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June 15, 2015

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Richard S. Rachal III, P.G.
Permitting Program Administrator
Florida Department of Environmental Protection
Northeast District
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256

Re: Remedial Action Plan
Confederate Park Site
956 Hubbard Street
Jacksonville, Florida
Duval County – Waste Cleanup Section
Site I.D. # COM_185118; Project I.D. #249048

Dear Mr. Rachal,

Enclosed please find a Remedial Action Plan (RAP) for the Confederate Park Site, which is being submitted pursuant to the March 20, 2015 letter from the Florida Department of Environmental Protection ("FDEP") to Level 3 Communications ("Level 3") and the City of Jacksonville ("Jacksonville") directing that a RAP be submitted to FDEP by June 16, 2015. This RAP is being submitted by Level 3 on behalf of its indirect subsidiary, Continental Holdings, Inc. ("CHI"). Jacksonville declined to participate in the preparation of the RAP.

It is important to note that on March 13, 2015, FDEP first notified Level 3 that its indirect subsidiary CHI may be subject to the requirements under Chapter 62-780, Florida Administrative Code, for assessment and remediation of contaminants released or discharged into the environment at Site and that, if FDEP concludes CHI is a responsible party and a Remedial Action Plan is not submitted by June 16, 2015, CHI could be subject to a formal enforcement action. Since that time, Level 3 has received no communication from FDEP notifying either Level 3 or CHI that FDEP has determined that CHI is a responsible party.

Level 3 and CHI deny that it has any liability to remediate the Site. Indeed, CHI has no relationship or connection with the Site. It is not the former owner operator or operator of a manufactured gas plant that ceased operating at the northeast corner of Main Street and State Street over 100 years ago. Nevertheless, in an abundance of caution, without any admission of liability, and with a full reservation of rights, Level 3 and CHI submit the enclosed RAP for Remedial Alternative 1 (Hydraulic Control) as required by FDEP.

If you have questions, please contact me.

Sincerely yours,

Ryan McManis

Remedial Action Plan

Confederate Park Site
956 Hubbard Street
Jacksonville, FL
Site I.D. # COM_185118; Project I.D. # 249048

Prepared for: **Mr. Richard Rachal III, P.G.**
Permitting Program Administrator
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PROFESSIONAL ENGINEER CERTIFICATION

Remedial Action Plan for:

Confederate Park Site
956 Hubbard Street
Jacksonville, Florida
COM_185118

In accordance with Chapter 471, Florida Statutes, I hereby certify that to the best of my knowledge all assessment data, engineering plans, specifications, and calculations included herein are in general accordance with standard and appropriate engineering practices. I also certify that by experience and training I am a qualified groundwater professional with experience in the assessment and remediation of contaminated groundwater.

Richard G Lewis, P.E., Ph.D.
Principal Engineer
FL Registration No. 52009
6/16/2015

In accordance with Chapter 492 F.S., hydrogeologic and geologic information, conclusions, and recommendations in this document have been prepared and/or reviewed by the undersigned CRA professional who is a registered Florida Professional Geologist.

William Hutchings, P.G., Ph.D.
Professional Geologist
FL Registration No. PG0002120
6/16/2015

Section 1.0 Introduction

Conestoga-Rovers & Associates (CRA) is pleased to present this Remedial Action Plan (RAP) for the Confederate Park Site located at 956 Hubbard Street, Jacksonville, Florida (the "Site") for submittal to the Florida Department of Environmental Protection (FDEP). The Site location is shown in **Figure 1** and the Site layout map is shown in **Figure 2**. This RAP has been prepared in general accordance with Chapter 62-780, Florida Administrative Code (FAC) in response to FDEP's Comment Letter dated March 20, 2015.

A Feasibility Study (FS) was prepared by Geosyntec Consultants, Inc. (Geosyntec) in January 2014 and a Comment Letter was submitted by CRA on December 15, 2014. The FS provides three remedial alternatives for further consideration at the site: 1) Hydraulic Control, 2) Barrier Wall with Excavation and Monitored Natural Attenuation (MNA), and 3) Barrier Wall with In-Situ Stabilization and MNA.

On May 20, 2014, the Tallahassee technical review section of FDEP issued review comments regarding the FS by Geosyntec. The FDEP reviewer provided the following analysis (emphasis added):

- *"Given the estimated extent and volume of MGP waste impacted zones in the subsurface, the concentrations of associated constituents (mostly BTEX & PAHs) in groundwater are lower than what I have seen at a couple of other MGP cleanup sites. The MGP subsurface waste material has reportedly been in place for about 100 years, and the more mobile and degradable compounds have likely attenuated leaving mostly the less mobile contaminants bound up in the soil matrix. <u>This alone gives support to consideration of a less aggressive remedial strategy such as hydraulic control/MNA (Alternative 1) as a site remedial strategy</u>. <u>Also, hydraulic control can serve as an engineering control for closure with conditions.</u>*
- *<u>Proposed remedial Alternative 2 and Alternative 3 would be significantly more expensive and disruptive than the Alternative 1 (hydraulic control) option that would arguably achieve the same level of protectiveness</u>. <u>There is something to be said for what was pointed out by one of the commenters, and that is there are serious risks to human health and the environment associated with implementation of a very disruptive and hazardous construction project, such as a large scale soil removal/treatment project, conducted within a developed urban setting.</u> It may be that this aspect of the risk analysis also favors a less disruptive remedial strategy such as hydraulic control/MNA to address site groundwater contamination.*
- *Presumably, it is intended that the selected remedial option will address "the site" inclusive of Confederate Park and properties immediately to the south impacted by releases from both the former MGP and petroleum USTs. One of the public comments received on the FS states that "It is also significant that at the public meeting held on March 17, 2014, Geosyntec acknowledged that the contaminants entrained in the wood debris lying above the dense non-aqueous phase liquid ("DNAPL") material was likely associated with discharges from the USTs and was not MGP material. Discussion and consideration of this*

> *contamination (and its eligibility for remediation under the Department program) is conspicuously absent from the Report." It is not clear if, and how, the Petroleum Restoration Program (PRP) would be involved in implementation of the selected remedial option. However, I did find where the Park View Inn site had its PRP State funded site eligibility status revoked."*

On March 20, 2015, the Northeast District of FDEP issued a Comment Letter regarding the FS by Geosyntec and the Comment Letter prepared by CRA. The DEP Comment Letter states that:

> *"Alternative 1 (Hydraulic Control), while a technically feasible remedial alternative, would not lead to eligibility for conditional site closure until the groundwater extraction and treatment system is operational, the ornamental pond is lined, and new groundwater flow dynamics as well as the lateral extent of the plume are firmly established. Moreover, since the contaminant source material would continue to affect groundwater for an indefinite period of time, a conditional site closure would also not be granted as long as groundwater continues to be impacted and the potential to access it exists…"*

This RAP was prepared to account for these comments. Specifically, the goal of this plan is to provide a path to closure for the site using Risk Management Option (RMO) Level III that does not require groundwater monitoring in perpetuity and that eliminates all potential exposure pathways. Because this strategy will require regulatory consensus, this document provides a stepwise path to closure for the site prior to completing the detailed design. This RAP provides (i) detailed groundwater modeling as the basis for the remedial design, (ii) a plan for the collection of additional remedial assessment data (e.g., pumping test data, *etc.*), and (iii) a conceptual design with a schedule to submit a detailed design.

Section 2.0 Site Description and Background

The Site is located in an urban setting in downtown Jacksonville, Florida. Hogan's Creek runs east-west through the Site. Hogan's Creek is a 1.5-mile long stream corridor that currently originates upstream of 8th Street in a stormwater retention pond, after which it meanders to its receiving end at the St. John's River, draining a surface area of approximately 2,000 acres. The environment in and around the creek consists of areas that include heavy and light industrial activities, manufacturing operations, commercial operations, urban residential, and recreational use. Many low-lying areas adjacent to and around the creek were reportedly used as municipal dumps during the late 1800's and early 1900's. In addition, debris from the Great Fire of 1901 was disposed of along the banks of Hogan's Creek in the Site area. In 1929, the City of Jacksonville conducted improvements to the Confederate Park including altering the original path of and filling in Hogan's Creek. Over the years of urban development, the water quality and ecological conditions within Hogan's Creek have been adversely impacted by the associated pollution and stream canalization and, as such, Hogan's Creek has been identified and listed by the State of Florida as an impaired water body in compliance with Section 303 (d) of the Clean Water Act. Known sources of contamination to Hogan's Creek exist upstream and downstream of the site. Analytical data collected by others indicate the presence of heavy metals and polycyclic aromatic hydrocarbons (PAH) contaminant levels exceeding screening levels in Hogan's Creek upstream and downstream of the Site.

The Site encompasses Confederate Park, the E.H. Thompson (EHT) property, the Park View Inn (PVI) property, a portion of the Warren Partnership property, and the Orange Street right-of-way (**Figure 2**). The Site is located within Section 13 Township 2S and Range 26E just north of downtown Jacksonville. The Site is bounded by Main Street (formerly known as Pine Street) to the west, State Street to the south, Phelps Street to the north, and Hubbard Street to the east. The Site is approximately 11.7 acres. Detailed summaries for each parcel are provided in the Site Assessment Report (SAR) dated May 2011 by Geosyntec and the Feasibility Study (FS) dated January 2014 by Geosyntec on behalf of the City of Jacksonville.

Portions of all the properties located within the approximate Site boundary show impacts could originate from underground storage tank (UST) releases, manufactured gas plant (MGP) residuals, up-gradient sources, stormwater runoff, and/or urban background. Based on discussions with the FDEP, the EHT property and Warren Partnership sites are eligible for the Abandoned Tank Restoration Program (ATRP), while the PVI property is eligible for the Petroleum Cleanup Participation Program (PCPP) under the State Petroleum Restoration Program (PRP), formerly known as the Bureau of Petroleum Storage Systems (BPSS). The Consent Order (Case Number 01-1931) between the City of Jacksonville and Florida Department of Environmental Protection (FDEP) (Consent Order) was filed on March 25, 2002 for Confederate Park only.

Contamination at the PVI property was initially discovered in 1991 during a petroleum investigation at the EHT property. The FDEP conducted a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Investigation (SI) at the PVI property. At the request of the City of Jacksonville, FDEP agreed to remove Confederate Park from the SI since the City agreed to perform an independent investigation. On behalf of the City of Jacksonville, Felicia M. Boyd & Associates performed a preliminary contamination assessment in June and July 2001 and prepared a Preliminary Contamination Assessment Report (PCAR) dated September 2001. Geosyntec conducted additional assessment between 2003 and 2010 and prepared a SAR dated May 2011. Site investigations for contamination associated with the use of former USTs have also been conducted at the EHT, the PVI property, and the Warren Partnership property. Among the three properties, soil excavation was conducted under ATRP at the Warren Partnership property. In early 2000's, bioremediation and bioventing remediation activities were performed at the EHT property with funding from FDEP's ATRP program. The remediation ceased in 2005 due to equipment malfunction. The assessment and remediation at PVI has not been conducted under the PCPP fund.

2.1 Confederate Park

Confederate Park is located at 956 Hubbard Street and is owned by the City of Jacksonville. The total area of Confederate Park is approximately 8.6 acres with about 6.1 acres of the Park located west of Hubbard Street and about 2.5 acres of the Park located east of Hubbard Street. The 6.1-acre western portion of Confederate Park, which is addressed in the Consent Order, is characterized by a grassed lawn gently sloping from north to south, with a few trees with Hogan's Creek dividing the Park into two distinct areas. Most of the western portion of Confederate Park is located north of Hogan's Creek (about 5.5 acres). This portion of the Park is fenced; however, it is accessible during the day. At night, this fenced (but accessible) portion of the Park is locked to prevent access. The western portion of Confederate Park located south of Hogan's Creek is about 0.6 acres. Access to this southern portion of the Park is restricted at all times by Hogan's Creek itself, fencing, and a locked gate.

The Park consists of a decorative pond (which is hydraulically connected to Hogan's Creek via an underground drainage pipe), concrete walkways, a Civil War Monument (Memorial to the Women of the Confederacy), a maintenance building, and a small office building (**Figure 2**). The pond was dredged in the mid 1990's and four feet (ft) of sediment was removed. Historic property ownership records of Confederate Park indicate that between May 1905 and April 1906, the City of Jacksonville acquired portions of Block 108, which consists of the area north of Hogan's Creek. The area south of Hogan's Creek (Block 141), between Ocean Street and Hubbard Street, was under private ownership until June 1929, at which time the City acquired the title from Elizabeth Clayton.

2.2 E. H. Thompson

The EHT property is currently owned by 937 Main Street LLC and has a total area of approximately 0.9 acres with almost half that amount covered with structures. The property is located at 937 Main Street, at the intersection of Main Street and Orange Street, south-southwest of Confederate Park. Historic property ownership information for the EHT property is reported by the Contamination Assessment Report (CAR) developed by PACO Consulting & Engineering, Inc. (PACO) in July 1993.

The property has been improved with two buildings that are currently unused. The property was once used as an automobile dealership and service center, and it housed three USTs and one above ground storage tank (AST) including a 1,200-gallon kerosene UST, a 550-gallon gasoline UST, a 300-gallon UST, and a 750-gallon used oil AST. According to the CAR developed by PACO in July 1993, the USTs and the AST were removed in 1991. Installation dates are unknown. Access to the EHT property is restricted by the configuration of the structures and fencing equipped with a locking rolling gate.

2.3 Park View Inn (PVI)

The PVI property is currently owned by Jacksonville Hospitality Holdings LLP, and it is located at 901 North Main Street across Orange Street from the EHT property and encompasses a total area of 1.5 acres. The property occupies the same city block as the former Main Street MGP. The former MGP ceased operation circa 1910, and significant excavations and earth moving activities have occurred since that time. The Park View Hotel building, demolished in 2011, was a six-story structure built in 1966 as a full service hotel with a total area of 180,300 square feet

(ft^2) comprised of approximately 91,000 ft^2 of heated space, an interior courtyard area, and a parking garage for the hotel. Excavation of the PVI property was required to construct the underground parking garage. The former hotel building and parking garage covered the city block bounded by Orange Street to the north, State Street to the south, Ocean Street to the west, and Main Street to the east. The parking garage structure remains intact for potential future use, and it effectively caps the property.

The property once housed a 2,000-gallon No. 2 fuel oil UST near the northwest corner of the hotel building (installation date unknown). According to the May 2008 Revised SAR developed by Aerostar Environmental Services, Inc. (Aerostar) for the property, the UST was taken out of service in the 1980's. The UST was abandoned in place in November 2002. Access to the PVI property is unrestricted, but the existing parking garage is currently acting as a cap.

2.4 Warren Partnership

The Warren Partnership property is located at 925 North Ocean Street and is currently owned by the Warren Partnership. The total area of the Warren Partnership property, which is utilized as a light manufacturing facility, is approximately 1.6 acres; however, only the northern-most portion of the property and the area along the Orange Street right-of-way was investigated as part of the Site investigation.

The property is improved with four one-story buildings constructed in 1950 for light manufacturing. The property was once used as an automobile dealership and service center, and housed a 3,000-gallon gasoline UST and a 500-gallon used oil UST. According to an Initial Site Assessment Report developed by Jones, Edmunds & Associates, Inc. (Jones, Edmunds) in May 2001, the USTs had not been used since 1970, and they were removed from the property in 1992. The installation date(s) of the USTs is not known. Current property use is as Nature Form Hatchery Systems. Access to the Warren Partnership property is gained through the main business office that faces Ocean Street or through a locking gate that is located along North Newman Street. The existing buildings sidewalks and roadway effectively cap this property.

Section 3.0 Summary of Site Assessment and Remedial Activities

3.1 Site Geology

Based on a review of boring logs and cross sections from the 2001 PCAR for Confederate Park, the E. H. Thompson 1991 CAR, the 1929 Hogan's Creek Improvement Project, and the investigation performed by Geosyntec (described in May 2011 SAR), the underlying lithology at the Site can be generally described as:

- 1 to 12 feet (ft) below land surface (BLS) - unconsolidated quartz sand, silt, and fill debris (wood, brick, slag, and asphalt fragments present at some locations);
- 12 to 25 ft BLS - peat/organic clay (medium to coarse-grained quartz sand in places where peat is not present);
- 25 to 28 ft BLS - silty, quartz sand;

- 28 to 37 ft BLS - weathered limestone, with a soft clay-marl consistently encountered between 30 and 32 ft BLS;
- 37 to 71 ft BLS - dense, phosphatic, gray marine clay;
- 71 to 76 ft BLS - sandy, silty marine clay;
- 76 to 121 ft BLS - dense, phosphatic, gray marine clay; and
- 121 to 126 ft BLS (maximum investigation penetration depth) - sandy, silty marine clay.

It should be noted that the referenced depths are approximations and vary across the Site. The east-west and north-south lithologic cross-sections across the Site are provided in the FS by Geosyntec (**Figures 3** and **4** of **Appendix A**). The upper 20 to 25 feet of the SAS at the Site consists primarily of relatively clean fine-to-medium sand. Beneath the upper sand unit is a transitional zone of limestone, silty sand, clay, peat, and coquina. Along the east-west transect near Hogan's Creek, the limestone unit that makes up the lower part of the SAS is in direct contact with the sand. On the eastern half of the Site, however, the two are separated by a five- to eight-foot thick peat layer. Peat was also noted in the borings installed on the eastern-most portion of the PVI property and in the borings on the EHT property. Similarly, the limestone is in direct contact with the sand (and/or a coquina layer) in the central and northern part of Confederate Park along the transect shown in **Figure 4** of **Appendix A**, with the peat separating the two as you move toward Hogan's Creek. The peat layer appears to be absent north of the decorative pond at Confederate Park. It is noted that a one- to three-foot marine clay layer has been identified in most of the soil borings along the transect shown in **Figure 4** at approximately -25 ft, National Geodetic Vertical Datum (NGVD); however, this unit is not as prevalent in the transect shown in **Figure 3** of **Appendix A**. **Figure 3** and **Figure 4** of **Appendix A** both indicate the presence of a layer of wood and debris deposited in the former location of Hogan's Creek that is unrelated to wastes generated in MGP process. This layer appeared to consist of natural wood fragments without evidence of a tar coating. The observation is likely consistent with historical reports to buried garbage and debris, which were used a fill in the former creek bed and adjacent low-lying areas.

A 10- to 15-foot thick (typically) limestone unit was observed beneath the sand layer of the upper SAS in almost all of the borings completed during the Site investigation. The limestone unit's surface elevation is variable, probably due to erosion, and the formation is very thin in some places (SB-11) and absent in others (SB-7). The deep (lower SAS) wells at the Site are completed in this limestone unit. The limestone unit is underlain by stiff sandy clay that is 10 to 15 feet thick and consistent across the Site. The clay is encountered between approximately -30 and -35 feet, NGVD. Underlying the stiff sandy clay is a glauconitic, somewhat silty marine clay that has been identified as the part of the Hawthorn Group due to the presence of phosphate chips and nodules. The Hawthorn Group is present beneath the entire Site. The lithological information observed during the installation of the soil borings during the Site investigation, coupled with land surface elevations, indicates that the Hawthorn Group slopes from the PVI property towards Hogan's Creek, with an approximate elevation difference of 2 feet from the southwest corner of the PVI property to the south bank of Hogan's Creek near the property boundary between the EHT property and Confederate Park. The Hawthorn Group has been reported to be around 400 feet thick in Duval County by the U. S. Geological Survey

(USGS), and it acts as a regional aquitard separating the SAS from the Floridan aquifer. JEA's well construction details confirm USGS's assertion that the Hawthorn layer is at least 400 feet thick in the vicinity of the Site.

3.2 Site Hydrogeology

The flow system at the Site is quite complex due, in large part, to the following conditions:

- historic fill material in the area;
- a creek (Hogan's Creek) that historically flowed naturally in a separate channel is now concrete lined; the concrete liner has numerous cracks, breaks, and fissures, the base of which consists of cedar planks;
- a man-made detention pond that is connected to both shallow groundwater and the concrete-lined creek by a culvert pipe that has been observed to flow in both directions;
- tidal influences from the St. Johns River;
- a relatively large topographic variation across the Site; and
- significant vertical gradients due to location.

Several investigations completed by Geosyntec allowed a better understanding of Site hydrology, including installation of deeper borings into the Hawthorn Group, analysis of vertical gradients in the subsurface using clustered wells in and around the Site, completion of a tidal study, and implementation of a detailed "stress-response" evaluation of the interactions between surface water(s) at Confederate Park and shallow groundwater. The pertinent results of these investigations are documented in Geosyntec's May 2011 SAR. From these investigations, Geosyntec developed a Conceptual Site Model (CSM) of hydrogeologic conditions, as summarized below:

- The SAS at the Site is approximately 30 to 40 feet thick, and it is underlain by a stiff, sandy clay. The 10-foot thick sandy clay is underlain by at least 90 feet of a glauconitic, marine clay with some shell fragments and phosphate chips that appear to be part of the Hawthorn Group.
- The SAS is divided into an upper and lower unit, consistent with published reports for Duval County. The upper units consist of 25 feet of relatively clean fine to medium sand, and the lower unit consists of 10 to 15 feet of (predominantly) limestone. The two units are separated by a transition zone that is quite variable. In some portions of the Site, a thin (one to three feet) marine clay was encountered at approximately -25 feet, NGVD. This clay does not appear to act as a hydraulic barrier based on an analysis of flow in, and interconnectedness of the upper and lower SAS.
- A peat layer, typically 5 to 10 feet in thickness, is found along much of the low-lying area of the Site located immediately south of Hogan's Creek. The peat is also observed in the Orange Street right-of-way and the eastern-most portion of the Park View Inn property. The peat extends northward approximately 200 feet, terminating in the vicinity of the decorative pond and appears to coincide with the former location of Hogan's Creek.

- Comparisons of water levels in the upper and lower SAS indicate that vertical hydraulic gradients are generally slightly downward in the northern part of the Site due to higher water levels in the upper SAS, but they are strongly upward in the southern part of the Site. The inflection point is likely to the north of the decorative pond. An upward gradient exists throughout most, if not all, of the area where constituents of concern (COCs) have been observed. This gradient serves to minimize the potential for significant downward movement of COCs.
- Groundwater flow in the upper SAS is influenced significantly by the decorative pond and less significantly by Hogan's Creek (**Figure 6** of **Appendix A**). The pond represents a local discharge area for the upper SAS. As you move away from the pond, influences of Hogan's Creek can be observed in wells that are located in close proximity to the creek bed (e.g., IMW-1 and CPW-3).
- Groundwater flow in the lower SAS is also influenced by Hogan's Creek and the decorative pond (**Figure 7** of **Appendix A**). The pond, in particular, seems to represent a local discharge feature for both the upper and lower SAS.
- The tidal influence study revealed a predictable response in an upper SAS well located approximately 50 feet from Hogan's Creek. No responses attributable to the tide function were observed in an upper SAS well located 200 feet from the creek or in either of two deep (lower SAS) wells. Permeability was estimated at 4 ft/day for the upper SAS in the vicinity of Hogan's Creek using the tidal response data.
- Using an assumed porosity of 0.30 for the upper SAS, the effective groundwater velocity is estimated to be approximately 50 ft/year. It is likely, however, that this is a high estimate for the SAS as a whole because of the increased horizontal hydraulic gradient present in proximity to the decorative pond.
- Both Hogan's Creek and the decorative pond respond erratically to tidal fluctuations, indicating a lack of direct connectivity with the St. John's River, influence of manmade structures (such as the culvert connecting the two), influences of shallow adjacent groundwater levels, and Creek flow rate based upon precipitation events.
- Groundwater movement in the area of COC impacts corresponds well with changes in water levels in the decorative pond, but poorly with similar water level changes in Hogan's Creek. This indicates a greater degree of connectivity between shallow groundwater and the decorative pond. The stress-response analysis indicates that the pond responds quickly (less than one hour) to changes in shallow groundwater.
- Groundwater in the upper and lower SAS is hydraulically connected – there are no barriers to flow between the two.

3.3 Land Use

Land use bordering the Site is commercial and industrial. The majority of Confederate Park has limited recreational use but nearby residents use the park west of Hubbard Street for a dog walk, playground, and basketball court. The City of Jacksonville owns, operates, and maintains Confederate Park.

3.4 Water Well Inventory

A water well inventory was conducted in April 2011 by Geosyntec. They found 10 State Underground Petroleum Environmental Response (SUPER) Act and 11 St. Johns River Water Management District (SJRWMD) permitted wells located within 0.5-mile radius of the Site (**Figure 1** of **Appendix A**). Four SUPER Act wells and five SJRWMD wells are located within a 1.25-mile radius of the Site. Other than one private well for the irrigation by First Presbyterian Church, all wells are owned by Jacksonville Electric Authority (JEA).

The JEA municipal Main Street wellfield exists to the west of Main Street and Confederate Park. The pumping wells are designated as "Main Street Well Pump" and numbered 1, 2, 3, 4, 6, 7, 8, 10, and 12 (installed in 1949, 1971, 1944, 1977, 1971, 1968, 1949, 1922, and 1972, respectively). The wells have total depths ranging from 1,276 to 1,319 ft with steel casing depths from 501 to 532 feet. The approximately 450-foot Hawthorn layer exists between the surficial aquifer and the JEA production well steel casing.

Well No.2 is located at the northwest corner of Confederate Park, and it was listed as out of service in 2011. CH2MHILL was retained by JEA to test the Well No.2 in 2013 and the results indicate that under the future pumping rate, Well No.2 is still at artesian flow. The water quality monitoring by JEA in 2013 indicates that no volatile organic compounds or pesticide compounds were detected at Well No.2.

3.5 Contaminant Distribution

3.5.1 Surface Soil

Thirty-two surface soil samples (including two duplicate samples) were collected from 0 to 2 feet BLS, and these sample locations are shown on **Figure 8** of **Appendix A**. As a first step, residential Soil Cleanup Target Levels (SCTLs) per Chapter 62-777 FAC were used to screen-out contaminants that were not of concern. Laboratory analytical results indicate that the following four chemicals had maximum detected concentrations in exceedance of residential SCTLs and were selected as COCs (arsenic, benzo(a)pyrene toxicity equivalents (BaP TEQs), barium, and lead). Given that an institutional control on land use will be implemented at the Site, commercial/industrial SCTLs were considered for the screened-in COCs, which left BAP TEQ as the only compounds exceeding commercial/industrial SCTLs. Although the majority of the samples from south of the Hogan’s Creek had BAP TEQ above commercial/industrial SCTLs, the majority of the samples from north of Hogan’s Creek had BAP TEQ below commercial/industrial SCTLs (**Figure 9** of **Appendix A**).

Florida Department of Health (FDOH)’s Public Health Assessment Main Street MGP/Confederate Park Site dated January 16, 2015 (**Appendix B**) concludes that the increased cancer risks are “very low” to “extremely low.” Further, FDOH does not expect PAHs in surface soil on the Site to harm workers’ or visitors’ health, based on the four soil samples collected from 0 to 1 feet. FDOH recommends that the City of Jacksonville collect an additional eight surface soil samples (0 to 6 inches deep) from the area bounded by Hogan’s Creek, Orange, Hubbard/Newman, and Market Street for the analysis of the following COCs: arsenic, barium, lead, and PAHs.

3.5.2 Subsurface Soil

Sixty-nine borings were advanced by Geosyntec to varying depths in and around the Site to evaluate site geology and the presence of source material. With the exception of soil borings installed within the confines of the PVI property parking garage, all borings were extended into the top of the Hawthorn Group and to "clean subsurface conditions".

The source materials (e.g., sheens and staining associated with MGP-related, UST-related, up-gradient industrial activities, upstream storm water, and urban background) were observed in soil cores recovered from the subsurface during the Site investigation, and they are present within the soil matrices of the surficial aquifer. Soils containing visible evidence of source materials are present within the Site and include the area directly south of the pond, the area of Confederate Park south of Hogan's Creek, the EHT property, the PVI property, and portions of the Orange Street right-of-way, extending slightly into the Hubbard Street right-of-way. The specific depths where source material and staining were observed are shown on **Figures 3** through **5** of **Appendix A**.

