water (DENR , August 2006)

NOTE
Only selected chemical constituents are shown hereon. See Table 3 for a complete list of compounds detected in ground water samples obtained from the site.

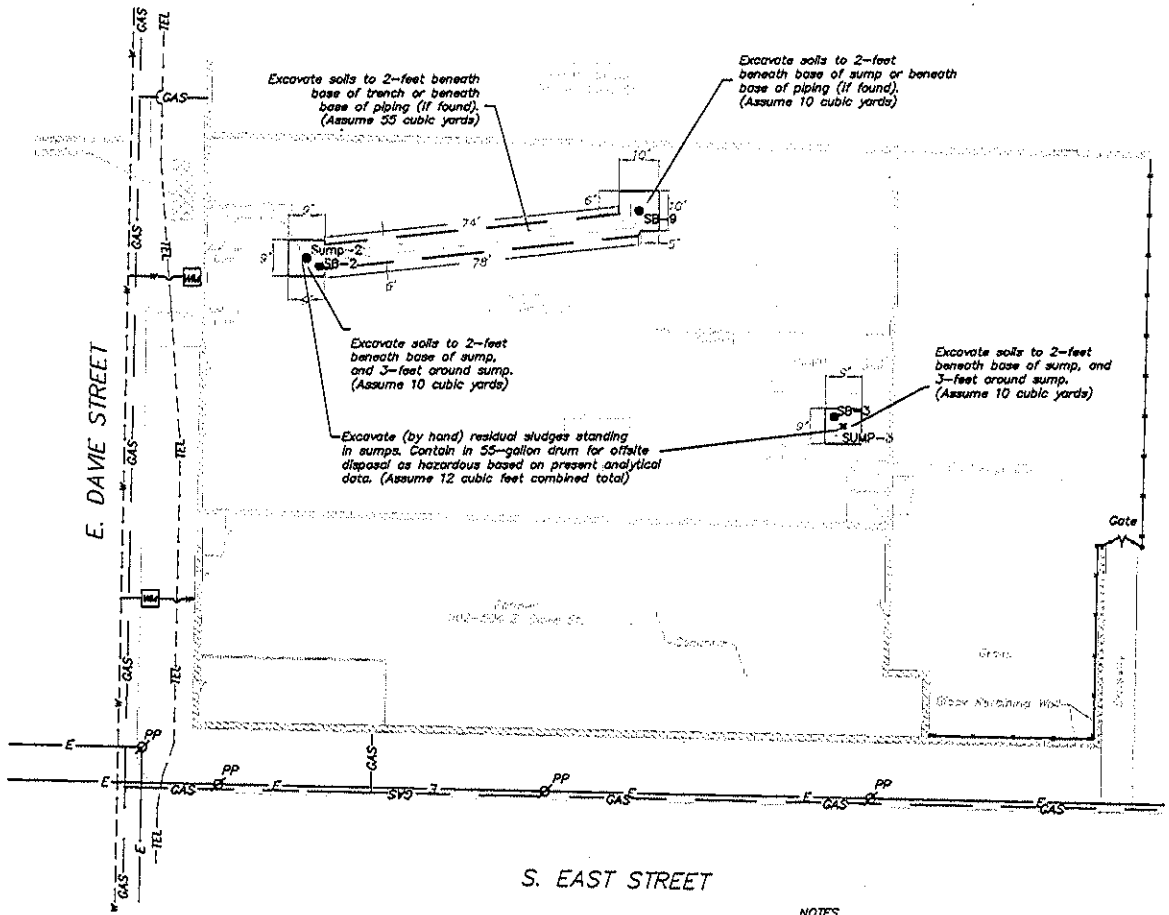
APPROXIMATE
0 30 60
SCALE IN FEET

TITLE
MAP OF CHEMICAL CONSTITUENTS IN GROUND WATER (ug/L)

PROJECT
500 EAST DAVIE STREET
RALEIGH, WAKE COUNTY, NORTH CAROLINA

Hart & Hickman
A PROFESSIONAL CORPORATION
8601 Six Forks Road-Suite 400
Raleigh, North Carolina 27615
919-847-42417(p) 919-847-4261(f)

DATE: 03/01/07 | REVISION NO. 0
JOB NO: RAL-001 | FIGURE NO. 5



LEGEND

- —GAS— Natural Gas Line
- —TEL— Fiber Optic Phone Line
- Fenceline
- —E— Power Line
- PP Power Pole
- —W— Water Line
- WM Water Meter
- SB-3 Soil Boring Location
- Sump-3 Sediment Sample

APPROXIMATE
0 30 60
SCALE IN FEET

NOTES
Base of sumps assumed to be approximately 2-feet beneath surface grade.
Concrete assumed to be 4 to 6-inches in thickness, possibly reinforced with rebar.
Assume disposal of a total of 1-drum soil/sludge as hazardous.
Assume disposal of a total of 65 cubic yards of soil as non-hazardous.
Assume disposal of a total of 350 cubic feet of concrete (as non-hazardous).
All dimensions shown in feet.

PROPOSED AREAS OF SOIL EXCAVATION

500 EAST DAVIE STREET
RALEIGH, WAKE COUNTY, NORTH CAROLINA

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)

DATE: 07/18/07	REVISION NO. 0
JOB NO: RAL-001	FIGURE NO. 5