3.5.3 Groundwater Impacts

The groundwater impacts primarily include benzene, toluene, ethyl benzene, and total xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs). The laboratory analytical results for the October 2010 and October 2013 groundwater sampling events for the upper SAS are illustrated on **Figure 10** of **Appendix A**, where the lower SAS area are illustrated on **Figure 11** of **Appendix A**. The groundwater impacts have been delineated to both the upper and lower SAS zones.

Considering data from October to December 2010 and October 2013, contaminant concentration decreases were noted in the groundwater samples collected from monitoring wells CAPMW-4D, IMW-1, MW-1EHT, MW-25S, and MW-27D when compared to previous sampling events (**Table 2** of **Appendix C**). Groundwater sampled from monitoring wells CAPPZ-4DD, CPW-1, MW-24D, MW-24S, MW27-D, MW-28S, MW-30D, MW-30S, MW-31S, MW-35D, and MW-35S during the October 2013 sampling event did not yield chemical concentrations above the Groundwater Cleanup Target Levels (GCTLs) established in Chapter 62-777, FAC. These results are consistent with previous groundwater sampling events for these monitoring wells (i.e., CAPPZ-4DD in October 2008, MW-35D and MW-35S March 2011, and the rest in October to December 2010). With the exception of the slight naphthalene concentration increase at monitoring well CAPMW-4H compared to October 2008, the dissolved groundwater contaminant concentrations remain relatively unchanged, indicating that the groundwater impacts are stable.

3.5.4 Sediment Impacts

No source material was observed in the sediment samples collected from Hogan's Creek and the decorative pond. Constituents detected in the sediment samples are presented on **Figure 12** of **Appendix A**. **Table 3** of **Appendix C** compares the detected sediment concentrations to the FDEP (1994) Sediment Quality Assessment Guidelines (SQAGs). The concentrations detected and types of constituents present in the samples collected within the Park are consistent with those detected in the upstream sample (SED-2). However, the concentrations of constituents detected in the sample collected upstream are slightly more elevated than those in the sample collected downstream (SED-6), indicating regional sediment impacts from sources other than those within the Site, indicating off-site, up-gradient sources of PAHs. FDOH concluded that the highest concentrations of arsenic, pesticides, PAHs, PCBs, and dioxins provided doses that were below minimal risk levels and increased cancer risks were very low or extremely low. Clearly, the majority of the contaminants of concern detected in the fish, including pesticides (i.e., Chlordane, Dieldrin, and Heptachlor Epoxide), PCBs, and dioxins, are unrelated to MGP operations.

Section 4.0 Conceptual Site Model

4.1 Conceptual Site Model

The Site investigation was conducted by Geosyntec (SAR, 2011), and it was approved by the FDEP in a letter dated May 24, 2012 (see below). Based on the Site investigation findings, CRA developed the following Conceptual Site Model (CSM):

- Surface soils (0 to 2 feet) have been impacted. Four COCs have been identified as arsenic, barium, PAHs, and lead above residential SCTLs, however, only PAHs (BaP TEQs) are above the Industrial/Commercial SCTL. Based on surface soil samples, FDOH concludes that surface soils do not pose an immediate danger to human health. Due to the number of surficial soil samples, FDOH recommended additional surface soil samples to confirm the PAH levels.
- Subsurface soil has been impacted. The existing source materials (i.e., staining and sheens) are primarily present at the south of the pond, the area of Confederate Park south of Hogan's Creek, the EHT property, the PVI property, and portions of the Orange Street right-of-way, extending slightly into the Hubbard Street right-of-way. The presence of the source materials is discrete and discontinuous vertically and horizontally.
- Groundwater has been vertically delineated with impacts limited to the surficial aquifer system (SAS). Groundwater has also been delineated laterally to the north, south, east, and west, based on the FDEP's SAR Review Letter dated May 24, 2012, which concurs with Geosyntec's report that states "that site assessment is substantially complete."
- Sediments were sampled within Hogan's Creek and the decorative pond. While PAHs were detected, there are other sources that contribute to contamination within Hogan's Creek, as indicated by the higher concentrations in upstream sediment samples. The results from the sediment investigation indicate that, in addition to site-related impacts,

there are regional impacts of a broader range of constituents (including PAHs) throughout the Hogan's Creek flow system. For example, as stated in Section 3.5.4 regarding FDOH's assessment, the majority of the contaminants of concern detected in the fish, including pesticides (i.e., Chlordane, Dieldrin, and Heptachlor Epoxide), PCBs, and dioxins, are unrelated to MGP operations and materials associated with those operations.

- The SAS at the Site is approximately 45 to 50 feet thick and is underlain by the stiff clay Hawthorn Formation. The SAS is divided into an upper and lower unit. The upper unit consists of 25 feet of relatively clean fine-to-medium sand, and the lower unit consists of 10 to 15 feet of limestone.
- The groundwater flow regime is well understood, including the interaction of groundwater with surface water bodies. Groundwater flow in the upper SAS is influenced significantly by the decorative pond, and less significantly by Hogan's Creek. Although there is some separation of water levels between the upper and lower SAS, the two units are connected, and they behave similarly. Vertical gradients at the Site are upward for all areas where COC impacts have been observed, and discharge is to the pond and creek, except during high water events (*e.g.,* flooding, *etc.*). This upward gradient greatly minimizes the potential for downward movement of groundwater from the SAS to the Hawthorn Group.

4.2 Human Health and Ecological Risk Exposure Pathways

FDOH prepared a Public Health Assessment at Main Street MGP/Confederate Park Site in 2015 (**Appendix B**). In the Public Health Assessment Report, FDOH identified three completed human health exposure pathways including worker on-site soil ingestion, park visitor on-site soil ingestion, and eating fish. Overall, FDOH finds the Main Street MGP/Confederate Park site is no apparent public health hazard and the increased cancer risks are "very low" to "extremely low."

Given that site groundwater is not used as a potable source, the potentially completed human health pathways from the Site are summarized below:

- Surface soil to workers and park visitors.
- Contact by workers and park visitors with surface water. Although no analytical data are available to directly confirm that surface water is impacted by site source material, the potential for impacts exists through discharge of impacted groundwater to Hogan's Creek and the decorative pond.

Each of these pathways will be addressed in this RAP.

4.3 Feasibility Study and Remedial Alternatives

A Feasibility Study (FS) was prepared by Geosyntec in January 2014 and a Comment Letter was submitted by CRA on December 15, 2014. The FS provides three remedial alternatives for further consideration at the site: 1) Hydraulic Control, 2) Barrier Wall with Excavation and Monitored Natural Attenuation (MNA), and 3) Barrier Wall with In-Situ Stabilization and MNA. On May 20, 2014, the Tallahassee technical review section of FDEP issued review comments regarding the FS by Geosyntec. The FDEP reviewer provided the following analysis (emphasis added):

- *"Given the estimated extent and volume of MGP waste impacted zones in the subsurface, the concentrations of associated constituents (mostly BTEX & PAHs) in groundwater are lower than what I have seen at a couple of other MGP cleanup sites. The MGP subsurface waste material has reportedly been in place for about 100 years, and the more mobile and degradable compounds have likely attenuated leaving mostly the less mobile contaminants bound up in the soil matrix. <u>This alone gives support to consideration of a less aggressive remedial strategy such as hydraulic control/MNA (Alternative 1) as a site remedial strategy</u>. <u>Also, hydraulic control can serve as an engineering control for closure with conditions.</u>*
- *<u>Proposed remedial Alternative 2 and Alternative 3 would be significantly more expensive and disruptive than the Alternative 1 (hydraulic control) option that would arguably achieve the same level of protectiveness</u>. <u>There is something to be said for what was pointed out by one of the commenters, and that is there are serious risks to human health and the environment associated with implementation of a very disruptive and hazardous construction project, such as a large scale soil removal/treatment project, conducted within a developed urban setting.</u> It may be that this aspect of the risk analysis also favors a less disruptive remedial strategy such as hydraulic control/MNA to address site groundwater contamination.*
- *Presumably, it is intended that the selected remedial option will address "the site" inclusive of Confederate Park and properties immediately to the south impacted by releases from both the former MGP and petroleum USTs. One of the public comments received on the FS states that "It is also significant that at the public meeting held on March 17, 2014, Geosyntec acknowledged that the contaminants entrained in the wood debris lying above the dense non-aqueous phase liquid ("DNAPL") material was likely associated with discharges from the USTs and was not MGP material. Discussion and consideration of this contamination (and its eligibility for remediation under the Department program) is conspicuously absent from the Report." It is not clear if, and how, the Petroleum Restoration Program (PRP) would be involved in implementation of the selected remedial option. However, I did find where the Park View Inn site had its PRP State funded site eligibility status revoked."*

On March 20, 2015, the Northeast District of FDEP issued the Comment Letter regarding the FS by Geosyntec and the Comment Letter prepared by CRA. The DEP Comment Letter states that:

> *"Alternative 1 (Hydraulic Control), while a technically feasible remedial alternative, would not lead to eligibility for conditional site closure until the groundwater extraction and treatment system is operational, the ornamental pond is lined, and new groundwater flow dynamics as well as the lateral extent of the plume are firmly established. Moreover, since the contaminant source material would continue to*

affect groundwater for an indefinite period of time, a conditional site closure would also not be granted as long as groundwater continues to be impacted and the potential to access it exists…"

In the Comment Letter dated December 15, 2014, CRA modeled the groundwater flow dynamics under a scenario wherein the pond and Hogan's Creek are lined and Hydraulic Control is occurring. The results indicated that the plume could be contained on the Site by pumping a relatively small volume of groundwater. This RAP evaluates the groundwater plume under the scenario of lining of the pond and the Hogan's Creek with and without the long-term operation of the hydraulic control – using the length of the creek liner as a critical design element. Additionally, by creating a more aerobic environment in the subsurface, the flux of the more mobile compounds (i.e., benzene and naphthalene) will be reduced and a more robust biological community established. Given the FDEP's requirements, two variations on the theme of hydraulic control were considered:

Scenario A:

- Surface soil management to the commercial/industrial SCTL or site-specific background level for PAHs with additional sampling in the areas proposed by FDOH;
- Sediment removal and Pond/Creek Lining (**Figure 3**);
- Hydraulic Control through groundwater recovery as an Engineering Control per Chapter 62-780 FAC used in conjunction with an Institutional Control on the use of groundwater after groundwater plume re-stabilization;
- Above ground treatment of recovered groundwater and discharge groundwater through an infiltration gallery or to surface water through the decorative pond (or the creek) under a National Pollutant Discharge Elimination System (NPDES) permit; and
- Operation and maintenance of the Hydraulic Control system as an Engineering Control, and monitoring groundwater elevations to ensure capture. Closure is issued when groundwater monitoring is no longer required.
- While the Hydraulic Control would continue as an Engineering Control, groundwater monitoring would end once the system achieved steady state. At that time, system maintenance would include a shift to monitoring groundwater elevations.

The Interstate Technology and Regulatory Council's (ITRC's) Enhanced Attenuation document (EACO-1, 2008) lays out the theoretical framework for the shift from active groundwater monitoring to more passive means of gauging success (e.g., groundwater elevation monitoring instead of groundwater sampling), which would also be part of any slurry wall design. Once the plume is captured and at steady state, the only variable would be maintaining capture, which could be monitored by groundwater elevations instead of concentrations. Regarding Scenario A, with the design presented below, a length of the creek will be lined such that the plume (without pumping) will not discharge above Surface Water Cleanup Target Levels (SWCTLs – Surface Water Quality Standards per Chapter 62-302 FAC) into Hogan's Creek. In addition, the plume will also be maintained inside the Institutional Control boundary at a concentration below the GCTL (**Figure 3** and **Section 5.4**).

Scenario B:

- Surface soil management to the commercial/industrial SCTL or site-specific background level for PAHs with additional sampling in the areas proposed by FDOH;
- Sediment removal and Pond/Creek Lining (**Figure 3**);
- Injection of biostimulation fluid (i.e., low-level nutrients and oxidant, such as dilute H_2O_2). This fluid will be injected through six to ten points and distributed by the Hydraulic Control system. Biostimulation will enhance the removal of the mobile and biodegradable compounds (i.e., benzene and naphthalene), weathering the source material, and reducing the mass of COCs in the source materials that provide a flux to groundwater. With the reduction or elimination of the mobile compounds, Hydraulic Control of the subsurface source materials is not necessary.
- Initial Hydraulic Control through groundwater recovery followed by implementation of an Institutional Control on the use of groundwater after groundwater plume re-stabilization;
- Above ground treatment of recovered groundwater and discharge groundwater through an infiltration gallery or to surface water through the decorative pond (or the creek) under a National Pollutant Discharge Elimination System (NPDES) permit; and
- Cessation of the Hydraulic Control when the groundwater re-establishes steady state below the SWCTL prior to groundwater discharge to Hogan's Creek, down-gradient of the liner and below the GCTL within the Institutional Control.
- Monitoring groundwater until steady state is achieved. Closure is achieved after a one-year monitoring period after groundwater pumping has ended.

In Scenario B, after an initial period of Hydraulic Control and biostimulation, the Hydraulic Control will be discontinued. Much as in the case for Scenario A discussed above, a length of the creek will be lined such that (without pumping) the plume will not discharge above SWCTLs into Hogan's Creek. In addition, the plume will also be maintained inside the IC boundary at a concentration below the default GCTL (**Figure 3** and **Section 5.4**).

As stated in the Comment Letter dated December 15, 2014, Alternative 1 (Hydraulic Control) has several benefits as compared to Alternatives2 (Barrier Wall with Excavation and Monitored Natural Attenuation (MNA)) and 3 (Barrier Wall with In-Situ Stabilization and MNA):

- is an Engineering Control that provides equivalent function as a physical barrier, like a slurry wall;
- provides the potential for post-startup optimization to improve capture under varying horizontal and vertical gradients that may change with time;
- has no impact on existing utilities, structures (including historical structures), decorative pond and Hogan's Creek, or floodplain;
- has only hypothetical exposure pathways once implemented, while implementation of Alternatives 2 and 3 results in real exposure to construction workers and off-site residents and actuarial risk of death associated with transportation and heavy construction;

- is much less intrusive, including issues with generating dust and traffic control in the neighborhoods;
- does not consume landfill space, remedial efforts release less greenhouse gas (e.g., carbon dioxide), and consume much less fuel; and
- costs approximately $10 million less without a measurable difference in risk reduction.

Hence, the potential human health and surface water impacts from the Site (**Section 4.2**) will be eliminated via Alternative 1.

Section 5.0 Conceptual Remedial Design and RAP Preparation

5.1 Remedial Action Objectives

The remedial action objective (RAO) for the Site is to meet the applicable No Further Action criteria of Rule 62 780.680, FAC, specifically using Risk Management Options Level III, which requires that the remedy be protective of human health (i.e., workers and visitors) and the environment (Hogan's Creek surface water). Implementation of the RAP will eliminate the surface soil risk to human health, use of Site groundwater, and subsurface impacts to surface water (i.e., all exposure pathways).

Based on the information collected during Site assessment activities, the following components, which will be used to meet the RAO, have been established:

- Hydraulically control and recover groundwater containing COCs such that groundwater above the SWCTL will not discharge to Hogan's Creek and groundwater with concentrations above the default GCTL does not extend beyond the Institutional Control boundary; and,
- Use of the regulatory framework per Chapter 62-780, FAC, to achieve Site closure in accordance with RMO III, including:

  Scenario A:
    - Operate a hydraulic control system as an Engineering Control (after lining the pond and a portion of the creek) and measuring groundwater elevations as a means of ensuring hydraulic control (much as a slurry wall requires the measurement of groundwater elevations inside and outside the wall in perpetuity to ensure proper operation);
    - Monitor groundwater concentrations to ensure that they remain below the applicable default GCTLs at the Institutional Control (IC) (**Figure 3**) boundaries for a minimum of four quarters; and,
    - Implement ICs on the use of groundwater per the Institutional Controls Procedures Guidance dated June 2012.

  Scenario B:
    - Operate a Hydraulic Control and biostimulation system (after lining the pond and a portion of the creek) until it can be demonstrated that the dissolved COC plume is shrinking or stable, after which cease operation of that hydraulic control system;

- o Achieve Site COC concentrations less than the applicable SWGCTLs prior to groundwater discharge to Hogan's Creek after monitoring for an appropriate period, as well as ensuring that GCTLs are not exceeded at the IC (**Figure 3**) boundaries after a minimum of four quarters of groundwater monitoring; and,
- o Implement ICs on groundwater per Institutional Controls Procedures Guidance dated June 2012.

This RAP design was based upon additional groundwater modeling that was performed to estimate the steady-state plume length after the initial operation of the hydraulic control system (**Section 5.4**). Specifically, immediately after the lining of the pond and a portion of the creek are complete, there will likely be a temporary increase in flux from the impacted area due to shifting flow patterns. Once flow patterns are reestablished, steady state will return, facilitated by a hydraulic control system. In Scenario B, once the flux from the impacted area is no longer sufficient to cause a discharge to Hogan's Creek down-gradient of the liner above the SWCTL (and considering concomitant resolution of the bulleted items above), the site will meet the RMO III requirements. In Scenario A, RMO III requirements are met when groundwater monitoring is complete and the monitoring is shifted to maintenance of the Hydraulic Control system by monitoring groundwater elevations (much as is done for a slurry wall by maintaining groundwater elevations inside and outside the slurry wall).

5.2 Surface Soil

As shown on **Figure 9** of **Appendix A**, the area containing BaP TEQs above the commercial/industrial SCTL is limited to the south of the pond and the south of Hogan's Creek. Although existing data indicate that BaP TEQs were above the commercial/industrial cleanup target level in certain portions of the park surface soil, the excavation and offsite disposal of the top two feet of soil may not be necessary given that the urban background levels surrounding the site are not currently known. In accordance with FDEP's Guidance for Comparing Background and Site Chemical Concentrations in Soil (January 2012), a plan for review by the FDEP will be developed to collect urban surface background soil samples to determine a site-specific alternative SCTL for the site. In addition, the eight surface soil samples (0 to 6 inches) requested by FDOH (**Section 3.5.1**) will be collected. Appropriate actions (*i.e.,* hotspot removal, clean fill, access restriction, *etc.*) will be taken to protect the workers and park visitors from hypothetical risk from exposure to the surface soil impacts exceeding alternative SCTLs.

5.3 Sediment Removal and Pond and Creek Lining

Prior to installation of the liner, sediments from the decorative pond and a segment of the Hogan's Creek will be excavated and hauled offsite for proper disposal. With a 2-foot deep excavation, approximately 2,500 and 1,500 cubic yards of sediment will be removed for proper disposal from the pond and the creek, respectively (areas for sediment removal shown in **Figure 3**). The excavation area of the pond and Hogan's Creek will be lined using impermeable materials (*e.g.,* AquaBlok). The lining of the pond and the segment of Hogan's Creek will eliminate the migration of COCs from the subsurface to the surface water. The length of the creek liner will be designed to eliminate discharge of groundwater above SWCTLs (**Section 5.4**)

5.4 Groundwater Contaminant Transport Modeling

The lining of the pond and the segment of Hogan's Creek will change the groundwater flow dynamics, and the groundwater plume will temporarily be out of equilibrium upon the new groundwater dynamics. CRA conducted groundwater fate-and-transport modeling of the dissolved COCs, particularly benzene and naphthalene, considering the new flow regime. Benzene and naphthalene are selected as the representative COCs for the fate-and-transport modeling given their relatively high concentrations in the groundwater plumes and their relatively higher mobility than other COCs at the Site. Below, groundwater modeling is discussed with (Scenario A) and without (Scenario B) the implementation of the hydraulic control system.

5.4.1 Without Pumping

The existing groundwater flow model (used in the FS) for the Site was updated to include a contaminant transport model of the plumes under two sets of modified conditions. Those conditions included (i) lining the decorative pond and the segment of the Hogan's Creek with low permeable materials and (ii) the implementation of hydraulic control through groundwater recovery after the liners are installed.

The mass transport model was created using MT3DMS (Zheng 2010), which simulates chemical transport using the advective-dispersive equation with fluid sinks/sources, equilibrium-controlled sorption, and first order irreversible rate degradation. The source areas were simulated as constant concentration boundaries using groundwater concentrations presented in the Feasibility Study (2014). The distributions of the source areas were represented in the upper and lower surficial aquifers consistent with the SAR (2011) and the recent Feasibility Study. The initial concentration plumes of dissolved phase benzene and naphthalene in the upper and lower surficial aquifers were simulated using the concentrations in monitor wells presented in the Feasibility Study.

Benzene and naphthalene were selected as the bellwether chemicals for remedial design because these two chemicals are present at the highest concentrations in groundwater, as well as having lower soil: water partition coefficients (e.g., as compared to the larger PAHs), meaning they can be transported further than the larger PAHs. Although the source flux will decay (especially initially), source decay terms for DNAPL were not identified from the literature research conducted; hence, no decay terms were incorporated into the model (which is a conservative assumption because the flux from the source is expected to continue to decrease with time). First order degradation rates for dissolved benzene and naphthalene were identified and used in the model. The decay rates (Howard, 1991) used in the model included the average value of 0.61 yr^{-1} for benzene, and the average value of 1.79 yr^{-1} for naphthalene.

The transport model also simulated the effects of linear, equilibrium-controlled sorption. The equation that describes linear sorption is as follows:

$$S = K_d \times C$$

where:

S	is mass sorbed per mass of sorbent (milligrams per kilogram [mg/Kg]);
K_d	is the distribution or partition coefficient (Liters/kilogram [L/Kg]); and
C	is concentration in groundwater at equilibrium (milligrams per Liter [mg/L]).

and

$$K_d = K_{oc} \times f_{oc}$$

K_{oc}	is the organic carbon partition coefficient; and
f_{oc}	is the fraction of organic carbon.

For K_{oc}, the FDEP default values are 59 L/Kg for benzene and 2000 L/Kg for naphthalene, and the default f_{oc} is 0.006 (0.6%). The K_d's calculated from these values of K_{oc} and f_{oc} were assigned to all layers of the model with the exception of layer 3, which represents the woody and peat material. The f_{oc} for this material was estimated at 0.45 (45%) according to the peat elemental composition analysis by International Humic Substance Society.

To simulate the worst case (e.g., no source decay term), the steady-state plume configuration without pumping was simulated to determine the fate of the dissolved plume with respect to potential discharge to the down-gradient portion of the creek beyond the area where the liner is to be installed. The site plan with the source impacts and the proposed lining are depicted on **Appendix D-Figure 1**. The model simulation results for naphthalene are presented on **Appendix D-Figure 2** and **Figure 3** and, for benzene, the results are presented on **Appendix D-Figure 4** and **Figure 5**. Based on the groundwater model, all groundwater ultimately discharges to the creek, and the point of discharge, as expected, is controlled by the length of the creek liner. Importantly, the maximum plume length (using the SWCTL) is achieved well short of the end of the creek liner and well short of the proposed IC boundary (using the default GCTL) without hydraulic control (**Figure 3**).

As a precaution, Hydraulic Control will initially be implemented (**Section 5.4.2**) for Scenario A and B. In order to determine when the operation of the Hydraulic Control system can be ended, the existing groundwater model will be used to assess the anticipated flux at given locations within the plume. In addition, a line of relatively closely spaced wells will be installed to monitor plume stability parallel with the flow direction (**Section 5.4.3**). Hence, both modeling results and monitoring data will be used to determine when the plume returns to steady state. That is, these groundwater flux results can be used to estimate the steady-state flux of contaminants at any location in the model, and, in particular, the flux compared to the flux recovered by the Hydraulic Control system. Hence, using the simulated flux to the down-gradient portion of the plume and measuring flux recovered from the Hydraulic Control system (next section), groundwater recovery can be terminated when the observed flux approximates the simulated flux. Alternatively, pumping can be terminated when the monitor and recovery well concentrations stabilize. After the desired flux is achieved, the Hydraulic Control can be terminated, and the plume monitoring can begin to confirm the modeling results.

The lined portion of Hogan's Creek is shown in **Figure 3**. Approximately 1000 feet of Hogan's Creek will be lined to eliminate the discharge of groundwater to the creek above the SWCTL. The current results of the transport model indicate that the plume will not discharge above SWCTLs to the creek in the USA. The plume in the LSA also decreases to below the SWCTL before discharging to the down-gradient parts of the creek.

5.4.2 With Pumping

The Hydraulic Control system was modeled with three recovery wells, each pumping at 14.55 m^3/day (2.76 gpm per well or 8 gpm total). The model simulation results for naphthalene are presented on **Appendix D-Figure 6** and **Figure 7** and, for benzene, the results are presented on **Appendix D-Figure 8** and **Figure 9**. The flow model was run to steady state. The Hydraulic Control system's capture zone demonstrates that the plume is effectively contained at this pumping rate. Due to the uncertainty of the source area and plume concentrations, the time required to operate the recovery system will be determined by comparing the static model fluxes (i.e., without pumping) for naphthalene and benzene to observed fluxes. That is, the groundwater model indicates that, at a given flux without pumping, the plume will not exceed the SWCTL when it discharges to the creek after the end of the creek liner, nor will the plume reach the Institutional Control boundary above the GCTL. With this approach, the system would be turned off and groundwater monitoring would begin (**Section 5.4.3**).

5.4.3 Mass Flux

Based on the fate-and-transport modeling results, the steady-state static groundwater fluxes in the USA and LSA are 0.01 m^3/day and 0.05 m^3/day (for a 20 ft^2 cell through the USA and LSA), respectively. These locations are immediately down-gradient from two of the proposed recovery wells. Using the source concentrations, the steady-state mass fluxes for benzene in the USA and LSA are 1.91 mg/day and 9.54 mg/day, respectively. In addition, the steady-state mass flux for naphthalene in the USA and LSA are 90.8 mg/day and 454 mg/day, respectively. Once these fluxes are achieved by recovery from the down-gradient recovery well pumping alone, the operation of the Hydraulic Control system can be discontinued. A series of three closely spaced nested monitoring wells (approximately 20-foot centers) would be installed prior to the end of the creek liner. These monitoring wells would be monitored over a one-year period to ensure plume stability.

5.5 Remedial Assessment Data

5.5.1 Urban Background PAHs

Approximately 15 surface soil samples will be collected in the vicinity of the Site to evaluate the urban background levels for PAHs in accordance with FDEP's Guidance for Comparing Background and Site Chemical Concentrations in Soil (January 2012). The urban background determined for the area may be used as an alternative SCTL for PAHs. In addition, the eight surface soil samples (0 to 6 inches deep) requested by FDOH (Section 3.5.1) will be collected.

5.5.2 Groundwater Sampling

Although the past groundwater monitoring results have shown a stable plume in the SAS, per the requirements of Chapter 62-780, FAC, a confirmatory round of sampling and analyses is required within 270 days prior to the submittal of the RAP. The previous round of groundwater sampling was conducted in October 2013. A round of groundwater sampling and analyses for BTEX and PAHs are necessary to confirm the current groundwater plume status and to validate the groundwater contaminant transport modeling. Upon approval of this RAP, a groundwater sampling event will be conducted using the scope of the groundwater monitoring event previously conducted in October 2013 by Geosyntec and reported in the FS. These data will become a basis for the detailed design.

5.5.3 Pumping Test

One 4-inch diameter well will be installed at one of the proposed groundwater recovery locations, and a pumping test will be conducted using a submersible pump, wiring, and control box, an electrical generator and fuel, a totalizing flow meter with valves and hoses, and two electrical water level measuring tapes. An InSitu data logger will be installed and operated, along with one pressure transducer capable of withstanding as much as 50 feet of head. It is understood that the water generated during the pumping test will be stored in a 5,000-gallon tank and tested prior to discharge (treatment will be conducted prior to discharge, if needed).

A step-drawdown test will be performed to determine a suitable pumping rate that will adequately stress the aquifer, without dewatering the well during an eight-hour pumping period. The step-test will be performed on the first day of the project. Following the step test, the pumping well will be allowed to recover overnight. On the second day, the continuous rate-pumping test will be conducted. The drawdown in the pumping well will be measured and recorded logarithmically with the data logger (supplemented by manual readings using an electrical water level measuring tape). Water levels will also be measured in the designated observation wells using pressure transducers and electronic measuring tapes.

Following completion of the pumping tests, recovery tests will be conducted until water levels have stabilized in the pumping and observation wells. The data will be downloaded from the data logger, and the manual measurements will be compiled from the observation wells. The aquifer test data will be used with applicable analytical pumping and recovery test solutions to calculate hydraulic parameters, including transmissivity and storativity. The test data will also be used to validate the groundwater flow model.

5.5.4 Soil Infiltration Test

Double-ring infiltrometer (DRI) tests will be conducted at two locations to evaluate the potential use of an infiltration gallery for the disposal of the treated groundwater. The testing locations are shown in **Appendix E**. The test will be performed in general accordance with ASTM D3385-09. The base of the ring will be set at an approximate depth of three feet BLS. The inner ring diameter of the infiltrometer is 30.5 cm and the outer ring diameter is 61 cm, totaling an annular area of 2189 square centimeters and inner ring diameter of 729 square centimeters. Water will be added to maintain constant head within the rings. Inner ring and annular space flow rates will be measured and infiltration velocities will calculated from these flow rates. The flow rates will be measured every quarter of an hour for the first hour and every half hour thereafter for a total of four hours. The feasibility and actual design of the infiltration gallery will be determined based upon the DRI test results. If feasible, the discharge through the infiltration gallery will be incorporated into the groundwater contaminant modeling to validate the fate and transport of the groundwater plume.

5.5.5 Treatment and Discharge Options

The recovered groundwater will be treated using granular activated carbon units and subsequently discharged. If the DRI test results do not support the discharge through an infiltration gallery, discharge to surface water through the decorative pond (or the creek) under a National Pollutant Discharge Elimination System (NPDES) permit will be pursued. Prior to the permit application, a pilot test of the groundwater recovery and treatment may be needed to meet the permit requirements.

5.5.6 Validation of Groundwater Contaminant Transport Modeling

The groundwater modeling will be validated, *i.e.,* model verification, using the pumping test results and infiltration gallery design parameters. The validated groundwater modeling will provide the final RAP design parameters, such as the groundwater recovery locations and depths, the flow rates, the infiltration gallery locations and layout, and the associated above ground treatment system. Using this data, the liner for the pond and a portion of the creek will be designed, and submitted for FDEP review.

5.5.7 Institutional Controls

The goal of achieving site closure is either through implementation of a hydraulic control system until the plume is anticipated to come to steady state within the Institutional Control boundary (Scenario B) or implementation of long-term hydraulic control as an Engineering Control, as defined in Chapter 62-780, FAC (Scenario A). Based upon current groundwater contaminant transport modeling, the area required to be within the IC includes the south portion of Confederate Park, the EHT property, the PVI property, the Warren Partnership property, and the portion of Orange Street right-of-way. A proposed IC boundary is shown in **Figure 3**. Permission to include these sites will be obtained as part of the detailed design.

5.6 Detailed Design Calculation Submittal Schedule

A timeline for the submittal of the RAP is listed in **Table 1** and depicted on **Figure 4**. The RAP detailed design calculations for surface soil removal (as needed), sediment removal from the pond and a portion of Hogan's Creek and off-site disposal, lining of the pond and a portion of Hogan's Creek, the hydraulic control well installation and recovery system, the groundwater treatment and disposal system, and the biostimulation system dosage system. In addition, a updated groundwater fate-and-transport model will be prepared using the remedial assessment data. Upon the approval of the RAP, the implementation of the RAP will be conducted.

Section 6.0 Conclusions

Based upon the FS by Geosyntec dated January 2014, Tallahassee technical review comments dated May 20, 2014, the Comment Letter by CRA on December 15, 2014, and the FDEP Northeast District Comment Letter dated March 20, 2015, three remedial alternatives were offered for the site: 1) Hydraulic Control, 2) Barrier Wall with Excavation and Monitored Natural Attenuation (MNA), and 3) Barrier Wall with In-Situ Stabilization and MNA.

In technical review, the FDEP discussed "*support [for] consideration of a less aggressive remedial strategy such as hydraulic control/MNA (Alternative 1) as a site remedial strategy. Also, hydraulic control can serve as an engineering control for closure with conditions"* and FDEP further stated that "*[p]roposed remedial Alternative 2 and Alternative 3 would be significantly more expensive and disruptive than the Alternative 1 (hydraulic control) option that would arguably achieve the same level of protectiveness*." In the Comment Letter, FDEP added further comments, stating, *"a conditional site closure would also not be granted as long as groundwater continues to be impacted and the potential to access it exists…"* In related discussions, CRA understood that the need for perpetual groundwater monitoring was an impediment to closure. Hence, CRA used these comments as a basis for the remedial strategy in this RAP.

Under Scenario A, the Hydraulic Control system is an Engineering Control that (as part of the entire remedy) eliminates potential exposure pathways and allows a shift to Engineering Control maintenance (i.e., monitoring groundwater elevations much as with a slurry wall) and away from active groundwater sampling. This shift to a more passive, long-term strategy is an underlying principle for ITRC's Enhanced Attenuation guidance. Under Scenario B, a key design element is the length of the creek liner. Like Scenario A, Scenario B eliminates potential exposure pathways and active groundwater sampling. By a judicious design selection, the plume will be captured by discharge to the creek (i.e., the plume is not uncontrolled), but the discharge concentration to the creek will be designed to be below the SWCTL, while the entire plume will also be held within the IC boundaries below the default GCTL by the creek capture. This remedial solution fits also nicely into the ITRC's Enhanced Attenuation theme by using natural energy to eliminate exposure routes, as well as allowing a shift away from active groundwater monitoring (after a period of monitoring and modeling to ensure system stability).

Some of the benefits for Hydraulic Control under Scenarios A & B are that it:

- leaves no source material uncontrolled, regardless of whether the source material has been discovered;
- is an Engineering Control that provides equivalent function as a physical barrier, like a slurry wall;

- maintains and enhances the upward gradient to prevent downward migration;
- provides the potential for post-startup optimization to improve capture under varying horizontal and vertical gradients that may change with time;
- has no impact on existing utilities, structures (including historical structures), or floodplain;
- does not require the re-routing of Hogan's Creek;
- has only hypothetical exposure pathways, while implementation of Alternatives 2 and 3 results in real exposure to construction workers and off-site residents and actuarial risk of death associated with transportation and heavy construction;
- is much less intrusive, including issues with generating dust and traffic control in the neighborhoods;
- does not consume landfill space, remedial efforts release less greenhouse gas (e.g., carbon dioxide), and consume much less fuel;
- does not utilize a slurry wall, which itself may require O&M of the long-term hydraulic control system; and
- costs $10,000,000 less without a measurable difference in risk reduction.

The site assessment data and health assessment are summarized as below:

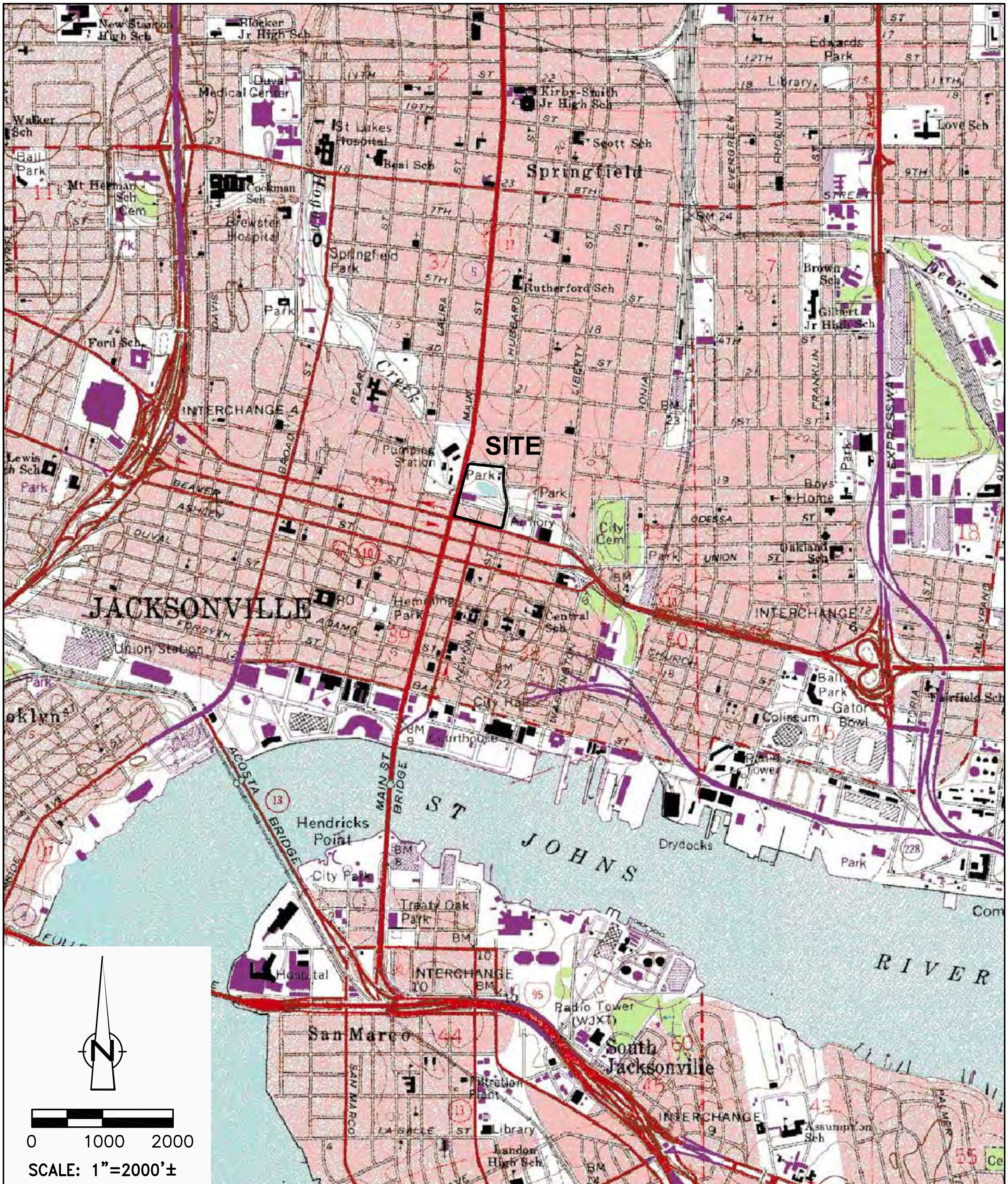
- The Site is located in an urban setting in downtown Jacksonville, Florida. The Site has surface and subsurface impacts from multiple sources, including MGP-related impacts, UST-related impacts, up-gradient industrial operations, storm water runoff, and urban background impacts.
- The COCs primarily include PAHs and BTEX. Groundwater has been delineated. The impacts are limited to the surficial aquifer system.
- Surface soils appear to have been impacted; however, they do not pose an immediate danger to human health based on the FDOH risk assessment.
- The results from the sediment investigation in the pond and the creek indicate that impacts exist, but that there are contributions from other upstream sources on Hogan's Creek.
- No potable wells are impacted from the Site contamination.
- The groundwater plumes are stable under the existing groundwater/surface water flow patterns.

Hydraulic Control used in conjunction with lining the pond and a portion of Hogan's Creek followed by implementation of an IC on the residual plume is proposed as the remedial alternative to eliminate the potential risk from exposure to site groundwater. Under Scenario A, the Hydraulic Control system is implemented as an Engineering Control with specific maintenance and groundwater elevation monitoring requirements, similar to those required for a slurry wall. Under Scenario B, the operation of the Hydraulic Control system ceases when the flux from the source is assimilated by the aquifer such that groundwater discharging to Hogan's Creek down-gradient of the creek liner is below the SWCTL. In addition, groundwater transport modeling under the proposed RAP approach indicates that groundwater at the edge of the IC boundary will not exceed the GCTL. Thus, with the implementation of the RAP system, the groundwater plume will be limited to the IC boundary as presented in **Section 5.4**. The Site will meet the conditional Closure requirements using RMO Level III per Chapter 62-780, FAC through:

- Testing and removal of on-site soils using default and alternative SCTLs for comparison, and removal and proper disposal of pond and creek sediments.
- ICs prohibiting groundwater use within the IC boundary, and IC against residential land use;
- Engineering control of the groundwater plume by lining the on-site pond and a portion of Hogan's Creek; and
- In either Scenario A or B, groundwater modeling and collection of one year of groundwater monitoring data that indicate that the plumes present are stable or shrinking (discussed in **Section 5.4**). Additionally, through modeling and monitoring, the plume does not discharge above the SWCTL into Hogan's Creek and it remains within the IC boundary at levels below the default GCTLs.
- The currently published commercial/industrial SCTLs, default GCTLs, and SWCTL (*e.g.,* Surface Water Quality Standards) will be used as the remedial design targets, unless these values are superseded by site-specific alternatives in the detailed design.

CRA recommends the approval of this RAP and conducting the RAP preparation tasks to prepare the detailed design portion of the RAP. As part of the implementation of the RAP, remedial assessment will be conducted upon RAP approval, including pumping tests, soil infiltration test and a pilot treatment test for NPDES permit if necessary, and obtaining the ICs for the areas within the groundwater plume boundary. A timeline for RAP remedial assessment and the submittal of the RAP is listed in **Table 1** and depicted on **Figure 4**.

Figures



SOURCE: JACKSONVILLE, FLA., U.S.G.S. QUADRANGLE MAP 1964, PHOTOREVISED 1992

Figure 1

SITE LOCATION
CONFEDERATE PARK
CONFEDERATE STREET
JACKSONVILLE, FLORIDA

090476-01

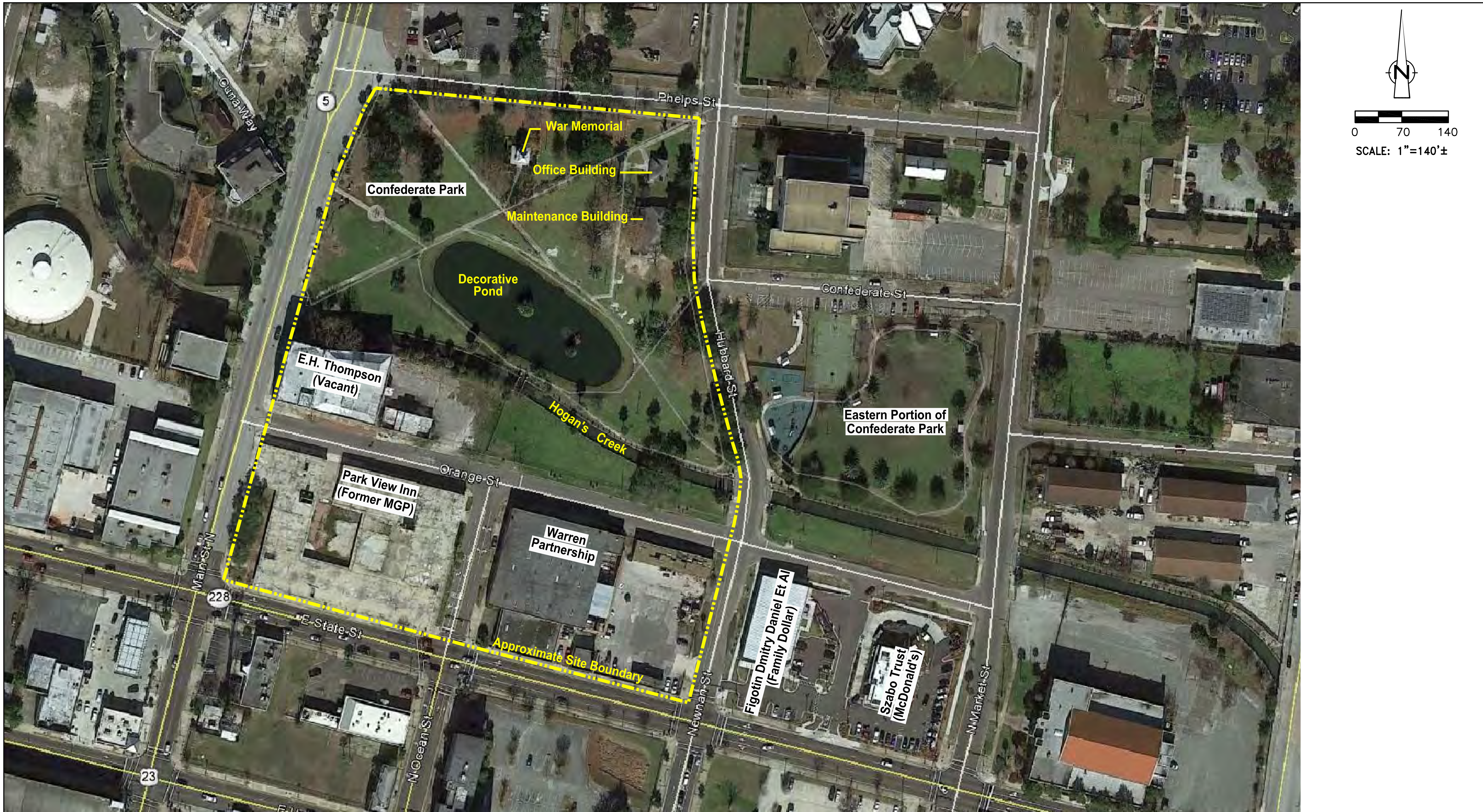


Figure 2

SITE LOCATION MAP
CONFEDERATE PARK
CONFEDERATE STREET
JACKSONVILLE, FLORIDA

SOURCE: 2014 AERIAL PHOTOGRAPH

090476-01

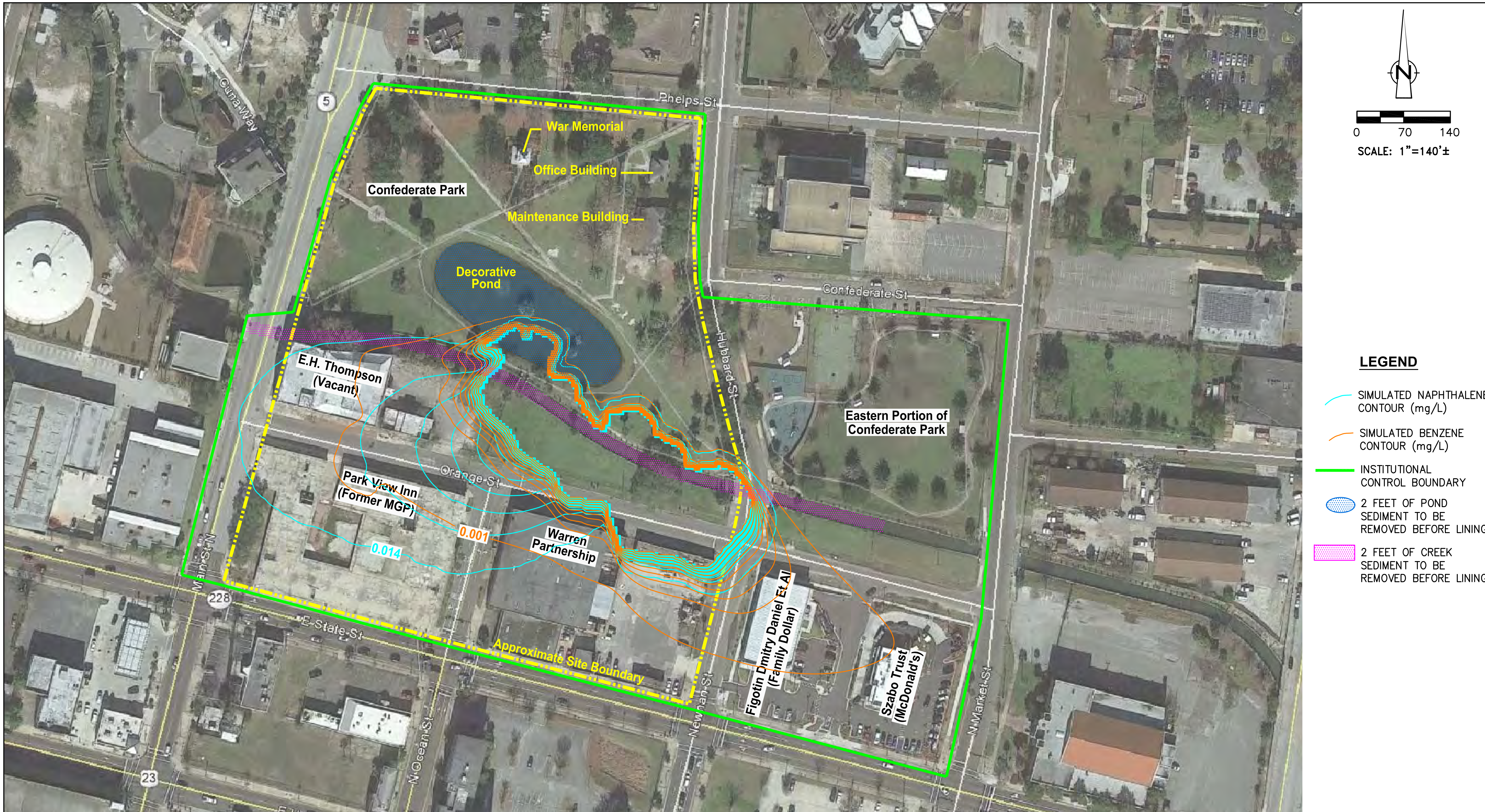


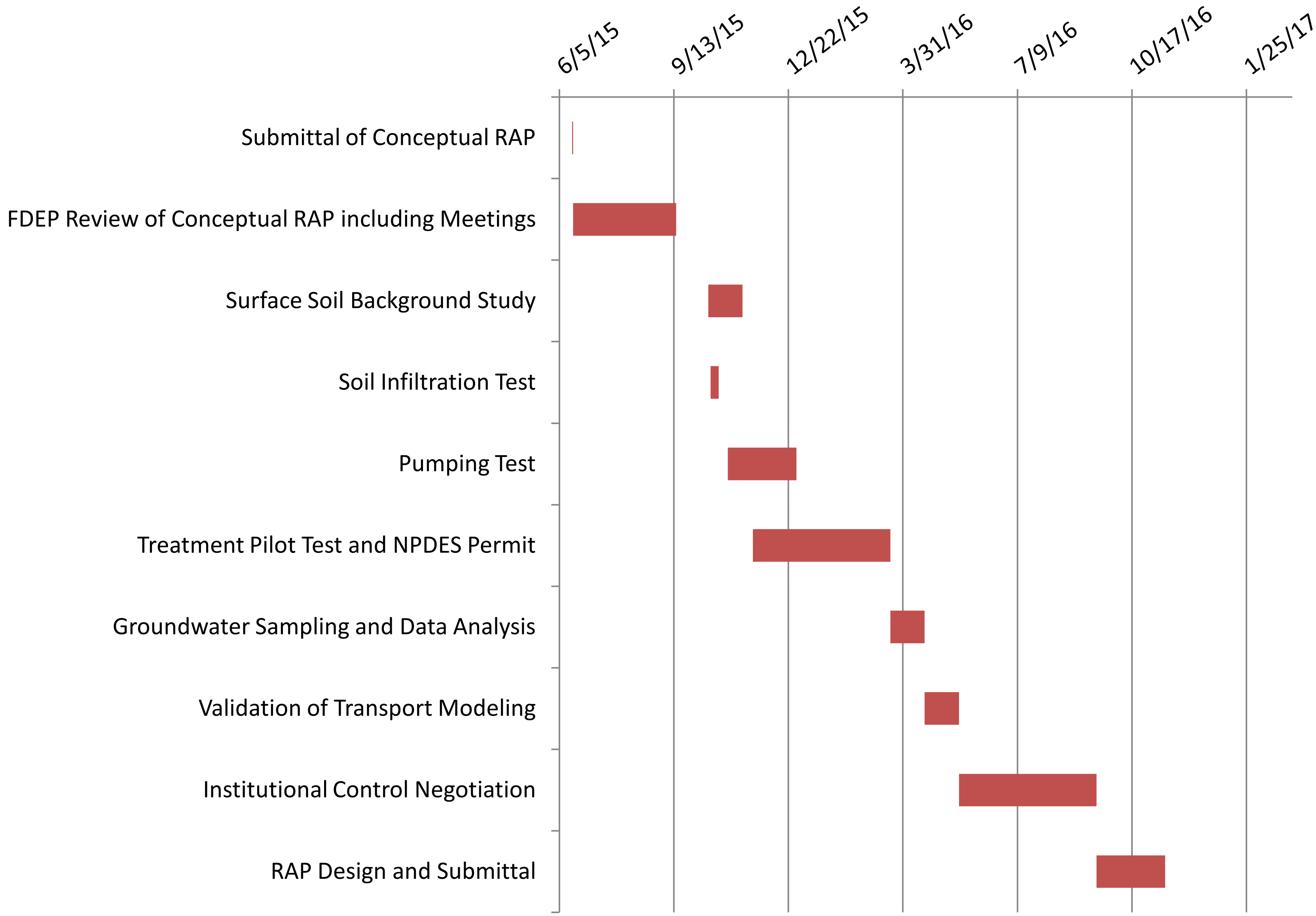
Figure 3

INSTITUTIONAL CONTROL BOUNDARY
CONFEDERATE PARK
CONFEDERATE STREET
JACKSONVILLE, FLORIDA

SOURCE: 2014 AERIAL PHOTOGRAPH

090476-01

Figure 4. Confederate Park RAP Preparation Milestones



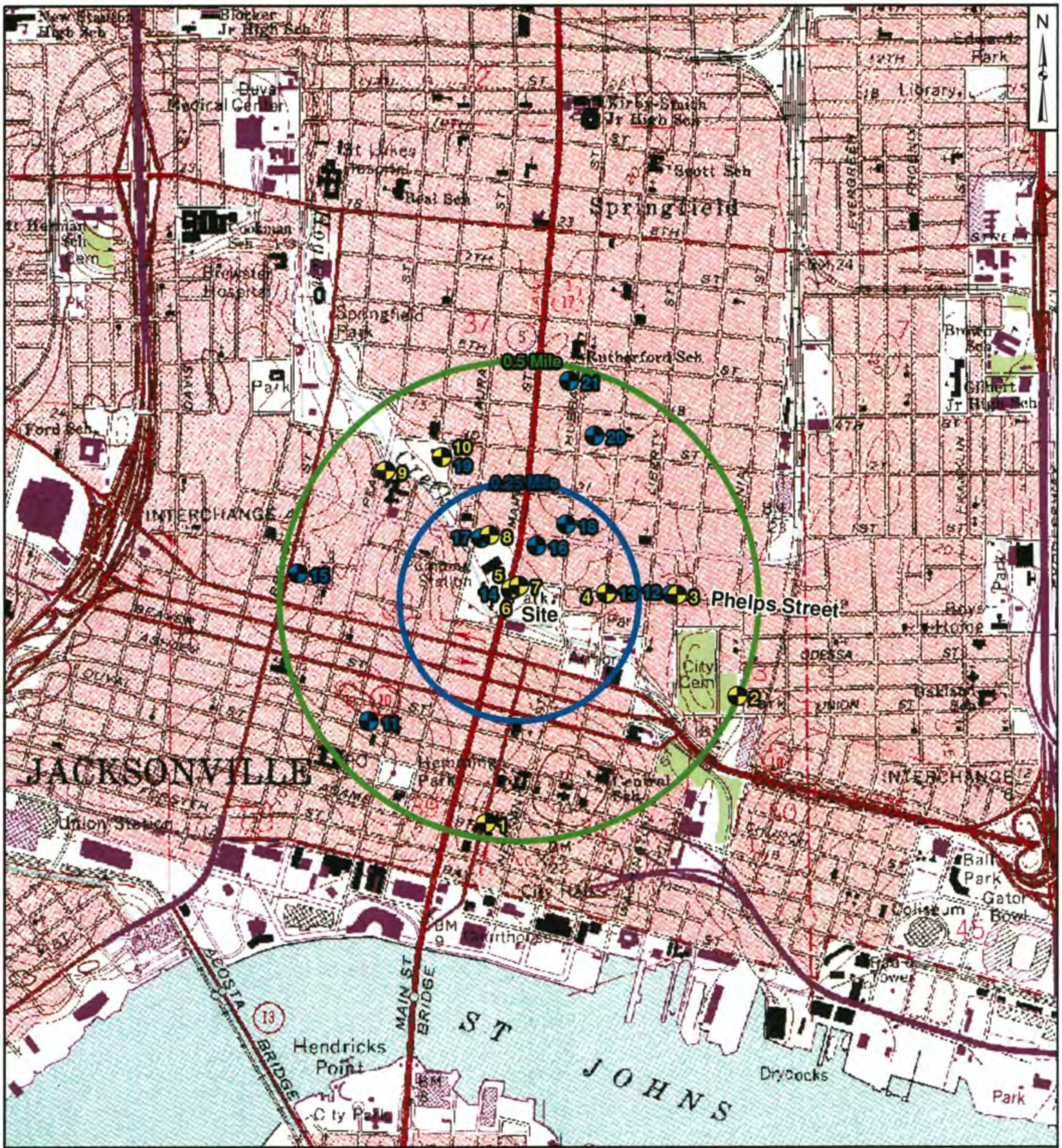
Tables

Table 1. Confederate Park Remedial Action Plan Milestones

Tasks	Start Date	Duration (days)	End Date
Submittal of Conceptual RAP	6/16/2015	1	6/17/2015
FDEP Review of Conceptual RAP including Meetings	6/17/2015	90	9/15/2015
Surface Soil Background Study	10/13/2015	30	11/12/2015
Soil Infiltration Test	10/15/2015	7	10/22/2015
Pumping Test	10/30/2015	60	12/29/2015
Treatment Pilot Test and NPDES Permit	11/21/2015	120	3/20/2016
Groundwater Sampling and Data Analysis	3/20/2016	30	4/19/2016
Validation of Transport Modeling	4/19/2016	30	5/19/2016
Institutional Control Negotiation	5/19/2016	120	9/16/2016
RAP Design and Submittal	9/16/2016	60	11/15/2016

Appendix A

Figure Excerpts from Geosyntec SAR and FS



Legend

- Approximate Subject Site Location
- SUPER ACT Well Location
- SJRWMD Well Location

1,600 800 0 1,600 Feet

Notes:

1. Source of Jacksonville, FL USGS 7.5 Minute Quadrange: Florida Department of Environmental Protection, Land Boundary Information System (LABINS).
2. St Johns River Water Management District (SJRWMD) well locations were downloaded from http://sjr.state.fl.us/gisdevelopment/docs/themes.html.
3. SUPER Act well locations were downloaded from http://www.doh.state.fl.us/environment/water/petroleum/saindex.html.

Site Location Map
and Water Well Inventory

Confederate Park
Jacksonville, FL

Geosyntec consultants

Jacksonville, FL	April 2011	Figure 1

Site Layout

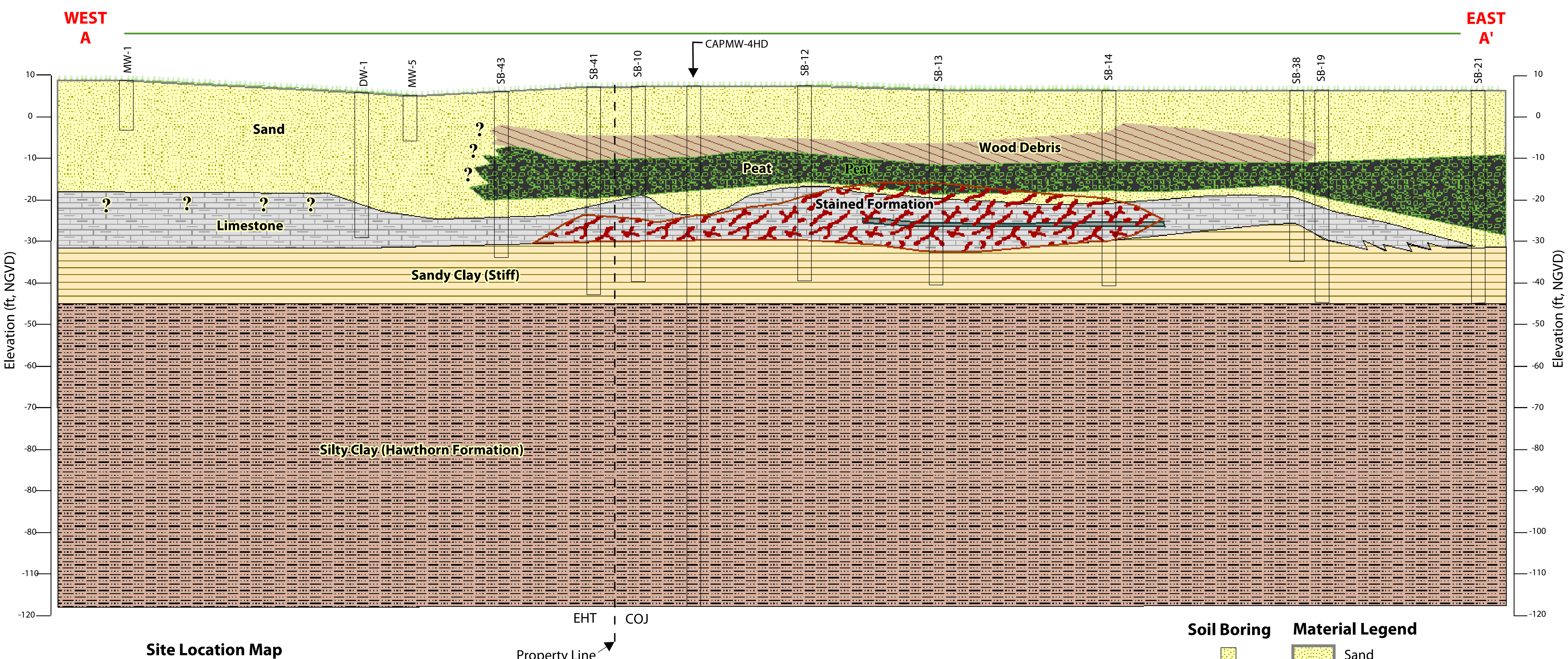
Confederate Park
Jacksonville, FL

Geosyntec consultants

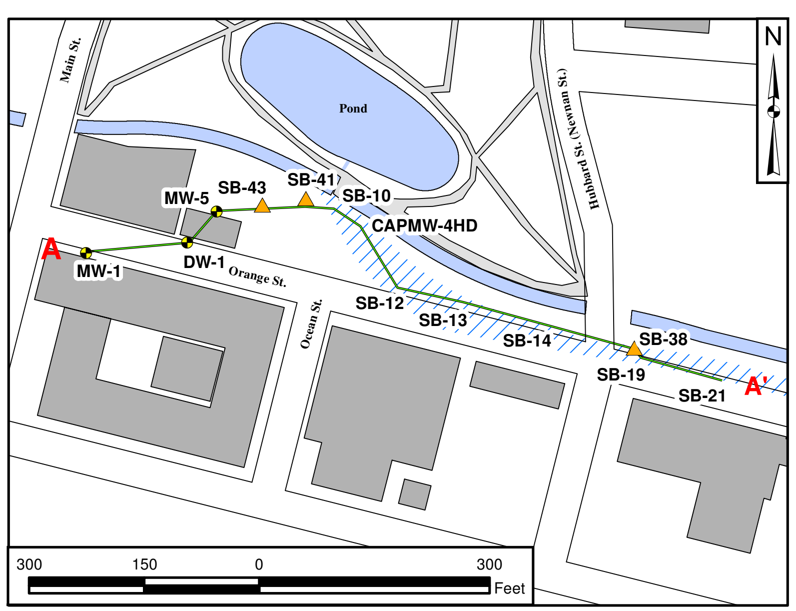
Figure 2

Jacksonville, FL | December 2013

Notes:
1. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.



Site Location Map



Lithologic Transect A - A'

Legend

- Monitoring Well Location
- Soil Boring Location
- Transect A to A'
- Building
- Concrete
- Water
- Approximate Location of the Former Creekbed Based on Historic Sanborn Maps

Notes:

1. Approximate Horizontal Scale: 1 inch = 60 ft
2. Vertical Exaggeration: 3x
3. HCIP = Hogan's Creek Improvement Project
4. Limestone contacts were used from HCIP borings
5. Extent of peat layer and wood debris inferred
6. COJ = City of Jacksonville
7. EHT = EH Thompson
8. NGVD = National Geodetic Vertical Datum
9. Visual impacts observed as a one inch layer in the wood debris, immediately above the peat, in SB-41.
10. Visual impacts observed at a thickness of 0.25 feet in the wood debris layer, immediately above the peat, in SB-43.

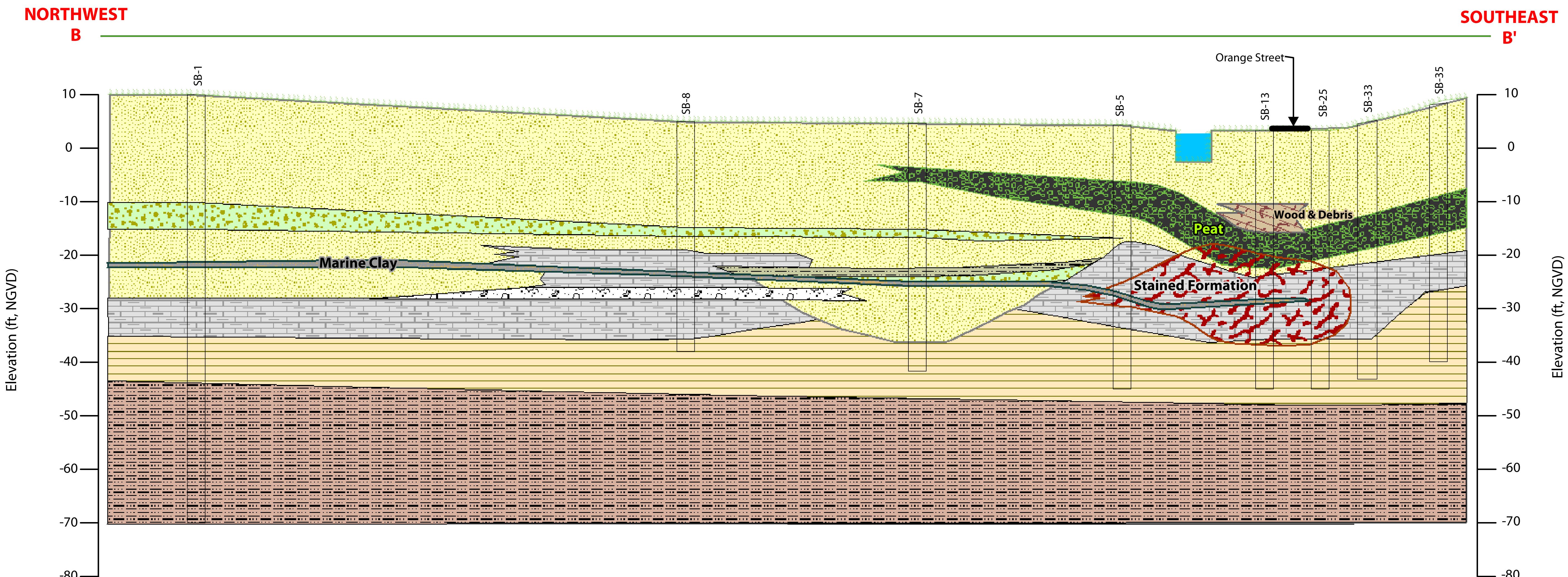
Conceptualized Lithologic Cross Section A-A'

Confederate Park
Jacksonville, FL

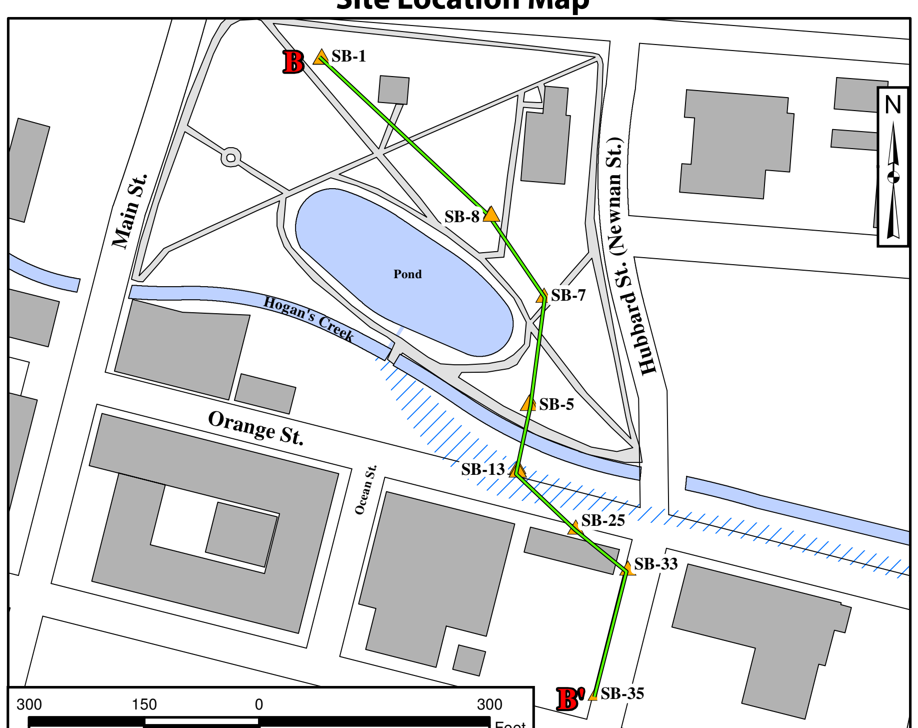
Geosyntec consultants

Figure 3

Jacksonville, FL | December 2013



Site Location Map



Lithologic Transect B-B'

Notes:

Approximate Horizontal Scale: 1 inch = 55 feet
Vertical Exaggeration: 3x
NGVD = National Geodetic Vertical Datum

Legend

- Soil Boring Location
- Transect B to B'
- Building
- Concrete
- Water
- Approximate Location of the Former Creekbed Based on Historic Sanborn Maps

Soil Boring

Material Legend

Sand	Coquina
Silty Clay	Limestone and Marine Clays
Stained Formation	Silty Sand
Sandy Clay	Peat
Coarse Sand	Wood and Debris
Marine Clay	Hogan's Creek

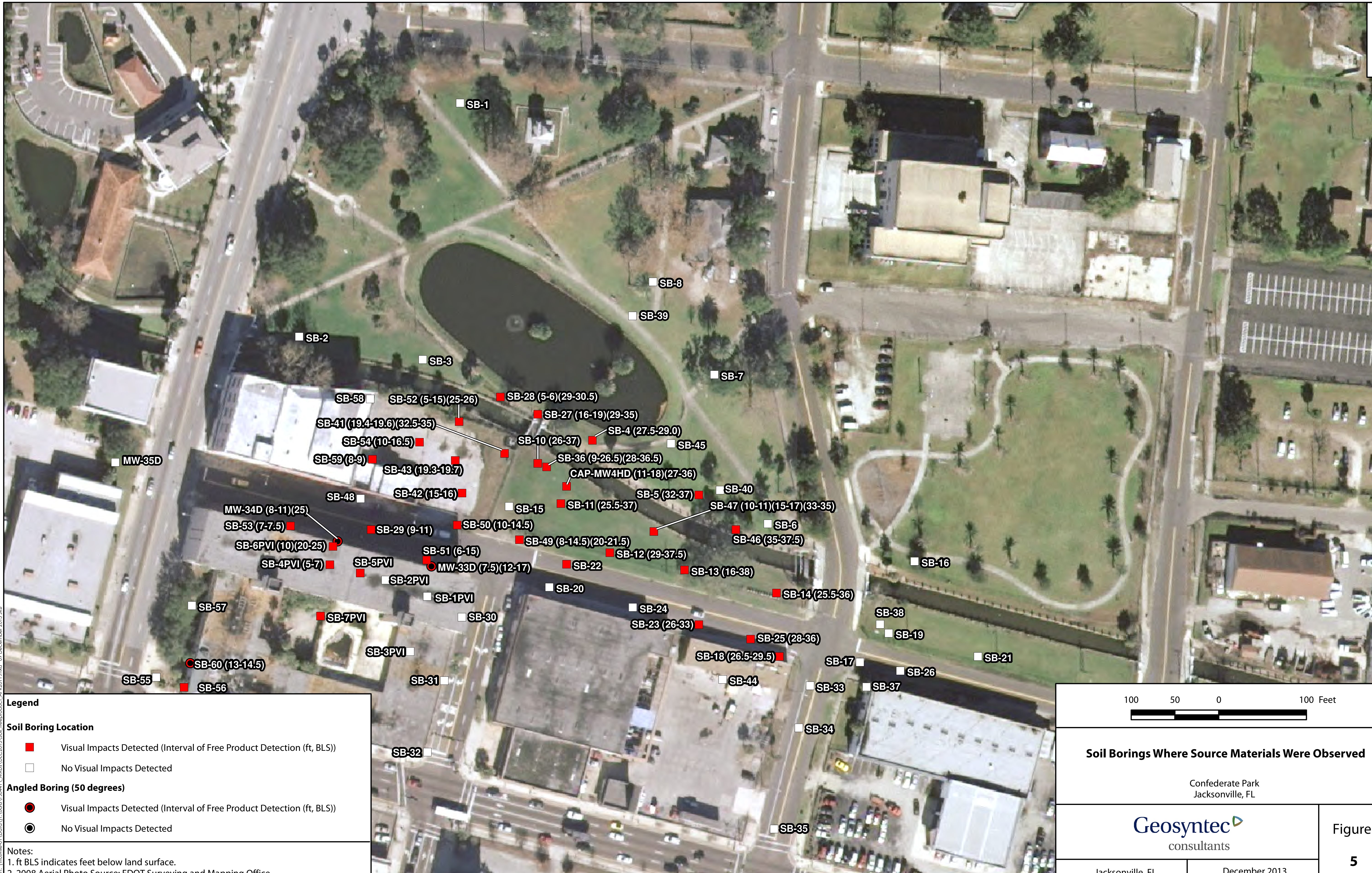
Conceptualized Lithologic Cross Section B-B'

Confederate Park
Jacksonville, FL

Geosyntec consultants

Figure 4

Jacksonville, FL | December 2013



Legend

Soil Boring Location

Visual Impacts Detected (Interval of Free Product Detection (ft, BLS))

No Visual Impacts Detected

Angled Boring (50 degrees)

Visual Impacts Detected (Interval of Free Product Detection (ft, BLS))

No Visual Impacts Detected

Notes:
1. ft BLS indicates feet below land surface.
2. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

Soil Borings Where Source Materials Were Observed

Confederate Park
Jacksonville, FL

Geosyntec consultants

Figure 5

Jacksonville, FL | December 2013

Legend

Monitoring Well Location (screen interval (ft, BLS)) and [groundwater elevation (ft, NGVD29)]

Inferred Groundwater Elevation (ft, NGVD29)

Groundwater Elevation (ft, NGVD29)

Groundwater Flow Direction

Notes:
1. ft, BLS indicates feet below land surface.
2. NGVD29 indcates National Geodetic Vertical Datum of 1929.
3. NM indicates not measured.
4. NI indicates not installed at time of water level measurement.
5. * indicates data not used to generate countours.
6. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

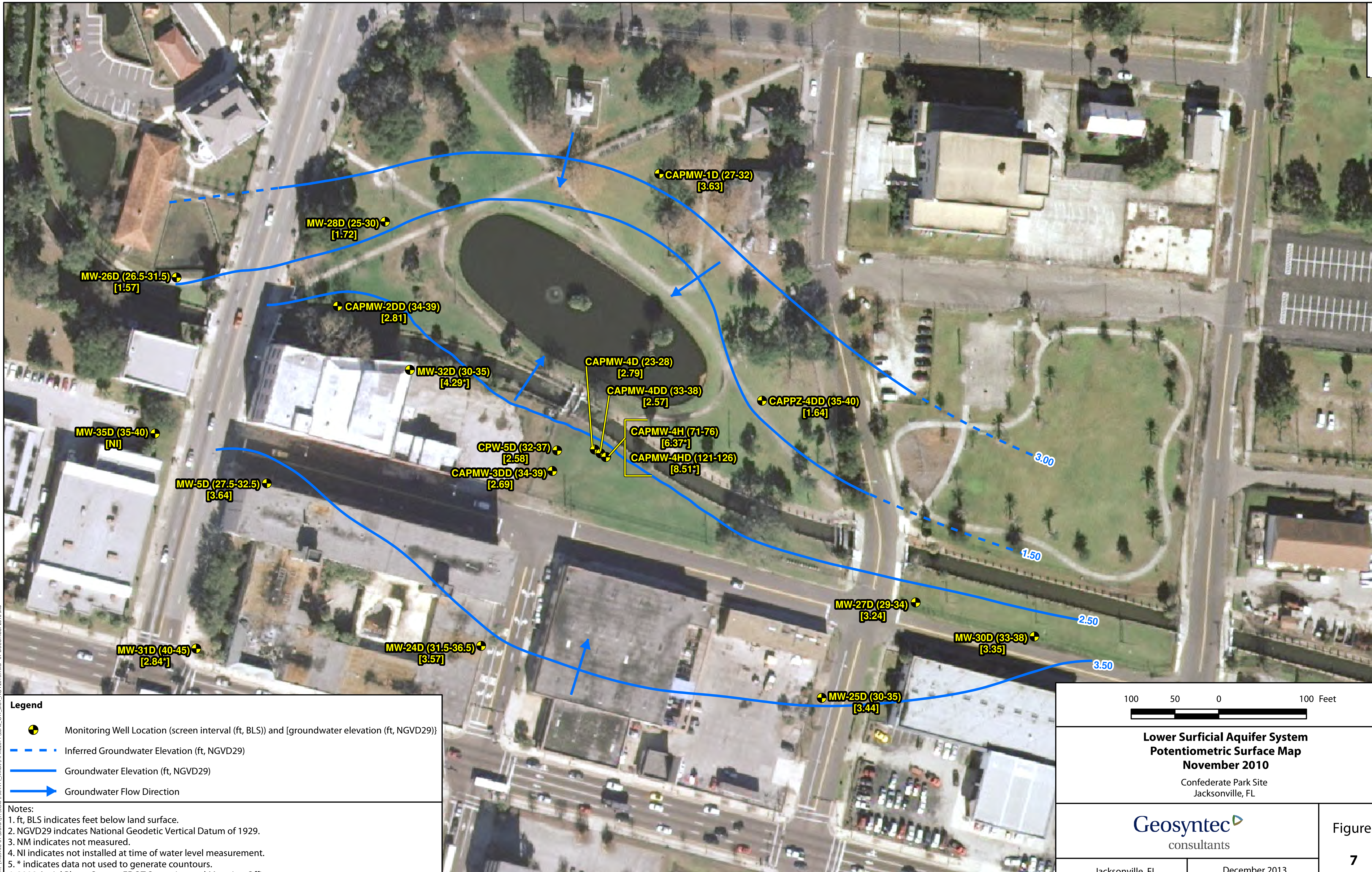
Upper Surficial Aquifer System Potentiometric Surface Map November 2010

Confederate Park Site
Jacksonville, FL

Geosyntec consultants

Figure 6

Jacksonville, FL | December 2013



Legend

- Monitoring Well Location (screen interval (ft, BLS)) and [groundwater elevation (ft, NGVD29)]
- Inferred Groundwater Elevation (ft, NGVD29)
- Groundwater Elevation (ft, NGVD29)
- Groundwater Flow Direction

Notes:
1. ft, BLS indicates feet below land surface.
2. NGVD29 indcates National Geodetic Vertical Datum of 1929.
3. NM indicates not measured.
4. NI indicates not installed at time of water level measurement.
5. * indicates data not used to generate countours.
6. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

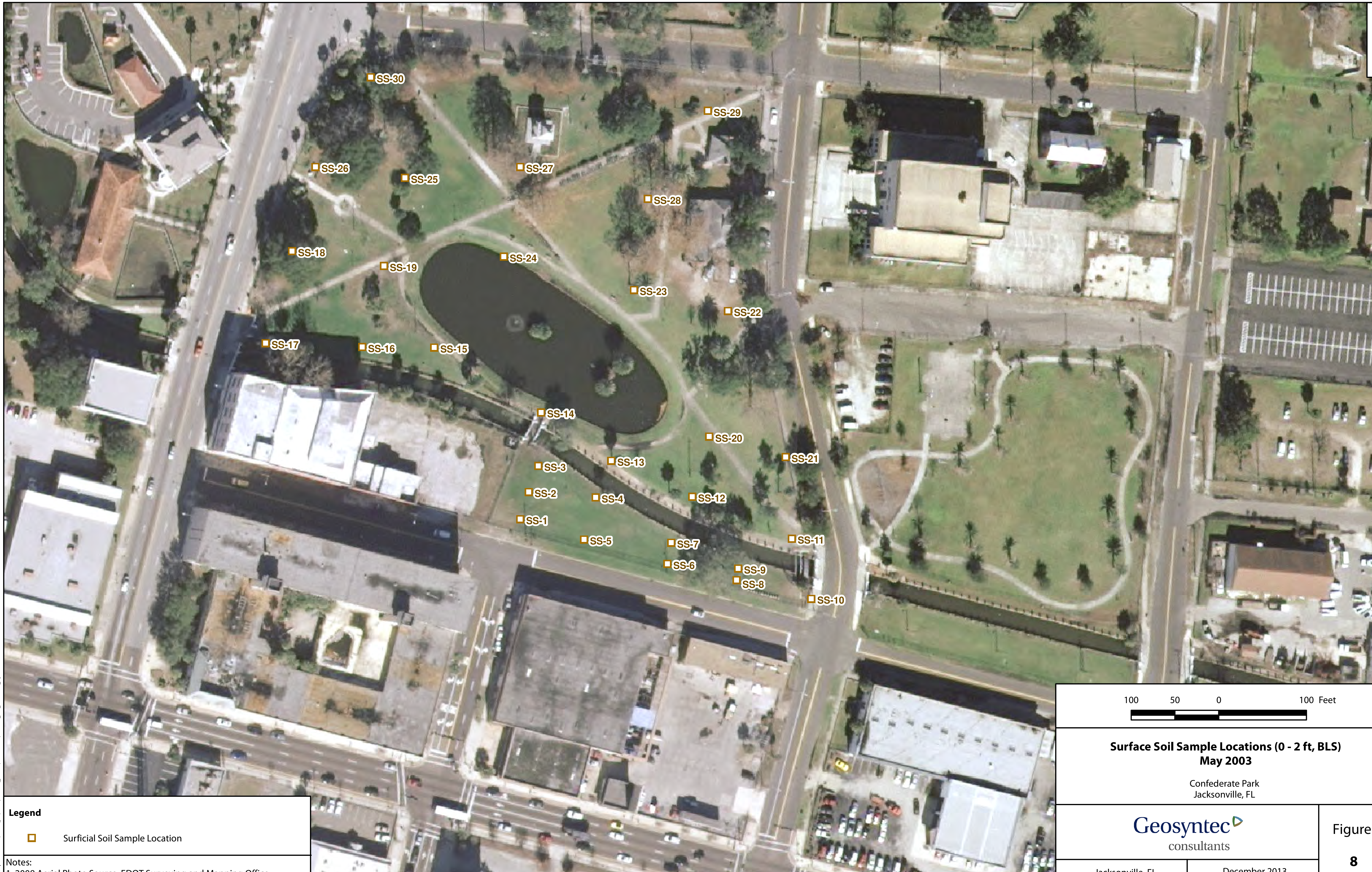
Lower Surficial Aquifer System Potentiometric Surface Map November 2010

Confederate Park Site
Jacksonville, FL

Geosyntec consultants

Figure 7

Jacksonville, FL | December 2013



Surface Soil Sample Locations (0 - 2 ft, BLS)
May 2003

Confederate Park
Jacksonville, FL

Geosyntec consultants

Figure **8**

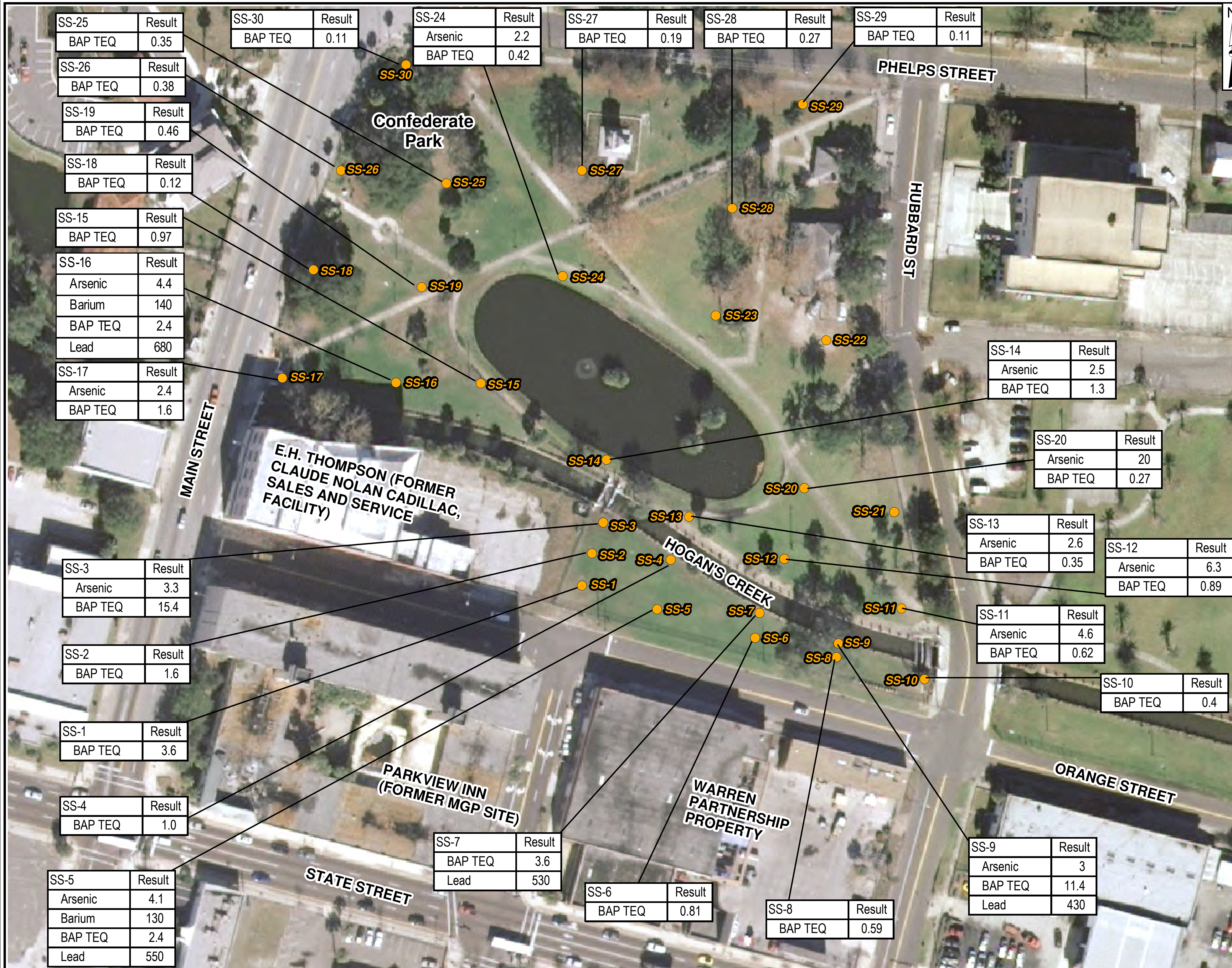
Jacksonville, FL | December 2013

Legend

Surficial Soil Sample Location

Notes:
1. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

Path: (Titusville-01\Data\)T:\0GIS\FJ0441_MXDs\APRIL2011\Surface_Soil_locations_Apr2011.mxd 09 December 2013 JRB



Legend

● Surficial Soil Sample Location

Notes:
1. All results presented in mg/kg dw.
2. SCTL indicates FDEP Soil Cleanup Target Level.
3. BAP TEQ indicates benzo(a)pyrene toxic equivalents.

Parameter	Residential SCTL (mg/kg)	Industrial SCTL (mg/kg)
Arsenic	2.1	12
Barium	120	130,000
BAP TEQ	0.1	0.7
Lead	400	1,400

0 50 100 200
Feet

Residential SCTL Exceedances in Surficial Soil (0-2 ft, BLS) May 2003

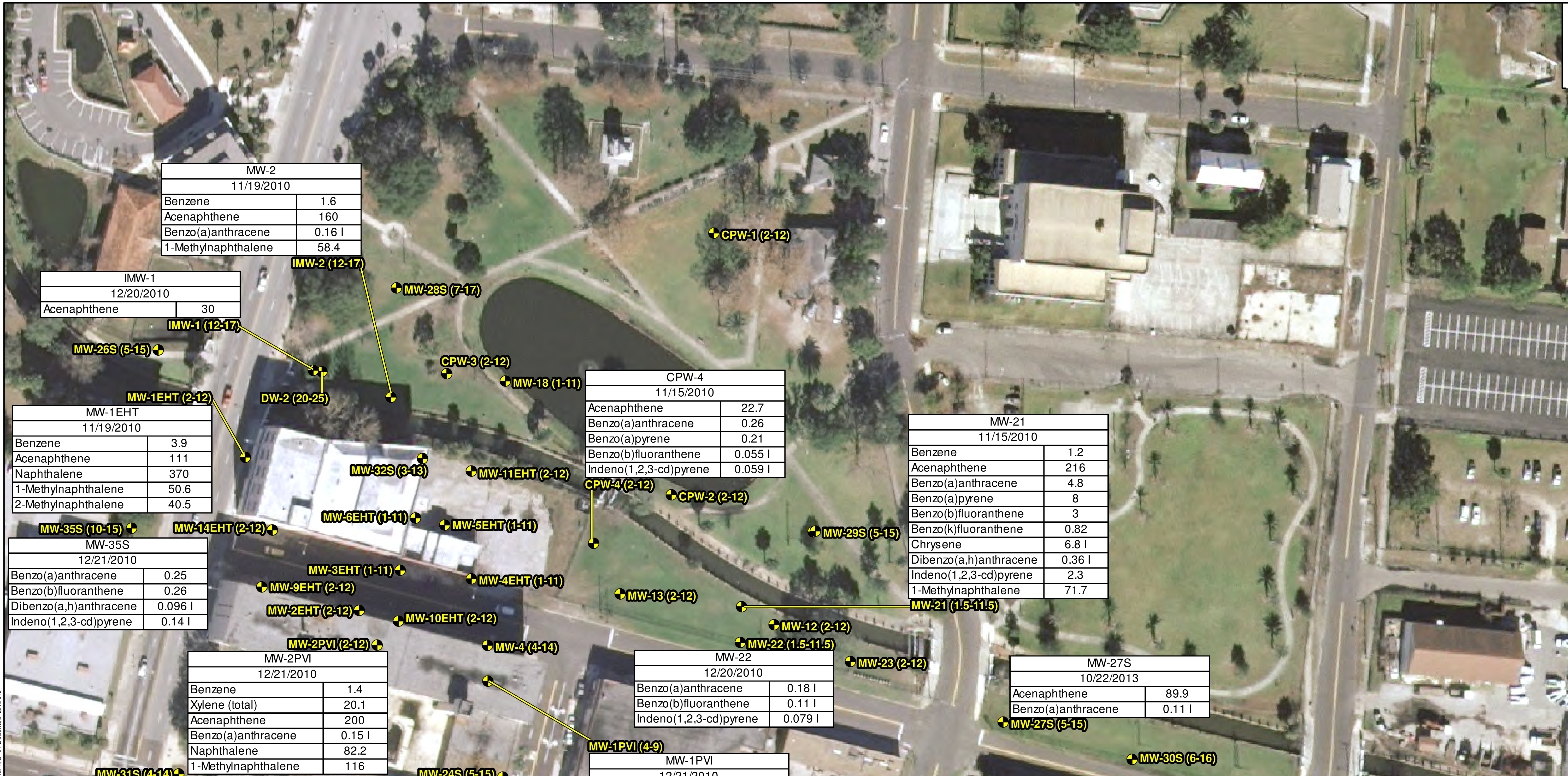
Confederate Park
Jacksonville, FL

Geosyntec consultants

Figure 9

Jacksonville, FL | December 2013

Path: (Titusville-01\Data\)T:\0GIS\FJ0441_MXDs\DEC2013\surface_soil_data_may03_Rev3.mxd 09 December 2013 JRB



MW-2	
11/19/2010	
Benzene	1.6
Acenaphthene	160
Benzo(a)anthracene	0.16 I
1-Methylnaphthalene	58.4

IMW-1	
12/20/2010	
Acenaphthene	30

MW-1EHT	
11/19/2010	
Benzene	3.9
Acenaphthene	111
Naphthalene	370
1-Methylnaphthalene	50.6
2-Methylnaphthalene	40.5

CPW-4	
11/15/2010	
Acenaphthene	22.7
Benzo(a)anthracene	0.26
Benzo(a)pyrene	0.21
Benzo(b)fluoranthene	0.055 I
Indeno(1,2,3-cd)pyrene	0.059 I

MW-21	
11/15/2010	
Benzene	1.2
Acenaphthene	216
Benzo(a)anthracene	4.8
Benzo(a)pyrene	8
Benzo(b)fluoranthene	3
Benzo(k)fluoranthene	0.82
Chrysene	6.8 I
Dibenzo(a,h)anthracene	0.36 I
Indeno(1,2,3-cd)pyrene	2.3
1-Methylnaphthalene	71.7

MW-35S	
12/21/2010	
Benzo(a)anthracene	0.25
Benzo(b)fluoranthene	0.26
Dibenzo(a,h)anthracene	0.096 I
Indeno(1,2,3-cd)pyrene	0.14 I

MW-2PVI	
12/21/2010	
Benzene	1.4
Xylene (total)	20.1
Acenaphthene	200
Benzo(a)anthracene	0.15 I
Naphthalene	82.2
1-Methylnaphthalene	116

MW-22	
12/20/2010	
Benzo(a)anthracene	0.18 I
Benzo(b)fluoranthene	0.11 I
Indeno(1,2,3-cd)pyrene	0.079 I

MW-27S	
10/22/2013	
Acenaphthene	89.9
Benzo(a)anthracene	0.11 I

MW-1PVI	
12/21/2010	
Benzo(a)anthracene	3.7
Benzo(a)pyrene	5.3
Benzo(b)fluoranthene	2.3
Benzo(k)fluoranthene	0.82
Dibenzo(a,h)anthracene	0.46
Indeno(1,2,3-cd)pyrene	3.3
Lead	108

Legend

Monitoring Well Location (screen interval (ft BLS))

Notes:
1. ft BLS indicates feet below land surface.
2. Results are presented in micrograms per liter (µg/L).
3. Locations and parameters with an exceedance of the Florida Department of Environmental Protection Groundwater Cleanup Target Level (F.A.C. 62-770) are presented on the figure.
4. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

Screening Criteria

Parameter	FDEP GCTL
Benzene	1
Xylene (total)	20
Acenaphthene	20
Benzo(a)anthracene	0.05
Benzo(a)pyrene	0.2
Benzo(b)fluoranthene	0.05
Benzo(k)fluoranthene	0.5
Chrysene	4.8
Dibenzo(a,h)anthracene	0.005
Indeno(1,2,3-cd)pyrene	0.05
Naphthalene	14
1-Methylnaphthalene	28
2-Methylnaphthalene	28
Lead	15

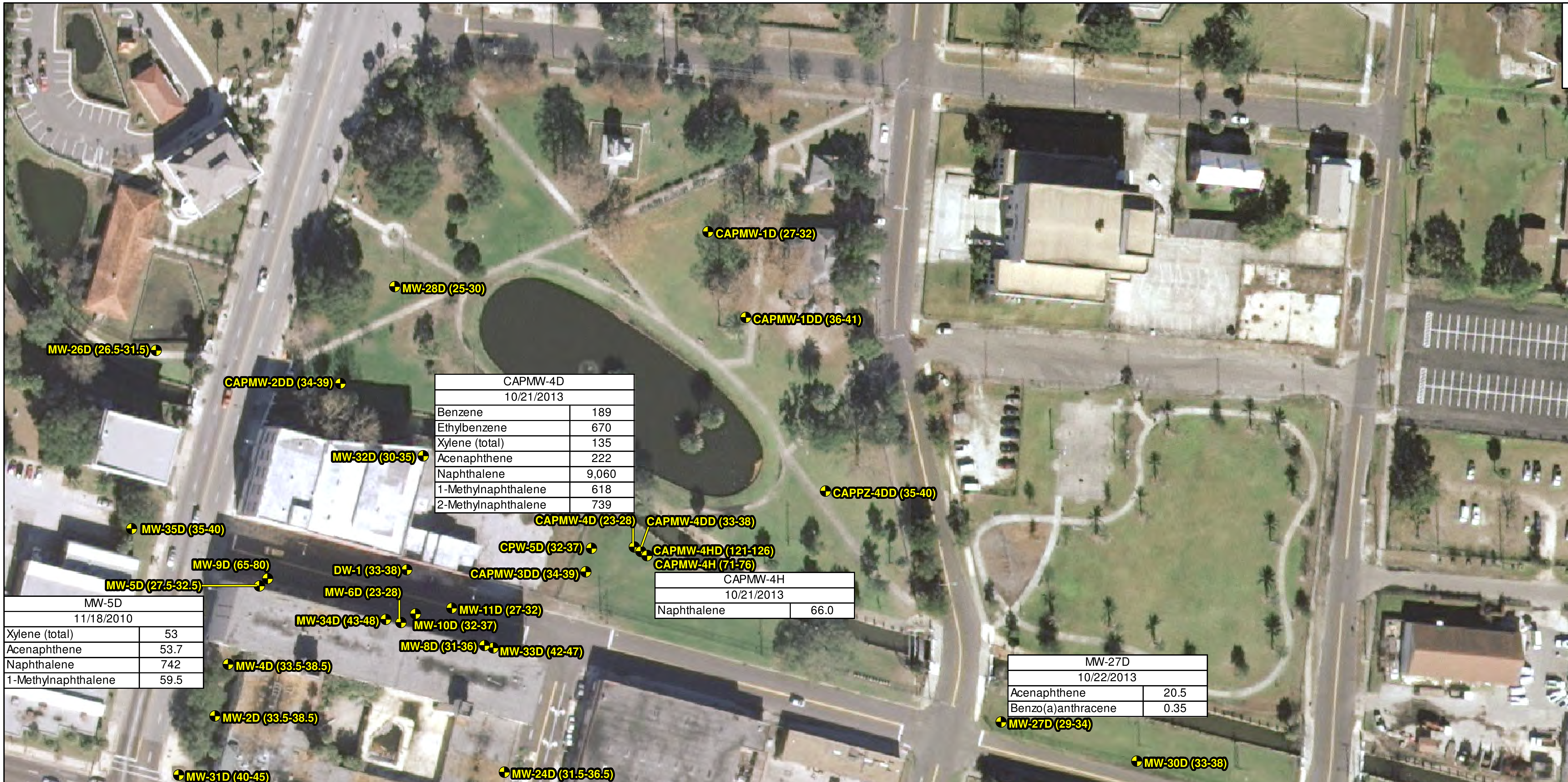
Groundwater Analytical Exceedances
Upper Surficial Aquifer System (0-25 ft, BLS)

Confederate Park
Jacksonville, FL

Geosyntec consultants

Jacksonville, FL | December 2013

Figure 10



CAPMW-4D	
10/21/2013	
Benzene	189
Ethylbenzene	670
Xylene (total)	135
Acenaphthene	222
Naphthalene	9,060
1-Methylnaphthalene	618
2-Methylnaphthalene	739

CAPMW-4H	
10/21/2013	
Naphthalene	66.0

MW-5D	
11/18/2010	
Xylene (total)	53
Acenaphthene	53.7
Naphthalene	742
1-Methylnaphthalene	59.5

MW-27D	
10/22/2013	
Acenaphthene	20.5
Benzo(a)anthracene	0.35

Legend

Monitoring Well Location (screen interval (ft BLS))

Screening Criteria	
Parameter	FDEP GCTL
Benzene	1
Ethylbenzene	30
Acenaphthene	20
Benzo(a)anthracene	0.05
Naphthalene	14
1-Methylnaphthalene	28
2-Methylnaphthalene	28

Notes:
1. ft BLS indicates feet below land surface.
2. Results are presented in micrograms per liter (µg/L).
3. Locations and parameters with an exceedance of the Florida Department of Environmental Protection Groundwater Cleanup Target Level (F.A.C. 62-770) are presented on the figure.
4. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

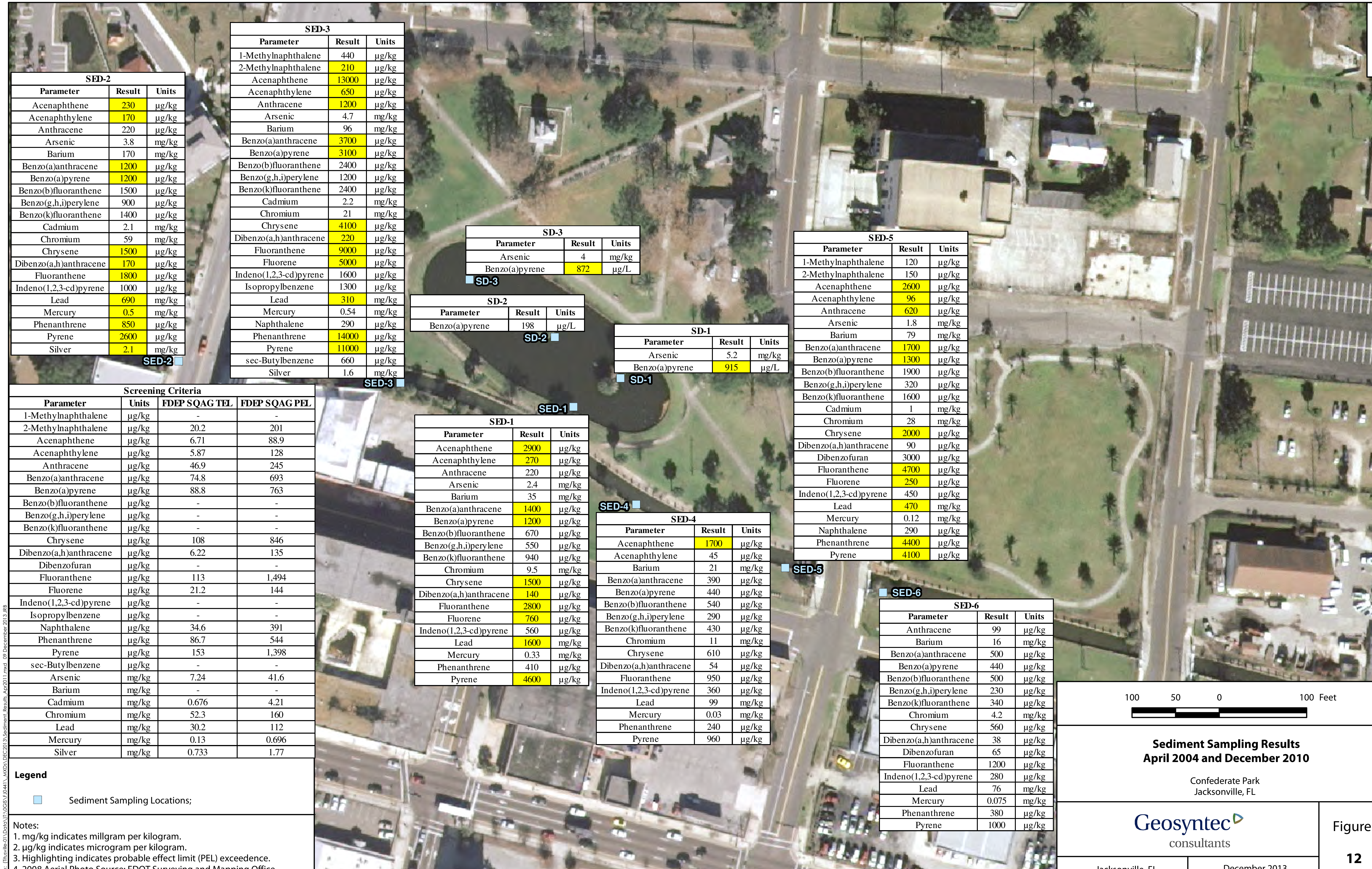
Groundwater Analytical Exceedances
Lower Surficial Aquifer System (>25 ft, BLS)

Confederate Park
Jacksonville, FL

Geosyntec consultants

Figure 11

Jacksonville, FL | December 2013



SED-2

Parameter	Result	Units
Acenaphthene	230	µg/kg
Acenaphthylene	170	µg/kg
Anthracene	220	µg/kg
Arsenic	3.8	mg/kg
Barium	170	mg/kg
Benzo(a)anthracene	1200	µg/kg
Benzo(a)pyrene	1200	µg/kg
Benzo(b)fluoranthene	1500	µg/kg
Benzo(g,h,i)perylene	900	µg/kg
Benzo(k)fluoranthene	1400	µg/kg
Cadmium	2.1	mg/kg
Chromium	59	mg/kg
Chrysene	1500	µg/kg
Dibenzo(a,h)anthracene	170	µg/kg
Fluoranthene	1800	µg/kg
Indeno(1,2,3-cd)pyrene	1000	µg/kg
Lead	690	mg/kg
Mercury	0.5	mg/kg
Phenanthrene	850	µg/kg
Pyrene	2600	µg/kg
Silver	2.1	mg/kg

SED-3

Parameter	Result	Units
1-Methylnaphthalene	440	µg/kg
2-Methylnaphthalene	210	µg/kg
Acenaphthene	13000	µg/kg
Acenaphthylene	650	µg/kg
Anthracene	1200	µg/kg
Arsenic	4.7	mg/kg
Barium	96	mg/kg
Benzo(a)anthracene	3700	µg/kg
Benzo(a)pyrene	3100	µg/kg
Benzo(b)fluoranthene	2400	µg/kg
Benzo(g,h,i)perylene	1200	µg/kg
Benzo(k)fluoranthene	2400	µg/kg
Cadmium	2.2	mg/kg
Chromium	21	mg/kg
Chrysene	4100	µg/kg
Dibenzo(a,h)anthracene	220	µg/kg
Fluoranthene	9000	µg/kg
Fluorene	5000	µg/kg
Indeno(1,2,3-cd)pyrene	1600	µg/kg
Isopropylbenzene	1300	µg/kg
Lead	310	mg/kg
Mercury	0.54	mg/kg
Naphthalene	290	µg/kg
Phenanthrene	14000	µg/kg
Pyrene	11000	µg/kg
sec-Butylbenzene	660	µg/kg
Silver	1.6	mg/kg

SD-3

Parameter	Result	Units
Arsenic	4	mg/kg
Benzo(a)pyrene	872	µg/L

SD-2

Parameter	Result	Units
Benzo(a)pyrene	198	µg/L

SD-1

Parameter	Result	Units
Arsenic	5.2	mg/kg
Benzo(a)pyrene	915	µg/L

SED-5

Parameter	Result	Units
1-Methylnaphthalene	120	µg/kg
2-Methylnaphthalene	150	µg/kg
Acenaphthene	2600	µg/kg
Acenaphthylene	96	µg/kg
Anthracene	620	µg/kg
Arsenic	1.8	mg/kg
Barium	79	mg/kg
Benzo(a)anthracene	1700	µg/kg
Benzo(a)pyrene	1300	µg/kg
Benzo(b)fluoranthene	1900	µg/kg
Benzo(g,h,i)perylene	320	µg/kg
Benzo(k)fluoranthene	1600	µg/kg
Cadmium	1	mg/kg
Chromium	28	mg/kg
Chrysene	2000	µg/kg
Dibenzo(a,h)anthracene	90	µg/kg
Dibenzofuran	3000	µg/kg
Fluoranthene	4700	µg/kg
Fluorene	250	µg/kg
Indeno(1,2,3-cd)pyrene	450	µg/kg
Lead	470	mg/kg
Mercury	0.12	mg/kg
Naphthalene	290	µg/kg
Phenanthrene	4400	µg/kg
Pyrene	4100	µg/kg

Screening Criteria

Parameter	Units	FDEP SQAG TEL	FDEP SQAG PEL
1-Methylnaphthalene	µg/kg	-	-
2-Methylnaphthalene	µg/kg	20.2	201
Acenaphthene	µg/kg	6.71	88.9
Acenaphthylene	µg/kg	5.87	128
Anthracene	µg/kg	46.9	245
Benzo(a)anthracene	µg/kg	74.8	693
Benzo(a)pyrene	µg/kg	88.8	763
Benzo(b)fluoranthene	µg/kg	-	-
Benzo(g,h,i)perylene	µg/kg	-	-
Benzo(k)fluoranthene	µg/kg	-	-
Chrysene	µg/kg	108	846
Dibenzo(a,h)anthracene	µg/kg	6.22	135
Dibenzofuran	µg/kg	-	-
Fluoranthene	µg/kg	113	1,494
Fluorene	µg/kg	21.2	144
Indeno(1,2,3-cd)pyrene	µg/kg	-	-
Isopropylbenzene	µg/kg	-	-
Naphthalene	µg/kg	34.6	391
Phenanthrene	µg/kg	86.7	544
Pyrene	µg/kg	153	1,398
sec-Butylbenzene	µg/kg	-	-
Arsenic	mg/kg	7.24	41.6
Barium	mg/kg	-	-
Cadmium	mg/kg	0.676	4.21
Chromium	mg/kg	52.3	160
Lead	mg/kg	30.2	112
Mercury	mg/kg	0.13	0.696
Silver	mg/kg	0.733	1.77

SED-1

Parameter	Result	Units
Acenaphthene	2900	µg/kg
Acenaphthylene	270	µg/kg
Anthracene	220	µg/kg
Arsenic	2.4	mg/kg
Barium	35	mg/kg
Benzo(a)anthracene	1400	µg/kg
Benzo(a)pyrene	1200	µg/kg
Benzo(b)fluoranthene	670	µg/kg
Benzo(g,h,i)perylene	550	µg/kg
Benzo(k)fluoranthene	940	µg/kg
Chromium	9.5	mg/kg
Chrysene	1500	µg/kg
Dibenzo(a,h)anthracene	140	µg/kg
Fluoranthene	2800	µg/kg
Fluorene	760	µg/kg
Indeno(1,2,3-cd)pyrene	560	µg/kg
Lead	1600	mg/kg
Mercury	0.33	mg/kg
Phenanthrene	410	µg/kg
Pyrene	4600	µg/kg

SED-4

Parameter	Result	Units
Acenaphthene	1700	µg/kg
Acenaphthylene	45	µg/kg
Barium	21	mg/kg
Benzo(a)anthracene	390	µg/kg
Benzo(a)pyrene	440	µg/kg
Benzo(b)fluoranthene	540	µg/kg
Benzo(g,h,i)perylene	290	µg/kg
Benzo(k)fluoranthene	430	µg/kg
Chromium	11	mg/kg
Chrysene	610	µg/kg
Dibenzo(a,h)anthracene	54	µg/kg
Fluoranthene	950	µg/kg
Indeno(1,2,3-cd)pyrene	360	µg/kg
Lead	99	mg/kg
Mercury	0.03	mg/kg
Phenanthrene	240	µg/kg
Pyrene	960	µg/kg

SED-6

Parameter	Result	Units
Anthracene	99	µg/kg
Barium	16	mg/kg
Benzo(a)anthracene	500	µg/kg
Benzo(a)pyrene	440	µg/kg
Benzo(b)fluoranthene	500	µg/kg
Benzo(g,h,i)perylene	230	µg/kg
Benzo(k)fluoranthene	340	µg/kg
Chromium	4.2	mg/kg
Chrysene	560	µg/kg
Dibenzo(a,h)anthracene	38	µg/kg
Dibenzofuran	65	µg/kg
Fluoranthene	1200	µg/kg
Indeno(1,2,3-cd)pyrene	280	µg/kg
Lead	76	mg/kg
Mercury	0.075	mg/kg
Phenanthrene	380	µg/kg
Pyrene	1000	µg/kg

Legend

Sediment Sampling Locations;

Notes:
1. mg/kg indicates millgram per kilogram.
2. µg/kg indicates microgram per kilogram.
3. Highlighting indicates probable effect limit (PEL) exceedence.
4. 2008 Aerial Photo Source: FDOT Surveying and Mapping Office.

Path: (Titusville-01\Data)T:\0GIS\FJ0441_MXDs\DEC2013\Sediment_Results_Apr2011.mxd 09 December 2013 JRB

Sediment Sampling Results
April 2004 and December 2010

Confederate Park
Jacksonville, FL

Geosyntec consultants

Jacksonville, FL | December 2013

Figure 12

Appendix B

FDOH's Public Health Assessment

Final

Public Health Assessment

Main Street MGP/Confederate Park Site

Jacksonville, Duval County, Florida

FDEP Site ID # 185118

January 16, 2015

Prepared by:
Florida Department of Health
Division of Disease Control and Health Protection
Under Cooperative Agreement with
U. S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Table of Contents

Foreword

The Florida Department of Health (Florida DOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This report was supported by funds from a cooperative agreement with the ATSDR, U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR. This health assessment is part of an ongoing effort to evaluate health effects associated with the Main Street Manufactured Gasification Plant (MGP)/Confederate Park site in Jacksonville, Florida. The Florida DOH evaluates site-related public health issues through the following processes:

■ Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how human exposures might occur. The U.S. Environmental Protection Agency (EPA) provided the information for this assessment.

■ Evaluating health effects: If Florida DOH finds evidence that exposures to hazardous substances are occurring or might occur, their scientists will determine whether that exposure could be harmful to human health. Florida DOH focuses this report on public health; that is, the health impact on the community as a whole, and bases it on existing scientific information.

■ Developing recommendations: In this report, the Florida DOH outlines, in plain language, its conclusions regarding any potential health threat posed by contaminated soil, groundwater, and vapor, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the U.S. EPA and the Florida Department of Environmental Protection (FDEP). If, however, an immediate health threat exists or is imminent, Florida DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.

■ Soliciting community input: The evaluation process is interactive. The Florida DOH starts by soliciting and evaluating information from various government agencies, individuals or organizations responsible for cleaning up the site, and those living in communities near the site. Florida DOH shares any conclusions about the site with the groups and organizations providing the information. Once Florida DOH prepares an evaluation report, they seek feedback from the public.

If you have questions or comments about this report, Florida DOH encourages you to contact us.

Please write to: Division of Disease Control and Health Protection
Bureau of Epidemiology
Public Health Toxicology Section
Florida Department of Health
4052 Bald Cypress Way, Bin # A-12
Tallahassee, FL 32399-1712

Or call: 850-245-4401 or toll-free in Florida: 1-877-798-2772

Summary

INTRODUCTION	At the former Main Street Manufactured Gas Plant (MGP)/Confederate Park site, the Florida Department of Health's (DOH) top priority is to ensure nearby residents have the best information to safeguard their health. The site is just north of downtown Jacksonville, Florida and is bounded by Phelps Street to the north, Hubbard Street to the east, State Street to the south, and Main Street to the west. Between 1875 and 1913, the Main Street MGP was an active manufactured gas plant. It used coal to make gas for lamps and stoves. Over time, the plant polluted on-site soil and groundwater. Additional sources may have also contributed to the pollution since 1913. Groundwater and soil pollution is mostly contained within the borders of the site.
CONCLUSION #1	If recreational fishermen consume fish from Hogans Creek, it might harm their health.
BASIS FOR DECISION #1	Although maximum doses for fish consumption were below minimal risk levels and increased cancer risks were very low or extremely low, there are other industrial sites along Hogans Creek. Some of these sites may contribute pollutants that were not analyzed for by the United States Environmental Protection Agency (EPA). Since EPA tested the fish in 2010, there is also the possibility that pollutant levels may have increased.
NEXT STEPS #1	Florida DOH recommends recreational fishermen and others not consume fish from Hogans Creek. Florida DOH also recommends the City of Jacksonville maintain fish advisory signs along Hogans Creek.
CONCLUSION #2	Surface soil in Confederate Park may still have site-related pollution from past stormwater runoff in the area where Hogans Creek used to be. This area is south of Hogans Creek's current location, north of Orange Street, and between Hubbard/Newnan and Market Streets.
BASIS FOR DECISION #2	Surface soil pollutant levels are uncertain since the City of Jacksonville did not test any soil in this area. Since the City is not planning to clean this area, it could be a future source of exposure.

NEXT STEPS #2	Florida DOH recommends the City test surface soil (0-3 inches deep) from the off-site area bounded by Hogans Creek, Orange, Hubbard/Newnan, and Market Streets.
CONCLUSION #3	Four samples are too few to determine the extent of surface soil pollution for the entire 8.6 acre Confederate Park site.
BASIS FOR DECISION #3	Because the City of Jacksonville only collected 4 surface soil samples (0-12 inches deep) over the entire site, large areas were not sampled.
NEXT STEPS #3	If the City does not remove surface soil as part of their cleanup, they should test more surface soil samples (0-3 inches deep) to find the full extent of pollution in on-site surface soil.
CONCLUSION #4	Incidental ingestion (swallowing) of pollutants in on-site surface soils is not likely to harm workers' health.
BASIS FOR DECISIONS #4	Based on just a few (4) samples, pollutants in the on-site surface soils are below levels likely to harm health. Contact with these levels would result in, at most, a "very low" to "extremely low" increased cancer risk.
CONCLUSION #5	Incidental ingestion of pollutants in on-site surface soils is not likely to harm the health of Confederate Park visitors.
BASIS FOR DECISIONS #5	Based on just a few samples, pollutants in the on-site surface soils are below levels likely to harm health. Contact with these levels would result in, at most, a "very low" to "extremely low" increased cancer risk.
FOR MORE INFORMATION	If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the Florida DOH toll-free at 877-798-2772 and ask for information about the former Main Street MGP/Confederate Park site.

Background and Statement of Issues

The purpose of this public health assessment is to assess the public health threat from toxic chemicals at the former Jacksonville Main Street Manufactured Gasification Plant (MGP)/Confederate Park site. The Florida DOH initiated this assessment.

The site encompasses Confederate Park, the E.H. Thompson property, the Park View Inn property (former Main Street MGP location), the Warren Partnership property, and the Orange Street right-of-way. Collectively, this report refers to these properties as the site. The site is within Section 13 Township 2S and Range 26E just north of downtown Jacksonville (Figure 1). It is bounded by Main Street (formerly known as Pine Street) to the west, State Street to the south, Phelps Street to the north, and Hubbard Street to the east (Figure 2). The site is approximately 11.7 acres.

The 1884 Sanborn Map depicted an MGP operating as the Jacksonville Gas Works in the location of what is now the Park View Inn property. Subsequent Sanborn Maps (1887, 1891, 1897, and 1903) show the expansion of the MGP. The MGP is no longer present in the 1913 Sanborn Map. In 1929, the City dredged a new creek bed and relocated Hogans Creek northward from what is now Orange Street to its current location [Geosyntec 2011].

FDEP discovered contamination at the former Main Street MGP in 1991 during a petroleum investigation for the E. H. Thompson property.

Area residents and businesses receive their drinking water from JEA (formerly the Jacksonville Electric Authority). A JEA municipal well field dating back to 1922 is west of Main Street and Confederate Park. Total depths of the wells range from 1,276 to 1,319 ft. Casing depths range from 501 to 532 ft. The Floridan aquifer is the principal source of potable water in the Jacksonville area. The top of the Floridan aquifer is located between 500 and 550 ft. below land surface (BLS) in this area [Geosyntec 2011].

In 2010, the EPA found fish (largemouth bass and mullet) from Hogans Creek at Confederate Park contained contaminants (arsenic, chlordane, dieldrin, heptachlor epoxide, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and dioxins) above the screening levels established by the Florida DOH [EPA 2011]. The Florida DOH in Duval County (DOH-Duval) recommended a fish consumption advisory for Hogans Creek and the City of Jacksonville posted signs.

Hogans Creek bisects the southern portion of Confederate Park. Hogans Creek flows to the southeast before discharging into the St. Johns River. The land north of Hogans Creek slopes southward, with surface drainage collected by the pond located near the center of the Park or Hogans Creek. The portion of the Park south of Hogans Creek appears to drain to the north towards the creek. A subsurface pipe, designed to prevent the pond from overflowing, connects the pond to Hogans Creek. However, during heavy rain events, both the pond and Hogans Creek overflow and minor flooding occurs south of the pond and along Hogans Creek. Surface water runoff from the Park View Inn, E.H. Thompson, and Warren Partnership properties all flow north toward Hogans Creek. Surficial aquifer groundwater flow in the area of the site is toward Hogans Creek [Geosyntec 2011].

This assessment considers the health of nearby workers, visitors to Confederate Park, and individuals eating fish from Hogans Creek and explores possible associations with site-related contaminants. This assessment requires the use of assumptions, judgments, and incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in this assessment err on the side of protecting public health and may overestimate the risk to public health.

Site Description

The former Jacksonville Main Street MGP/Confederate Park site covers approximately 11.7 acres bounded by Main Street to the west, State Street to the south, Phelps Street to the north, and Hubbard Street to the east. The site consists of five parcels; Confederate Park, the E.H. Thompson property, the Park View Inn Property (former Main Street MGP location), the Warren Partnership property, and the Orange Street right-of-way.

Confederate Park

The City of Jacksonville owns Confederate Park at 956 Hubbard Street. The total area of Confederate Park is approximately 8.6 acres. About 6.1 acres of the Park is west of Hubbard Street; the remaining portion of Confederate Park (2.5 acres) is east of Hubbard Street. The portion of Confederate Park west of Hubbard Street is a grassed lawn gently sloping from north to south, with a few trees. Hogans Creek divides the Park into two distinct areas. Most of Confederate Park is north of Hogans Creek (about 5.5 acres). This portion of the Park is fenced; however, it is accessible during the day. The City locks this portion of the Park at night to prevent access. The portion of Confederate Park south of Hogans Creek is about 0.6 acres. Access to this portion of the Park is restricted at all times by fencing and a locked gate. The Park consists of a decorative pond, which connects to Hogans Creek via an underground drainage pipe, concrete walkways, a Civil War Monument (Memorial to the Women of the Confederacy), a maintenance building, and a small office building. In the mid-1990s, the City dredged the pond and removed four feet of sediment. The City did not report testing for contamination during the sediment removal [Felicia Boyd & Associates, 2001].

E. H. Thompson

The E. H. Thompson property has a total area of approximately 0.9 acre, with almost half that amount covered with structures. The property is at 937 Main Street, at the intersection of Main Street and Orange Street, south-southwest of Confederate Park.

An automobile dealership and service center once used the property. It housed three underground storage tanks (UST) and one above ground storage tank (AST) including a 1,200-gallon kerosene UST, a 550-gallon gasoline UST, a 300-gallon UST, and a 750-gallon used oil AST. In 1993, the site owner removed the USTs and the AST [PACO 1993]. Reports do not indicate the dates for installation of the tanks. The configuration of the structures and fencing equipped with a locking, rolling gate restricts access to the E. H. Thompson property.

Park View Inn

The Park View Inn property is at 901 North Main Street across Orange Street from the E. H. Thompson property and encompasses a total area of 1.5 acres. The Park View Inn building, demolished in 2011, was a six-story structure built in 1966 as a full service hotel with an interior courtyard area and a parking garage. The inn covered the entire city block bounded by Orange Street to the north, State Street to the south, Ocean Street to the west, and Main Street to the east. Only the parking garage remains.

The property occupies the same city block as the former Main Street MGP. The Parkview Inn had a 2,000-gallon No. 2 fuel oil UST near the northwest corner of the building (installation date unknown). The owner took the UST out of service in the 1980s and abandoned it in place in November 2002. Access to the property is unrestricted [Geosyntec 2011].

Warren Partnership

The Warren Partnership property is at 925 North Ocean Street. The total area of the Warren Partnership property, which the owners now use as a light manufacturing facility, is approximately 1.6 acres. However, consultants only investigated the northern-most portion of the property and the area along the Orange Street right-of-way as part of the Main Street MPG/Confederate Park site investigation.

The property has four, one-story buildings constructed in 1950 for light manufacturing. The property owners once used it as an automobile dealership and service center and housed a 3,000-gallon gasoline UST and a 500-gallon used oil UST. The owners have not used the USTs since 1970 and removed them in 1992 [Jones 2001]. The installation date(s) of the USTs is not known.

Access to the Warren Partnership property is from Ocean Street or through a locking gate on Newnan Street [Geosyntec 2011].

Site Visit

On March 17, 2014, Florida DOH visited the Main Street MGP/Confederate Park site. We observed flooding in Confederate Park between Hogans Creek and the decorative pond due to heavy rainfall earlier in the day. The water level in Hogans Creek was higher than average. Access to Confederate Park north of Hogans Creek is through unlocked gates. Access to Confederate Park south of Hogans Creek is restricted by the creek and fencing. Hogans Creek is easily accessible north of the site and passes through local recreational areas. Hogans Creek south of the site is less accessible and passes through some residential areas before entering industrial areas and then the St. Johns River. Florida DOH observed debris, indicating people congregate along Hogans Creek just south of the site, but there were no indications of fishing. We observed fish advisory signs at Confederate Park.

Demographics

Florida DOH examines demographic and land use data to identify sensitive populations, such as young children, the elderly and women of childbearing age, to determine whether these sensitive populations are exposed to any potential health risks. Demographics also provide details on population mobility and residential history in a particular area. This information helps Florida DOH evaluate how long residents might have been exposed to contaminants.

Approximately 14,160 people live within a 1.0-mile radius of the site. Sixty-four percent (64%) are African-American, 32% are white, 3% are of Hispanic origin, and 1% represents other racial or ethnic groups. Sixteen percent (16%) are less than 18 years old, and 84% are older than 18. Fifty-nine percent (59%) have a high school diploma or less, and 41% have at least some college. Ninety-four percent (94%) speak only English, and 79% make less than $50,000 a year (EPA 2010).

Land Use

Land use bordering the site is commercial and industrial. The majority of Confederate Park has limited recreational use but nearby residents use the park west of Hubbard Street for a dog walk, playground, and basketball court. Land use farther to the north and west of the site is predominantly residential. Land use to the south and west of the site is predominantly commercial and industrial.

Community Health Concerns

On March 17, 2014, nearby residents and other interested parties attended a community meeting where the City of Jacksonville presented plans for cleanup at the Main Street MGP/Confederate Park site. Health concerns involved use of the dog park and the impact of contamination on drinking water and irrigation wells. The City said cleanup plans would protect public health.

Florida DOH solicited additional health concerns during the public comment period on this public health assessment by sending community updates to 300 addresses near the site. This update also summarized the conclusions and recommendations and provided recipients with a comment form to return. Only three forms were returned and none included health concerns to address in this final report.

Discussion

Pathway Analyses

Chemical contamination in the environment can harm your health but only if you have contact with those contaminants (exposure). Without contact or exposure, there is no harm to health. If there is contact or exposure, how much of the contaminants you contact (concentration), how often you contact them (frequency), for how long you contact them (duration), and the danger level of the contaminant (toxicity) all determine the risk of harm.

Knowing or estimating the frequency with which people could have contact with hazardous substances is essential to assessing the public health importance of these contaminants. The method for assessing whether a health hazard exists to people is to determine whether there is a completed exposure pathway from a contaminant source to a receptor population and whether exposures to contamination are high enough to be of health concern.

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. A source of contamination like a hazardous waste site.
2. An environmental medium like air, water or soil that can hold or move the contamination.
3. A point where people come into contact with a contaminated medium like water at the tap or soil in the yard.
4. An exposure route like ingesting (contaminated soil, water or fish) or breathing (contaminated air).
5. A population who could be exposed to contamination like nearby residents.

Generally, the ATSDR/Florida DOH consider three exposure categories: 1) completed exposure pathways; that is, all five elements of a pathway are present; 2) potential exposure pathways; that is, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element; and 3) eliminated exposure pathways; that is, a receptor population does not come into contact with contaminated media. ATSDR/Florida DOH use exposure pathways to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future.

Completed Exposure Pathways

Incidental ingestion of on-site soil by workers is a completed exposure pathway. The former Main Street MGP is the source and on-site surface soil is the medium and point of exposure. Incidental ingestion is the route of exposure and workers are the exposed population. Workers were exposed in the past, are being exposed now, and may be exposed in the future (Table 1).

Incidental ingestion of on-site soil by park visitors is also a completed exposure pathway. The former Main Street MGP is the source and on-site surface soil is the medium and point of exposure. Incidental ingestion is the route of exposure and park visitors are the exposed population. Park visitors were exposed in the past, are being exposed now, and may be exposed in the future (Table 1).

Ingestion of fish by recreational fishers is another completed exposure pathway. The former Main Street MGP and other industrial sites are the source. Fish are the exposure medium. Hogans Creek or the on-site pond is the point of exposure. Ingestion is the route of exposure and recreational fishers are the exposed population. People who eat these fish were exposed in the past, are being exposed now, and may be exposed in the future (Table 1).

Potential Exposure Pathway

For this assessment, Florida DOH evaluated the potential long-term health threat from incidental ingestion (swallowing) of very small amounts of surface soil (0-12 inches deep) from two currently restricted areas of Confederate Park south of Hogans Creek. One area is between Main Street and Hubbard/Newnan and the other is between Hubbard/Newnan and Market Street.

For this potential exposure pathway, the former Main Street MGP hazardous waste site is the source. Spills and improper disposal of by-products and waste material have contaminated the soil. Surface soil is the medium and these two currently restricted areas would be the points of exposure if the City ever allows access to visitors. Ingestion would be the exposure route and park visitors would be the exposed population (Table 2).

Eliminated Exposure Pathways

Florida DOH concludes that incidental ingestion of sub-surface soil or sediments are eliminated exposure pathways. Drinking or showering with water from local private or municipal drinking water wells and vapor intrusion into on-site buildings were also eliminated (Table 3).

There is no evidence of exposure to sub-surface soils at or sediments near the site. Cement, asphalt and buildings cover most of the on-site sub-surface soil and access is restricted to those areas not covered. There are currently no businesses conducting excavation or other activities that might regularly expose people to subsurface soil or sediments on or near the site.

Drinking and showering with water from nearby private or municipal wells are also eliminated exposure pathways. JEA supplies water to residential and commercial properties in this area and tests annually. Consultants identified one private well within a one quarter mile radius but it is used for irrigation only.

Surface water is an eliminated exposure pathway since it is unlikely people would drink from or swim in the on-site pond or Hogans Creek.

There is no evidence of exposure at the site due to vapor intrusion into on-site buildings. Most of the buildings at the site are unoccupied. In addition, groundwater flow in the area is away from the buildings used by workers.

Public Health Implications

Health scientists look at what chemicals are present and in what amounts. They compare those amounts to health guidelines. These guidelines are set far below known or suspected levels associated with health effects. .

This public health assessment also considers health concerns of nearby residents and explores possible associations with site-related contaminants. This assessment requires the use of assumptions and judgments, and relies on incomplete data. These factors contribute to uncertainty in evaluating the health threat. Assumptions and judgments in the assessment of the site's impact on public health err on the side of protecting public health and may overestimate the risk.

Florida DOH estimates the health risk for individuals exposed to the highest measured level of contamination. Florida DOH provides site-specific public health recommendations on the basis of toxicological literature, levels of environmental contaminants, evaluation of potential exposure pathways, duration of exposure, and characteristics of the exposed population. Whether a person will be harmed depends on the type and amount of contaminant, how they are exposed, how long they are exposed, how much contaminant is absorbed, genetics, and individual lifestyles.

After identifying contaminants of concern, Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin [1988] explains the concept of dose as follows:

> "…all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.

> Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton) elephant. In each case, the amount per weight is the same; 1 ounce for each pound of animal."

This amount per weight is the *dose*. Toxicology uses dose to compare toxicity of different chemicals in different animals. Florida DOH uses the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) to express doses in this assessment. A milligram is 1/1,000 of a gram (3-4 grains of rice weigh approximately 100 mg); a kilogram is approximately two (2) pounds.

To calculate the daily doses of each contaminant, the Florida DOH uses standard factors for dose calculation [ATSDR 2005; EPA 1997]. Florida DOH assumes that people are exposed daily to the maximum concentration measured and makes the health protective assumption that 100% of the ingested chemical is absorbed into the body. The exception is arsenic, which has an oral bioavailability factor of 33% in soil [FDEP 2005]. This means FDEP determined that 33% of the arsenic ingested in soil is absorbed into the body.

Florida DOH and ATSDR use the following formula to estimate a dose:

$$D = (C \times IR \times EF \times CF) / BW$$

D = exposure dose (milligrams per kilogram per day or mg/kg/day)
C = contaminant concentration (milligrams per kilogram or mg/kg)
IR = intake rate of contaminated sediment (milligrams per day or mg/day)
EF = exposure factor (unitless)
CF = conversion factor (10^{-6} kilograms per milligram or kg/mg)
BW = body weight (kilograms or kg)

$$EF = F \times ED / AT$$

EF = exposure factor (unitless)
F = frequency of exposure (days/year)
ED = exposure duration (years)
AT = averaging time (days) (ED x 365 days/year for noncarcinogens; Lifetime exposure duration x 365 days/year for carcinogens)

ATSDR groups health effects by duration of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15 – 364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period for animal exposures). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion (swallowing) of contaminated soil, Florida DOH uses the following standard assumptions:

1) Children ages 6 months to 1 year incidentally ingest an average of 60 milligrams (mg) and an upper percentile of ingestion of 100 mg of soil per day.
2) Children ages 1 to 21 years incidentally ingest an average of 100 mg and an upper percentile of ingestion of 200 mg of soil per day (about the weight of a postage stamp).
3) Adults incidentally ingest an average of 50 mg and an upper percentile of ingestion of 100 mg of soil per day.
4) Children's average weights vary with age: (0.5 to 1 year: 9.2 kg), (1 to 2 years: 11.4 kg), (2 to 6 years: 17.4 kg), (6 to 11 years: 31.8 kg), (11 to 21 years: 64.2 kg).
5) Adults ages 21 to 65 weigh an average of 80 kg, or about 176 pounds.
6) Adults ages 65 and older weigh an average of 76 kg.
7) The frequency of exposure is assumed to be 365 days per year.
8) Lifetime exposure duration for adults is 78 years.
9) Exposure duration for children is 6 years.

Florida DOH compares estimated exposure doses to ATSDR chemical-specific minimal risk levels (MRLs). MRLs are comparison values that establish exposure levels many times lower than levels where scientists observed no effects in animals or human studies. ATSDR designed the MRL to protect the most sensitive, vulnerable individuals in a population. The MRL is an exposure level below which noncancerous harmful effects are unlikely, even after daily exposure over a lifetime. Although ATSDR considers concentrations at or below the relevant comparison value reasonably safe, exceeding a comparison value does not imply adverse health effects are likely.

If contaminant concentrations are above comparison values, Florida DOH further analyzes exposure variables (for example, duration and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for health effects. Florida DOH uses chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available, they use intermediate length MRLs [ATSDR 2005].

Risk –For noncancer illnesses, Florida DOH estimates the health risk by comparing the exposure dose to MRLs.

For cancer illnesses, Florida DOH and ATSDR use the following equation to estimate cancer risk:

$$\text{Risk (unitless)} = D \times SF$$

D = exposure dose (mg/kg/day). See above equation.
SF = cancer slope factor in milligrams per kilogram per day $(mg/kg/day)^{-1}$

For carcinogens that have a mutagenic mode of action, such as benzo(a)pyrene (BaP), Florida DOH and ATSDR use the following equation to estimate the cancer risk for various age groups:

$$Risk = D \times SF \times ADAF$$

D = exposure dose (mg/kg/day). See above equation.
SF = cancer slope factor in milligrams per kilogram per day $(mg/kg/day)^{-1}$
ADAF = age-dependent adjustment factor

This is a high estimate of the increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual cancer may be as low as zero. If there is no cancer slope (potency) factor, Florida DOH/ATSDR cannot quantify the cancer risk.

To put the cancer risk into perspective, Florida DOH/ATSDR uses the following descriptors for the different numeric cancer risks:

1 in 10 (10^{-1})	"very high" increased risk
1 in 100 (10^{-2})	"high" increased risk
1 in 1,000 (10^{-3})	"moderate" increased risk
1 in 10,000 (10^{-4})	"low" increased risk
1 in 100,000 (10^{-5})	"very low" increased risk
1 in 1,000,000 (10^{-6})	"extremely low" increased risk

To select one of the above increased cancer risk descriptors, Florida DOH rounds the calculated cancer risk to the nearest power of ten. For example, a calculated increased cancer risk of 8.4×10^{-6} would round to 10×10^{-6} or 1×10^{-5}, which is a "very low" increased cancer risk.

Health scientists know too little about the combined toxic effect of multiple contaminants to assess the health risk from exposure to mixtures. Therefore, this report assessed the health threat based on exposure to individual contaminants.

Environmental Data

Soil

This assessment only addresses surface soil sample data from 0 to 12 inches below land surface (BLS) and does not include samples taken from 0 to 24 inches BLS. Considering soil samples 0 to 24 inches BLS may underestimate the true concentration of water-insoluble contaminants deposited on and likely to remain at the ground surface.

Consultants collected on-site surface soils from beneath impervious material, such as asphalt, as well as from exposed soil. Because people are not exposed to soil beneath impervious material, Florida DOH evaluated only those samples from exposed soil.

Consultants collected 32 soil samples from 0 to 24 inches BLS in May 2003. They also collected four soil samples from 0 to 12 inches BLS (Figure 3). However, they did not collect any soil samples from the area of the former creek bed downstream of the site. This area is south of Hogans Creek, north of Orange Street, and between Hubbard/Newnan and Market Streets. Stormwater runoff from the site may have deposited contaminants in this area of the former creek bed.

Florida DOH considers four (4) surface soil samples (0-12 inches BLS) for the size of this site as too few to determine the extent of surface soil contamination. Therefore, for purposes of this assessment, the City has not adequately characterized the extent of on-site surface soil contamination.

Consultants analyzed soil samples for metals, PAHs, volatile organic chemicals (VOCs), and cyanide [Geosyntec 2003]. They found surface soil samples contaminated with arsenic, PAHs, lead and/or barium above screening guidelines (Table 4).

Fish

In December 2010, the EPA collected largemouth bass (top predator) and striped mullet (bottom-dweller) from Hogans Creek between Main and Hubbard Streets [EPA 2011]. They analyzed eight composite samples (five bass and three mullet) for pesticides, PCBs, PAHs, metals, and dioxins. All bass and mullet exceeded Florida DOH recreational fishermen screening values (SVs) for dieldrin, total PCBs, total benzo(a)pyrene equivalence (BaP TEq), and dioxins. Additionally, all mullet samples exceeded SVs for technical chlordane, heptachlor epoxide, and inorganic arsenic. One largemouth bass sample exceeded the SV for technical chlordane and one exceeded the SV for heptachlor epoxide (Table 9).

For the purpose of this assessment, EPA has adequately characterized fish quality in Hogans Creek.

Identifying Contaminants of Concern

Florida DOH compares the maximum concentrations of contaminants found at a site to ATSDR and other comparison values. Comparison values are specific for the medium contaminated (soil, water, air, etc.). They screen the environmental data using these comparison values:

- ATSDR Cancer Risk Evaluation Guide (CREG)
- ATSDR Environmental Media Evaluation Guides (EMEGs)

- ATSDR Reference Media Evaluation Guides (RMEGs)
- ATSDR Minimal Risk Level (MRL)
- Florida DEP Soil Cleanup Target Levels (SCTLs)
- EPA Maximum Contaminant Levels (MCLs)
- EPA Lifetime Health Advisory (LTHA)
- EPA Reference Concentration for Chronic Inhalation Exposure (RfC)
- Other guidelines

When determining which comparison value to use, Florida DOH follows ATSDR's general hierarchy and uses professional judgment.

Florida DOH selects for further evaluation contaminants with maximum concentrations above a comparison value. Comparison values, however, are not thresholds of toxicity. Florida DOH and ATSDR do not use them to predict health effects or to establish clean-up levels. A concentration above a comparison value does not necessarily mean harm will occur. It does indicate, however, the need for further evaluation.

Maximum contaminant concentrations below comparison values are not likely to cause illness and Florida DOH/ATSDR does not evaluate them further.

By comparing the highest measured concentrations in soil ATSDR and EPA screening guidelines, Florida DOH selected arsenic, benzo(a)pyrene toxic equivalents (BaP TEq) as a measurement for PAHs, barium, and lead as contaminants of concern (COCs). Using the Florida DOH SVs for fish, Florida DOH chose arsenic, chlordane, dieldrin, heptachlor epoxide, BaP TEq, total PCBs, and dioxin TEqs as COCs for fish sampled.

Selection of these contaminants does not necessarily mean there is a public health risk. Rather, Florida DOH selected these contaminants for scrutiny. Concentrations of other contaminants are below screening guidelines and are not likely to cause illness. Florida DOH/ATSDR does not evaluate these contaminants further.

Arsenic

Arsenic is a naturally occurring metal widely distributed in soil. Scientists usually find it combined with oxygen, chlorine, and sulfur. Most arsenic compounds have no smell or special taste [ATSDR 2007a].

Arsenic, like most metals, is not well absorbed through the skin. If you get arsenic-contaminated soil on your skin, only a small amount will go through your skin into your body, so skin contact is usually not a health risk [ATSDR 2007a]. The lack of air monitoring data prevents an evaluation of the risk from breathing arsenic-contaminated dust.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with inorganic arsenic may cause redness and swelling.

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults [ATSDR 2007a].

State and federal environmental agencies base their arsenic cleanup standards on workplace studies and laboratory animal studies. Because of uncertainties in these studies, their cleanup standards include large safety factors to ensure public health. Although concentrations slightly above these cleanup standards may not necessarily cause harm, the responsible party should clean up the soil to protect public health.

Barium

Barium is a silvery-white metal that exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds. The oil and gas industries use barium compounds to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. Industries also use barium compounds to make paint, bricks, ceramics, glass, and rubber.

Doctors sometimes use barium sulfate to perform medical tests and to take x-rays of the gastrointestinal tract.

Heath scientists have found barium causes gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died. The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

The DHHS and the IARC have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure [ATSDR 2013].

Chlordane

Chlordane is a manufactured (man-made) chemical used as a pesticide in the United States from 1948 to 1988. Technical chlordane is not a single chemical, but is actually a mixture of pure chlordane mixed with many related chemicals. It does not occur naturally in the environment. It is a thick liquid that is colorless to amber. Chlordane has a mild, irritating smell. Some of its trade names are Octachlor and Velsicol 1068. Until 1983, the United States used chlordane as a pesticide on crops like corn and citrus and on home lawns and gardens. Because of concern about damage to the environment and harm to human health, the EPA banned all uses of chlordane in 1983 except to control termites. In 1988, EPA banned all uses.

Chlordane affects the nervous system, the digestive system, and the liver in people and animals. Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice have occurred in people who breathed air containing high concentrations of chlordane or accidentally swallowed small amounts of chlordane. Large amounts of chlordane taken by mouth can cause convulsions and death. The International Agency for Research on Cancer has determined that chlordane is not classifiable as to its carcinogenicity to humans. Studies of workers who made or used chlordane do not show that exposure to chlordane is related to cancer, but the information is not sufficient to know for sure. Mice fed low levels of chlordane in food developed liver cancer [ATSDR 2001a].

The EPA recommends that a child should not drink water with more than 60 parts of chlordane per billion parts of drinking water (60 ppb) for longer than one (1) day. EPA has set a limit in drinking water of 2 ppb. EPA requires that people report spills or releases of chlordane into the environment of 1 pound or more. The Food and Drug Administration (FDA) limits the amount of chlordane and its breakdown products in most fruits and vegetables to less than 300 ppb and less than 100 ppb in animal fat and fish [ATSDR 1995a].

Dieldrin

Aldrin and dieldrin are insecticides with similar chemical structures. We discuss them together in this report because aldrin quickly breaks down to dieldrin in the body and in the environment. Pure aldrin and dieldrin are white powders with a mild chemical odor. The less pure commercial powders have a tan color. Neither substance occurs naturally in the environment. From the 1950s until 1970, aldrin and dieldrin were widely used pesticides for crops like corn and cotton. Because of concerns about damage to the environment and potentially to human health, EPA banned all uses of aldrin and dieldrin in 1974, except to control termites. In 1987, EPA banned all uses.

Aldrin and dieldrin affect health in similar ways. Health scientists have seen symptoms of aldrin and dieldrin poisoning in people who were exposed to very large amounts of these pesticides during their manufacture. They have also seen symptoms of poisoning in people who intentionally or accidentally ate or drank large amounts of aldrin or dieldrin. Most of these people experienced convulsions or other nervous system effects, and some had kidney damage. Some people who intentionally ate or drank large amounts of aldrin or dieldrin died. Health effects in people exposed to smaller amounts of aldrin or dieldrin occur because levels of the chemicals build up in the body over time. Exposure to moderate levels of aldrin or dieldrin for a long time causes headaches, dizziness, irritability, vomiting, or uncontrollable muscle movements. Some sensitive people seem to develop a condition in which aldrin or dieldrin causes the body to destroy its own blood cells. The IARC has determined that aldrin and dieldrin are not classifiable as to their carcinogenicity to humans. Based on studies in animals, the EPA has determined that aldrin and dieldrin are probable human carcinogens [ATSDR 2002].

The federal government has developed regulatory standards and guidelines to protect people from the harmful health effects of aldrin and dieldrin. In 1974, EPA banned all uses of aldrin or dieldrin except as a termite killer. In 1981, EPA required labeling changes to warn against applying these chemicals near water supplies, heating ducts, or crawl spaces. They also warned against applying them too frequently. Even though EPA banned all uses of aldrin and dieldrin in 1987, the chemicals persist in the environment. EPA advises lifetime drinking water exposure concentration limits for aldrin and dieldrin of 0.001 and 0.002 milligrams per liter (mg/L), respectively, for protection against adverse non-cancer health effects, which assume all of the exposure to the contaminants are from drinking water. Regarding cancer risk, EPA advises a drinking water exposure concentration limit of 0.0002 mg/L for aldrin and dieldrin that would, in theory, limit the lifetime risk for developing cancer from exposure to each compound to 1 extra cancer case in 10,000 people.

Dioxins

"Dioxins" refers to a group of toxic chemical compounds that share certain chemical structures and biological characteristics. Forest fires, backyard burning of trash, certain industrial activities, and residue from past commercial burning of waste can release dioxins into the environment. Dioxins break down very slowly and past releases of dioxins from both man-made and natural sources still exist in the environment.

Studies have shown that exposure to dioxins at high enough levels may cause a number of adverse health effects, including cancer. The health effects associated with dioxins depend on a variety of factors including: the level of exposure, when someone was exposed, and for how long and how often someone was exposed.

The most obvious non-cancer health effect in people exposed to large amounts of dioxin is chloracne. Chloracne cases have typically been the result of accidents or significant contamination events. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other non-cancer effects of exposure to large amounts of dioxin include developmental and reproductive effects, damage to the immune system, interference with hormones, skin rashes, skin discoloration, excessive body hair, and possibly mild liver damage.

EPA has taken actions to reduce dioxin emissions to the environment by placing regulatory controls on all of the major industrial sources of dioxin, including large and small municipal waste combustors, hospital medical waste incinerators, commercial, industrial and solid waste incinerators, and secondary aluminum smelters. As a result, air emissions of dioxins have been reduced 90 percent from 1987 levels [EPA 2012].

Heptachlor epoxide

Heptachlor is a manufactured chemical and does not occur naturally. Pure heptachlor is a white powder that smells like camphor (mothballs). The less pure grade is tan. Trade names include Heptagran®, Basaklor®, Drinox®, Soleptax®, Termide®, Gold Crest H-60®, and Velsicol 104®. The United States used heptachlor extensively in the past for killing insects in homes, buildings, and on food crops. These uses stopped in 1988. Currently it can only be used for fire ant control in underground power transformers. Heptachlor epoxide is also a white powder. Bacteria and animals break down heptachlor to form heptachlor epoxide. The epoxide is more likely found in the environment than heptachlor [ATSDR 2007b].

There is no reliable information on heptachlor health effects in humans. Health scientists have observed liver damage, excitability, and decreases in fertility in animals ingesting heptachlor. The effects are worse when the exposure levels were high or when exposure lasted many weeks. Although there is very little information on heptachlor epoxide, it is likely that similar effects would also occur after exposure to this compound. Lifetime exposure to heptachlor resulted in liver tumors in animals. IARC and the EPA have classified heptachlor as a possible human carcinogen. EPA also considers heptachlor epoxide as a possible human carcinogen.

The EPA requires that drinking water should not contain more than 0.0004 milligrams heptachlor per liter of water (0.0004 mg/L) and 0.0002 mg heptachlor epoxide per liter of water (0.0002 mg/L). The FDA regulates the amount of heptachlor and heptachlor epoxide in raw food crops and edible seafood. The limit in food crops is 0.01 parts heptachlor per million parts food (0.01 ppm). The limit in milk is 0.1 parts per million of milk fat. The limit in edible seafood is 0.3 ppm.

Lead

Lead is a naturally-occurring bluish-gray metal found in small amounts in the soil. Lead is in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Because of health concerns, lead from paints, ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. In 1996, the government banned the use of lead as an additive to gasoline in the United States.

Adults and children may be exposed to lead by hand-to-mouth contact with lead-containing soil or dust. Most exposure comes from accidental ingestion rather than dermal exposure. Health scientists have long recognized environmental exposure to lead as a public health problem, particularly among children. Studies show that excessive concentrations of lead in soil increase blood lead levels in young children [ATSDR 2007c].

Lead, like most metals, is not well absorbed through the skin. Soil that contains lead may get on your skin, but only a small portion of the lead will pass through your skin and enter your blood. The only kinds of lead compounds that easily penetrate the skin are the additives in leaded gasoline, which manufacturers no longer sell to the general public. Therefore, the general public is not likely to encounter lead that can enter through the skin [ATSDR 2007c]. The lack of air monitoring data prevents an evaluation of the risk from breathing lead-contaminated dust in this public health assessment.

Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Signs and symptoms associated with lead toxicity include decreased learning capacity and memory, lowered Intelligence Quotient (IQ), speech and hearing impairments, fatigue and lethargy.

Florida DOH used EPA's Adult Lead Methodology model [EPA 1996] to estimate the blood lead levels for adult workers and park visitors. Estimated blood lead levels more accurately predict health effects than traditional dose estimates.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of over 100 different chemicals formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. Health scientists usually find PAHs as a mixture containing two or more of these compounds, such as soot.

PAHs detected in soils at the site include anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene. To evaluate toxicity, ATSDR relates the toxicities of the carcinogenic PAH family members to the toxicity of BaP. They estimate carcinogenic activity relative to BaP as the toxicity equivalency factor, or TEF. TEFs are in Appendix C. To determine the PAH toxicity equivalent (TEQ), concentrations of carcinogenic PAHs other than BaP are multiplied by their respective TEF and then added to the concentration of BaP. ATSDR considers the PAH TEQ concentration the most valid measure of cancer-producing potency of a complex mixture of PAH compounds.

Animal studies have shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. However, health scientists have not seen these effects in people. The DHHS has determined that some PAHs may reasonably be expected to be carcinogens [ATSDR 1995b]. Because health scientists believe PAHs may cause cancer through a mutagenic mode, ATSDR and Florida DOH use age-dependent adjustment factors to estimate the increased cancer risk.

Polychlorinated Biphenyls (PCBs)

PCBs are a mixture of individual chemicals, which the United States no longer produces, but are still in the environment. Industries used PCBs as coolants and lubricants in transformers, capacitors, and other electrical equipment because they do not burn easily and are good insulators. PCBs have no known smell or taste. Many commercial PCB mixtures in the U.S. go by the trade name Aroclor.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs. Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. Health scientists do not associate PCBs with birth defects. The DHHS has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the IARC have determined that PCBs are probably carcinogenic to humans [ATSDR 2001].

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). People must report to EPA all discharges, spills or accidental releases of one (1) pound or more of PCBs into the environment. The FDA requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

On-Site Surface Soil – Worker Exposure

Consultants collected four on-site surface soil samples (SS-3, SS-16, SS-26 and SS-28) from 0 to 12 inches deep (Table 4). Figure 3 shows the four sample locations. Florida DOH calculations used a soil intake of 100 mg/day, adult worker (outdoor with low soil contact) weighing 80 kg (approximately 176 pounds), exposed five (5) times per week with an exposure duration of 25 years. Based on a limited number of samples, Florida DOH does not expect exposures to surface soil on the Main Street MGP/Confederate Park site to harm workers' health. Estimated increased cancer risks are "very low" to "extremely low."

Arsenic
Florida DOH estimated adult worker exposure using a maximum on-site soil concentration for arsenic of 5.7 mg/kg and a bioavailability factor of 0.33.

Noncancer illnesses
A maintenance worker who incidentally ingests very small amounts of surface soil from the site with the highest arsenic levels is unlikely to develop noncancer illnesses. The maximum worker arsenic noncancer dose (1.6×10^{-6} mg/kg/day) is less than ATSDR's chronic MRL (3×10^{-4} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 5).

Cancer
Workers who incidentally ingest surface soil with the highest arsenic levels at the site over a 25-year period are at an "extremely low" increased estimated risk of cancer (Table 5). Multiplying the maximum arsenic cancer dose (5.2×10^{-7} mg/kg/day) by the EPA cancer slope factor (1.5 mg/kg/day^{-1}) results in an increased estimated cancer risk of 8 in 10 million (0.0000008 or 8×10^{-7}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 3,333,333 in 10,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to arsenic in the surface soil at the Site would increase the cancer incidence from 3,333,333 in 10,000,000 to 3,333,341 in 10,000,000.

Barium
Florida DOH estimated adult worker exposure using a maximum on-site soil concentration for barium of 190 mg/kg.

Noncancer illnesses
A maintenance worker who incidentally ingests very small amounts of surface soil from the site with the highest barium levels is unlikely to develop noncancer illnesses. The maximum worker barium dose (1.7×10^{-4} mg/kg/day) is less than ATSDR's chronic MRL (2×10^{-2} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 5).

Cancer

The U.S. DHHS and the IARC have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure [ATSDR 2013].

Lead

Florida DOH estimated adult worker exposure using a maximum on-site soil concentration for lead of 920 mg/kg.

Noncancer illnesses

Estimated blood lead levels more accurately predict health effects than traditional dose estimates. Using EPA's Adult Lead Methodology model [EPA 1996], Florida DOH estimates that exposure to the highest concentration of lead in surface soil on the site (920 mg/kg) would result in approximately 2.3 to 2.8 micrograms of lead per deciliter blood (µg/dL) in adult workers (Table 6). In general, adults with blood lead levels less than 5 µg/dL are not likely to suffer any noncancer illness (ATSDR 2007c). For adult workers, the U.S. Occupational Safety and Health Administration (OSHA) recommends an evaluation when blood lead levels exceed 40 µg/dL.

Cancer

The U.S. DHHS has determined that lead is reasonably anticipated to be a human carcinogen based on limited evidence from studies in humans and sufficient evidence from animal studies. EPA has determined that lead is a probable human carcinogen. The IARC has determined that inorganic lead is probably carcinogenic to humans [ATSDR 2007c].

EPA has not established a cancer slope factor for lead. Therefore, Florida DOH was unable to calculate a lifetime increased cancer risk.

PAHs

Florida DOH estimated adult worker exposure using a maximum on-site soil concentration for PAHs as measured as a BaP TEq of 6.1 mg/kg and 20-year exposure duration. Calculations also used a soil intake of 100 mg/day and an 80 kg (approximately 176 pound) adult worker exposed five (5) times per week.

Noncancer illnesses

Florida DOH estimated exposure using the maximum commercial soil concentration for each of the ATSDR noncarcinogenic PAHs (1-methylnaphthalene, 2- methylnaphthalene, acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, and pyrene). Florida DOH also compared the maximum concentration for laboratory results of additional noncarcinogenic PAHs against the EPA noncarcinogenic screening levels. A maintenance worker who incidentally ingests very small amounts of surface soil with the highest noncarcinogenic PAH levels is unlikely to develop noncancer illnesses. Florida DOH did not calculate doses for the noncarcinogenic PAHs since all maximum concentrations were below ATSDR and/or EPA noncarcinogenic screening levels.

Cancer
Workers who incidentally ingest (swallow) very small amounts of surface soil with the highest BaP TEq levels at the site over a 20-year period are at a "very low" increased estimated risk of cancer (Table 5). Multiplying the maximum BaP TEq dose (0.000005 mg/kg/day) by the EPA cancer slope factor (7.3 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 10 in one million (0.0000099 or 9.9 x 10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to BaP TEq levels in the surface soil at the Site would increase the cancer incidence from 333,333 in 1,000,000 to approximately 333,343 in 1,000,000.

On-Site Surface Soil – Park Visitor Exposure

Consultants collected three on-site surface samples (SS-16, SS-26 and SS-28) from 0 to 12 inches deep (Table 4). Florida DOH did not use sample SS-3 in these calculations since the City collected it in a section of the park restricted to visitors. Figure 3 shows the three sample locations. Florida DOH calculations used a soil intake of 100 mg/day, park visitor weighing 70 kg (approximately 154 pounds), exposed four (4) times per week with an exposure duration of 20 years. Florida DOH used the adult visitor exposure scenario to represent the most common user of this section of the park. Children are more likely to use other sections of the park. Based on a limited number of samples, Florida DOH does not expect exposures to surface soil on the Main Street MGP/Confederate Park site to harm park visitors' health. Estimated increased cancer risks are "very low" to "extremely low."

Arsenic
Florida DOH estimated adult visitor exposure using a maximum on-site soil concentration for arsenic of 5.7 mg/kg and a bioavailability factor of 0.33 [FDEP 2005].

Noncancer illnesses
A park visitor who incidentally ingests very small amounts of surface soil from the site with the highest arsenic levels is unlikely to develop noncancer illnesses. The maximum visitor arsenic noncancer dose (1.5 x 10^{-6} mg/kg/day) is less than ATSDR's chronic MRL (3 x 10^{-4} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 7).

Cancer
Visitors who incidentally ingest surface soil with the highest arsenic levels at the site over a 20-year period are at an "extremely low" increased estimated risk of cancer (Table 7). Multiplying the maximum arsenic cancer dose (4 x 10^{-7} mg/kg/day) by the EPA cancer slope factor (1.5 mg/kg/day^{-1}) results in an increased estimated cancer risk of 6 in 10 million (0.0000006 or 6 x 10^{-7}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 3,333,333 in 10,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to arsenic in the surface soil at the Site would increase the cancer incidence from 3,333,333 in 10,000,000 to 3,333,339 in 10,000,000 people.

Barium

Florida DOH estimated adult visitor exposure using a maximum on-site soil concentration for barium of 190 mg/kg.

Noncancer illnesses

A park visitor who incidentally ingests very small amounts of surface soil from the site with the highest barium levels is unlikely to develop noncancer illnesses. The maximum visitor barium dose (1.7×10^{-4} mg/kg/day) is less than ATSDR's chronic MRL (2×10^{-1} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 7).

Cancer

The U.S. DHHS and the IARC have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure [ATSDR 2013].

Lead

Florida DOH estimated adult visitor exposure using a maximum on-site soil concentration for lead of 920 mg/kg.

Noncancer illnesses

Estimated blood lead levels more accurately predict health effects than traditional dose estimates. Using EPA's Adult Lead Methodology model [EPA 1996], Florida DOH estimates that exposure to the highest concentration of lead in surface soil on the site (920 mg/kg) would result in approximately 2.3 to 2.8 micrograms of lead per deciliter blood (µg/dL) in adult park visitors (Table 6). In general, adults with blood lead levels less than 5 µg/dL are not likely to suffer any noncancer illness (ATSDR 2007c).

Cancer

The U.S. DHHS has determined that lead is reasonably anticipated to be a human carcinogen based on limited evidence from studies in humans and sufficient evidence from animal studies. EPA has determined that lead is a probable human carcinogen. The IARC has determined that inorganic lead is probably carcinogenic to humans [ATSDR 2007c].

EPA has not established a cancer slope factor for lead. Therefore, Florida DOH was unable to calculate a lifetime increased cancer risk.

PAHs

Florida DOH estimated adult visitor exposure using a maximum on-site soil concentration for PAHs as measured as a BaP TEq of 3.6 mg/kg and 20-year exposure duration. Calculations also used a soil intake of 100 mg/day and a 70 kg (approximately 154 pounds) visitor exposed 4 times per week.

Noncancer illnesses
Florida DOH estimated exposure using the maximum commercial soil concentration for each of the ATSDR noncarcinogenic PAHs (1-methylnaphthalene, 2- methylnaphthalene, acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, and pyrene). Florida DOH also compared the maximum concentration for laboratory results of additional noncarcinogenic PAHs against the EPA noncarcinogenic screening levels. A park visitor who incidentally ingests very small amounts of surface soil with the highest noncarcinogenic PAH levels is unlikely to develop noncancer illnesses. Florida DOH did not calculate doses for the noncarcinogenic PAHs since all maximum concentrations were below ATSDR and/or EPA noncarcinogenic screening levels.

Cancer
Visitors who incidentally ingest (swallow) very small amounts of surface soil with the highest BaP TEq levels at the site over a 20-year period are at a "very low" increased estimated risk of cancer (Table 7). Multiplying the maximum BaP TEq dose (8×10^{-7} mg/kg/day) by the EPA cancer slope factor (7.3 mg/kg/day^{-1}) results in an increased estimated cancer risk of 6 in a million (0.000006 or 6×10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to BaP TEq levels in the surface soil at the site would increase the cancer incidence from 333,333 in 1,000,000 to approximately 333,339 in 1,000,000.

On-Site Fish – Recreational Fisherman Exposure

EPA collected five composite fish samples for largemouth bass and three composite samples for striped mullet from Hogans Creek between Main Street and Hubbard Street in 2010. Florida DOH calculations used a fish intake of 32 g/day (1 fish meal per week) and a 70 kg (approximately 154 lbs) recreational fisherman with an exposure duration of 33 years. Although EPA collected the samples from within the boundaries of Confederate Park only, Florida DOH believes these samples would be representative of bass and mullet along the length of Hogans Creek.

Florida DOH does not expect some consumption of fish taken from Hogans Creek to harm recreational fishermen's health. Although maximum doses of arsenic, pesticides, PAHs, PCBs, and dioxins were below minimal risk levels and increased cancer risks were very low or extremely low, there are other industrial sites along Hogans Creek. Some of these sites may contribute contaminants that EPA did not analyze. There is also the possibility that contaminant concentrations in fish may have increased since 2010.

Therefore, Florida DOH recommends recreational fishermen and others not consume fish from Hogans Creek. Florida DOH also recommends the City of Jacksonville maintain fish advisory signs along Hogans Creek.

Arsenic
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for arsenic of 0.049 mg/kg (Table 8).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest arsenic levels is unlikely to develop noncancer illnesses. The maximum arsenic noncancer dose (3.2×10^{-6} mg/kg/day) is less than ATSDR's chronic MRL (3×10^{-4} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest arsenic levels at the site over a 33-year period are at an "extremely low" increased estimated risk of cancer (Table 9). Multiplying the maximum arsenic cancer dose (1×10^{-6} mg/kg/day) by the EPA cancer slope factor (1.5 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 2 in 1 million (0.000002 or 2×10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to arsenic in the surface soil at the site would increase the cancer incidence from 333,333 in 1,000,000 to 333,335 in 1,000,000.

Chlordane (sum of *cis*- and *trans*- isomers)
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for chlordane of 0.038 mg/kg (Table 8).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest chlordane levels is unlikely to develop noncancer illnesses. The maximum chlordane noncancer dose (2.5×10^{-6} mg/kg/day) is less than ATSDR's chronic MRL (5×10^{-4} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest chlordane levels at the site over a 33-year period are at an "extremely low" increased estimated risk of cancer (Table 9). Multiplying the maximum chlordane cancer dose (1×10^{-6} mg/kg/day) by the EPA cancer slope factor (0.35 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 4 in 10 million (0.00000035 or 3.5×10^{-7}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 3,333,333 in 10,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to chlordane in the fish at the site would increase the cancer incidence from 3,333,333 in 10,000,000 to 3,333,337 in 10,000,000.

Dieldrin
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for dieldrin of 0.037 mg/kg (Table 8).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest dieldrin levels is unlikely to develop noncancer illnesses. The maximum dieldrin noncancer dose (2.4×10^{-6} mg/kg/day) is less than ATSDR's chronic MRL (5×10^{-5} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest dieldrin levels at the site over a 33-year period are at a "very low" increased estimated risk of cancer (Table 9). Multiplying the maximum dieldrin cancer dose (1.1×10^{-6} mg/kg/day) by the EPA cancer slope factor (16 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 2 in 100,000 (0.000016 or 1.6×10^{-5}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 33,333 in 100,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to dieldrin in the fish at the site would increase the cancer incidence from 33,333 in 100,000 to 33,335 in 100,000.

Heptachlor epoxide
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for heptachlor epoxide of 0.0059 mg/kg (Table 9).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest heptachlor epoxide levels is unlikely to develop noncancer illnesses. The maximum heptachlor epoxide noncancer dose (3.8×10^{-7} mg/kg/day) is less than ATSDR's chronic MRL (1.3×10^{-5} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest heptachlor epoxide levels at the site over a 33-year period are at an "extremely low" increased estimated risk of cancer (Table 9). Multiplying the maximum heptachlor epoxide cancer dose (1.6×10^{-7} mg/kg/day) by the EPA cancer slope factor (9.1 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 2 in a million (0.0000015 or 1.5×10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to heptachlor epoxide in the fish at the site would increase the cancer incidence from 333,333 in 1,000,000 to 333,335 in 1,000,000.

PAHs
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for PAHs as BaP TEq of 0.016 mg/kg (Table 8).

Noncancer illnesses
Florida DOH did not calculate doses for noncarcinogenic PAHs since the data was not provided in the EPA fish tissue assessment report [EPA 2011].

Cancer
Fishermen who ingest fish with the highest BaP TEq levels at the site over a 33-year period are at an "extremely low" increased estimated risk of cancer (Table 9). Multiplying the maximum BaP TEq dose (4.4 x 10^{-7} mg/kg/day) by the EPA cancer slope factor (7.3 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 3 in a million (0.0000032 or 3.2 x 10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to BaP TEq in the fish at the site would increase the cancer incidence from 333,333 in 1,000,000 to 333,336 in 1,000,000.

PCBs (total)
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for PCBs of 0.24 mg/kg (Table 8).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest PCBs levels is unlikely to develop noncancer illnesses. The maximum PCBs noncancer dose (1.6 x 10^{-5} mg/kg/day) is less than ATSDR's chronic MRL (2 x 10^{-5} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest dieldrin levels at the site over a 33-year period are at a "very low" increased estimated risk of cancer (Table 8). Multiplying the maximum PCBs cancer dose (6.6 x 10^{-6} mg/kg/day) by the EPA cancer slope factor (2.0 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 1 in 100,000 (0.000013 or 1.3 x 10^{-5}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 33,333 in 100,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to PCBs in the fish at the site would increase the cancer incidence from 33,333 in 100,000 to 33,334 in 100,000.

Dioxins TEq
Florida DOH estimated exposure using a maximum on-site fish tissue concentration for dioxins of 8.4×10^{-7} mg/kg (Table 8).

Noncancer illnesses
A recreational fisherman who ingests fish from the site with the highest dioxins levels is unlikely to develop noncancer illnesses. The maximum dioxins noncancer dose (5.5×10^{-11} mg/kg/day) is less than ATSDR's chronic MRL (7×10^{-10} mg/kg/day) and thus unlikely to cause noncancer illnesses (Table 9).

Cancer
Fishermen who ingest fish with the highest dioxins levels at the site over a 33-year period are at an "extremely low" increased estimated risk of cancer (Table 9). Multiplying the maximum dioxins cancer dose (2×10^{-11} mg/kg/day) by the EPA cancer slope factor (130,000 mg/kg/day^{-1}) results in an increased estimated cancer risk of approximately 3 in a million (0.0000026 or 2.6×10^{-6}).

To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333,333 in 1,000,000) will be diagnosed with some form of cancer in their lifetime. Adding the estimated increased cancer risk from exposure to dioxins in the fish at the site would increase the cancer incidence from 333,333 in 1,000,000 to 333,336 in 1,000,000.

Health Outcome Data

Florida DOH epidemiologists did not evaluate actual area cancer rates because maximum estimated increased cancer risks for exposure to contaminants of concern in the surface soil and fish at this site is "very low' to "extremely low."

Child Health Considerations

This assessment takes into account the special vulnerabilities of children. It specifically considered the health risk for children playing in the surface soil of properties near the Confederate Park site. Florida DOH found that children rarely use the section of the site addressed in this report. Florida DOH considers adult workers and visitors to be the primary users and more likely to be effected by soil contamination at this site than children.

Community Health Concerns Evaluation

1. Residents of the neighborhood near the site are concerned about the health risk from contaminated drinking water.

> JEA supplies water to residential and commercial properties in this area and tests annually. One private well was identified within a one-quarter mile radius but is used for irrigation only. Florida DOH does not expect contamination from this site to impact drinking water or irrigation wells.

2. Residents of the neighborhood near the site are concerned about the health risk from surface soil at the section of Confederate Park currently used for a dog walking area.

> It does not appear that contamination has impacted the dog park.

Conclusions

Overall, Florida DOH finds the Main Street MGP/Confederate Park hazardous waste site is no apparent public health hazard. Florida DOH has reached the following five conclusions.

1. If recreational fishermen consume fish from Hogans Creek, it might harm their health. Although the highest doses of arsenic, pesticides, PAHs, PCBs, and dioxins were below minimal risk levels and increased cancer risks were very low or extremely low, there are other industrial sites along Hogans Creek. Some of these sites may contribute pollutants that EPA did not analyze. There is also the chance that pollutant levels may have increased since 2010.

2. The City of Jacksonville did not test any soil in an area where Hogans Creek used to be: south of its current location, north of Orange Street, and between Hubbard/Newnan and Market Streets. Surface soil in this area may still have PAHs from past site stormwater runoff. Since the City is not planning to clean this area, it could be a future source of exposure.

3. The City of Jacksonville only collected four surface soil samples (0-12 inches deep) over the entire site. For a site this size, four samples are too few to determine the extent of surface soil pollution.

4. Based on just a few (4) samples, Florida DOH does not expect PAHs in surface soil on the site to harm workers' health. Increased cancer risks are "very low" to "extremely low."

5. Based on just a few samples, Florida DOH does not expect PAHs in surface soil on the site to harm park visitors' health. Increased cancer risks are "very low" to "extremely low."

Recommendations

1. Florida DOH recommends recreational fishermen and others not consume fish from Hogans Creek. Florida DOH also recommends the City of Jacksonville maintain fish advisory signs along Hogans Creek.

2. Florida DOH recommends the City of Jacksonville collect eight surface soil samples (0-3 inches deep) from the off-site area bounded by Hogans Creek, Orange, Hubbard/Newnan, and Market Streets. Florida DOH recommends the City analyze these samples for COCs found at this site (arsenic, barium, lead, and PAHs (as BaP TEq)).

3. Since the City of Jacksonville plans to remove on-site surface soil as part of their cleanup, Florida DOH does not recommend more surface soil testing at this time. If, however, the City does not remove surface soil, then they should collect and analyze more surface soil samples (0-3 inches deep) to find the full extent of pollution in the surface soil on the site.

Public Health Action Plan

Actions Taken

In 2011, the Florida DOH in Duval County recommended a fish consumption advisory for Hogans Creek and the City of Jacksonville posted signs.

On March 17, 2014, FDOH attended a public meeting at the Jacksonville Public Library, 303 North Laura Street. The City and their consultants presented cleanup plans for the site. Approximately 10 nearby residents attended the meeting.

Florida DOH shared the draft report with approximately 300 community members to address any additional health concerns in the final report. There were no health concerns expressed relating to the draft report. In a letter to Florida DOH dated January 6, 2015, the Urban Core Citizens Planning Advisory Committee voted to concur with the Department's conclusions and recommendations.

The Florida DOH will consider review of new data by request.

Report Preparation

The Florida DOH prepared this Health Consultation for the former Main Street Gasification Plant/Confederate Park site under a cooperative agreement with the federal ATSDR. It is in accordance with the approved agency methods, policies, and procedures existing at its publication. Florida DOH completed an editorial review of this report.

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Appendices

Appendix A

Tables

Table 1. Completed Human Exposure Pathways at the Main Street MGP/Confederate Park Site

Completed Pathway Name	Exposure Pathway Elements					Time
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population	
Worker on-site soil ingestion	Former MGP	surface soil	On-site	Incidental ingestion	Workers	Past, present, and future
Park visitor on-site soil ingestion	Former MGP	surface soil	On-site	Incidental ingestion	Park visitors	Past, present, and future
Eating fish	Former MGP and other urban sources	Fish	Hogans Creek or On-site Pond	Ingestion	Recreational Fishers	Past, present, and future

Table 2. Potential Human Exposure Pathways at the Main Street MGP/Confederate Park Site

Potential Pathway Name	Exposure Pathway Elements					Time
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population	
Incidental ingestion (swallowing) of restricted on-site soil	Former MGP	Surface soil	Confederate Park South of Hogans Creek between Main & Hubbard/Newnan	Ingestion	Park visitors	Future
Incidental ingestion (swallowing) of restricted off-site soil	Former MGP	Surface soil	Confederate Park South of Hogans Creek between Hubbard/Newnan & Market	Ingestion	Park visitors	Future

Table 3. Eliminated Human Exposure Pathways at the Main Street MGP/Confederate Park Site

Eliminated Pathway Name	Exposure Pathway Elements				
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Population
On-site subsurface soil	Former MGP	Soil	On-site	Ingestion	None
Off-site subsurface soil	Former MGP	Soil	Off-site	Ingestion	None
Sediments	Former MGP	Sediment	Hogans Creek or on-site pond	Ingestion	None
Drinking water from municipal wells	Former MGP	Deep aquifer groundwater	Tap water	Ingestion	None
Drinking water from shallow wells	Former MGP	Surficial aquifer groundwater	Private drinking water wells	Ingestion	None
Surface water	Former MGP	Surface water	Hogans Creek or on-site pond	Ingestion	None
Vapor intrusion into on-site buildings	Former MGP	Indoor air	On-site buildings	Inhalation	None

Table 4. Contaminant Concentrations in On-Site Surface Soil (0 to 1 Foot Deep) at the Main Street MGP/Confederate Park Site

Contaminants	Concentration Range (mg/kg)	Maximum Concentration in Surface Soil (mg/kg) (sample#)	Soil Screening Guideline (mg/kg)*	Source of Screening Guideline	# of Samples Above Screening Guideline/Total # Samples
Arsenic	1.3 – 5.7	5.7 (SS-16)	0.47	CREG	4/4
Barium	26 - 190	190 (SS-16)	110	FDEP Residential SCTL	1/4
Lead	190 - 920	920 (SS-16)	400	FDEP Residential SCTL	2/4
PAHs as BaP TEq	0.47 – 6.1	6.1 (SS-3)	0.1	CREG	4/4

Data Source = [Geosyntec 2003]

BaP TEq = Benzo(a)Pyrene Toxicity Equivalents

CREG = ATSDR cancer risk evaluation guide

FDEP = Florida Department of Environmental Protection

mg/kg = milligrams per kilogram

PAH = polycyclic aromatic hydrocarbon

SCTL = soil cleanup target level

***** Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness.

Table 5. **Estimated Worker Dose and Increased Cancer Risk From Inadvertent Ingestion of Surface Soil on the Main Street MGP/Confederate Park Site**

Contaminants	Maximum On-Site Soil Concentration (0-1' deep) (mg/kg)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (noncancer) (mg/kg/day)	ATSDR Minimal Risk Level (mg/kg/day)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (cancer) (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Source of Oral Cancer Slope Factor	Estimated Increased Cancer Risk
Arsenic	5.7	1.6×10^{-6} (a)	3×10^{-4} (chronic)	5.2×10^{-7} (a)	1.5	EPA IRIS	8×10^{-7} (extremely low)
Barium	190	1.6×10^{-4}	2×10^{-2} (chronic)	NA	none	NA	NA
Lead	920	< 5µg/dL *	none **	NA	none	NA	NA
PAHs as BaP TEq	6.1	NA	none ***	1.7×10^{-6}	7.3	EPA IRIS	1×10^{-5} (very low)

Data Source = [Geosyntec 2003]

ATSDR = Agency for Toxic Substances and Disease Registry

BaP TEq - Benzo(a)Pyrene Toxicity Equivalents

EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2013b)

mg/kg = milligrams per kilogram

mg/kg/day = milligrams per kilogram per day

NA = non-applicable

PAH = polycyclic aromatic hydrocarbon

µg/dL = micrograms per deciliter

(a) = Arsenic dose reflects a bioavailability factor of 0.33 (see Technical Report for 62-777 F.A.C.)

***** = This is an estimate, using EPA's IEUBK model, of the blood lead level in children exposed to soil with a lead concentration of 920 mg/kg.

****** = Minimal risk levels for lead have not been established but the Centers for Disease Control and Prevention considers blood lead levels in children above 5µg/dL to be elevated

******* = The Centers for Disease Control and Prevention has not calculated a minimal risk level for PAHs but the estimated maximum dose at this site is well below the oral no adverse effect level of 1.3 mg/kg/day

Table 6. Blood Lead Concentrations (PbBs) in Adult Workers and Visitors From Incidental Ingestion (Swallowing) of Surface Soil at the Main Street MGP/Confederate Park Site

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES III (Phases 1&2)
PbS	Soil lead concentration	ug/g or ppm	920	920
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	2.1
PbB_0	Baseline PbB	ug/dL	1.0	1.5
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	219	219
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	PbB of adult worker, geometric mean	ug/dL	2.3	2.8
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	ug/dL	5.5	8.6
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	10.0	10.0
$P(PbB_{fetal} > PbB_t)$	Probability that fetal PbB > PbB_t, assuming lognormal distribution	%	0.4%	3.2%

Source = U.S. EPA [1996]

NHANES = National Health and Nutrition Examination Survey

Table 7. Estimated Park Visitor Dose and Increased Cancer Risk From Inadvertent Ingestion of Surface Soil on the Main Street MGP/Confederate Park Site

Contaminants	Maximum On-Site Soil Concentration (0-1' deep) (mg/kg)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (noncancer) (mg/kg/day)	ATSDR Minimal Risk Level (mg/kg/day)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (cancer) (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Source of Oral Cancer Slope Factor	Estimated Increased Cancer Risk
Arsenic	5.7	1.5×10^{-6} (a)	3×10^{-4} (chronic)	4×10^{-7} (a)	1.5	EPA IRIS	6×10^{-7} (extremely low)
Barium	190	1.7×10^{-4}	2×10^{-2} (chronic)	NA	none	NA	NA
Lead	920	< 5µg/dL *	none **	NA	none	NA	NA
PAHs as BaP TEq	3.6		none ***	8×10^{-7}	7.3	EPA IRIS	6.0×10^{-6} (very low)

ATSDR = Agency for Toxic Substances and Disease Registry

BaP TEq - Benzo(a)Pyrene Toxicity Equivalents

EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2013b)

mg/kg = milligrams per kilogram

mg/kg/day = milligrams per kilogram per day

NA = non-applicable

PAH = polycyclic aromatic hydrocarbon

µg/dL = micrograms per deciliter

(a) = Arsenic dose reflects a bioaccumulation factor of 0.33 (see Technical Report for 62-777 F.A.C.)

***** = This is an estimate, using EPA's IEUBK model, of the blood lead level in children exposed to soil with a lead concentration of 920 mg/kg.

****** = Minimal risk levels for lead have not been established but the Centers for Disease Control and Prevention considers blood lead levels in children above 5µg/dL to be elevated

******* = The Centers for Disease Control and Prevention has not calculated a minimal risk level for PAHs but the estimated maximum dose at this site is well below the oral no adverse effect level of 1.3 mg/kg/day

Table 8. Contaminant Concentrations in Fish from Hogans Creek at the Main Street MGP/Confederate Park Site

Contaminants	Concentration Range (mg/kg)	Maximum Concentration in Fish Tissue (mg/kg) (sample#)	FDOH[e] Screening Guideline (mg/kg)*	# of Samples Above Screening Guideline/Total # Samples
Arsenic (inorganic [a])	0.0081 – 0.049	0.049 (H-MUL[c]2)	0.015	3/8
Chlordane (sum of *cis*- and *trans*- isomers)	0.013 – 0.038	0.038 (H-MUL3)	0.017	4/8
Dieldrin	0.0068 – 0.037	0.037 (H-MUL3)	0.0014	8/8
Heptachlor epoxide	0.0021 – 0.0059	0.0059 (H-MUL3)	0.0024	4/8
PAHs as BaP TEq	0.011 – 0.016	0.016 (H-MUL1)	0.003	8/8
PCBs (total)[b]	0.05 – 0.24	0.24 (H-MUL3)	0.05	8/8
Dioxins TEq	3.4×10^{-7} – 8.4×10^{-7}	8.4×10^{-7} (H-LMB[d]1)	1.5×10^{-7}	8/8

Data source = [EPA 2011]

[a] Arsenic (inorganic) (Calculated at 10% of total Arsenic [USFDA 1993])

[b] Total PCBs (Sum of PCB congeners)

[c] H-MUL is a composite fish tissue sample from mullet taken from Hogans Creek at the site

[d] H-LMB is a composite fish tissue sample from largemouth bass taken from Hogans Creek at the site

[e] FDOH, 2012. Fish Tissue Screening Values. Florida Department of Health, Bureau of Epidemiology, Tallahassee, FL.

BaP TEq = Benzo(a)Pyrene Toxicity Equivalents

mg/kg = milligrams per kilogram

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

***** Screening guidelines only used to select chemicals for further scrutiny, not to judge the risk of illness.

Table 9. **Maximum Dose and Increased Cancer Risk From Fish Consumption at the Main Street MGP/Confederate Park Site**

Contaminants	Maximum Fish Tissue Concentration (mg/kg)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (noncancer) (mg/kg/day)	ATSDR Minimal Risk Level (mg/kg/day)	Estimated Worker Maximum Inadvertent Soil Ingestion Dose (cancer) (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Source of Oral Cancer Slope Factor	Estimated Increased Cancer Risk
Arsenic (inorganic [(a)])	0.049	3.2×10^{-6}	3×10^{-4} (chronic)	3.2×10^{-6}	1.5	EPA IRIS	5×10^{-6} (extremely low)
Chlordane (sum of *cis*- and *trans*-)	0.038	2.5×10^{-6}	5×10^{-4} (chronic)	1×10^{-6}	0.35	EPA IRIS	3.7×10^{-7} (extremely low)
Dieldrin	0.037	2.4×10^{-6}	5×10^{-5} (chronic)	1×10^{-6}	16	EPA IRIS	1.6×10^{-5} (very low)
Heptachlor epoxide	0.0059	3.8×10^{-7}	1.3×10^{-5} (chronic)	1.6×10^{-7}	9.1	EPA IRIS	1.5×10^{-6} (extremely low)
PAHs as BaP TEq	0.016	NA	none *	4.4×10^{-7}	7.3	EPA IRIS	3.2×10^{-6} (extremely low)
PCBs (total) [(b)]	0.24	1.6×10^{-5}	2×10^{-5} (Aroclor 1254)	6.6×10^{-6}	2	EPA IRIS	1.3×10^{-5} (very low)
Dioxins TEq (fish)	8.4×10^{-7}	5.5×10^{-11}	7×10^{-10} (chronic) 2×10^{-8} (LOAEL)	2×10^{-11}	130,000	TAC	2.6×10^{-6} (extremely low)

Data source = [EPA 2011]
[(a)] Arsenic (inorganic) (Calculated at 10% of total Arsenic (USFDA 1993))
[(b)] Total PCBs (Sum of PCB congeners)
ATSDR = Agency for Toxic Substances and Disease Registry
BaP TEq - Benzo(a)Pyrene Toxicity Equivalents
EPA IRIS = U.S. Environmental Protection Agency Integrated Risk Information System (EPA 2013b)
LOAEL = lowest observed adverse effect level
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day

NA = non-applicable
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TAC = Toxic Air Contaminant document, California Office of Environmental Health Hazard Assessment (OEHHA)
***** = The Centers for Disease Control and Prevention has not calculated a minimal risk level for carcinogenic PAHs but the estimated maximum dose at this site is well below the oral no adverse effect level of 1.3 mg/kg/day

Appendix B

Figures

Figure 1. Main Street MGP/Confederate Park Site Map

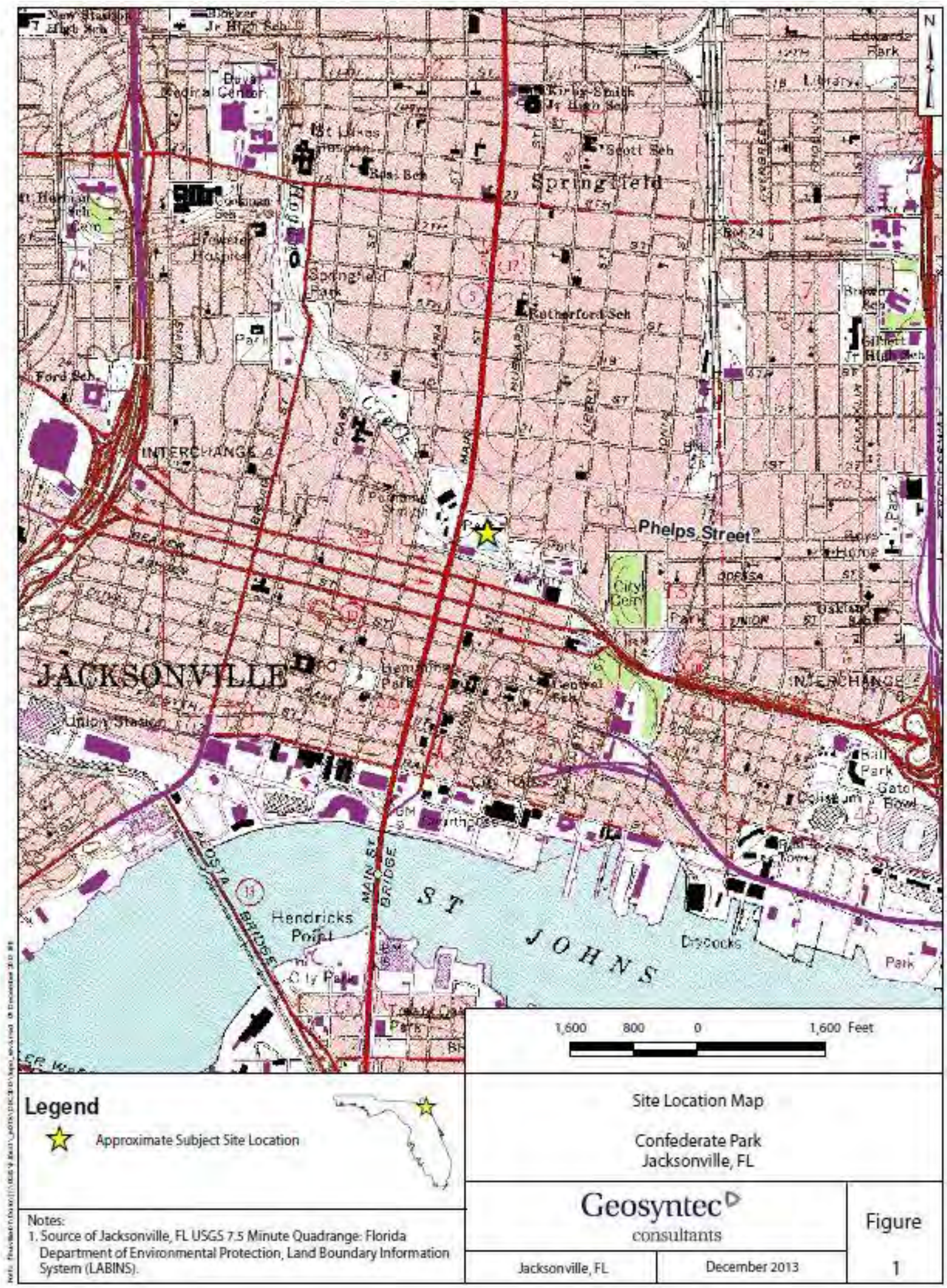


Figure 2. Main Street MGP/Confederate Park Site Layout

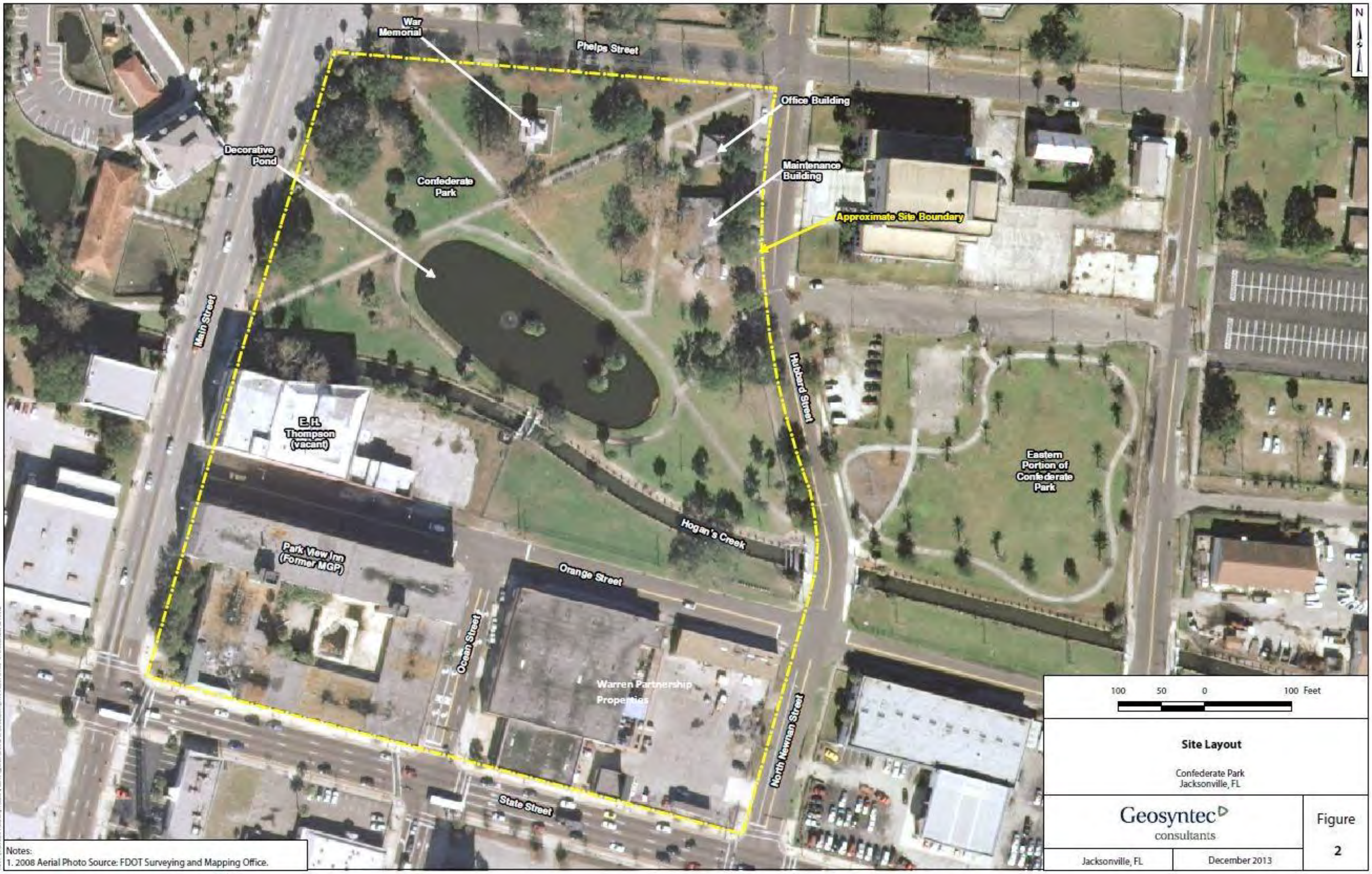


Figure 3. Main Street MGP/Confederate Park Site Surface Soil Sample Locations

Appendix C

PAH Toxicity Equivalency Factors

PAH Toxicity Equivalency Factors (TEF)

Compound	TEF
Acenaphthene	0.001
Acenaphthylene	0.001
Anthracene	0.01
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Benzo(g,h,i)perylene	0.01
Chrysene	0.01
Dibenz(a,h)anthracene	5
Fluoranthene	0.001
Fluorene	0.001
Indeno(1,2,3-cd)pyrene	0.1
Phenanthrene	0.001
Pyrene	0.001

Note: Data from Toxicological Profile for Polycyclic Aromatic Hydrocarbons (ATSDR 1995)

Glossary

Absorption
The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time (compare with **chronic**).

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) (compare with **intermediate duration exposure** and **chronic exposure)**.

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together (compare with **antagonistic effect** and **synergistic effect)**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Aerobic
Requiring oxygen (compare with **anaerobic**).

Ambient
Surrounding (for example, *ambient* air).

Anaerobic
Requiring the absence of oxygen (compare with **aerobic**).

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together (compare with **additive effect** and **synergistic effect**).

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) **biomedical testing** or (b) the measurement of a substance (an **analyte**), its **metabolite**, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance (also see **exposure investigation**).

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP
See **Community Assistance Panel**.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk of for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA (see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**)

Chronic
Occurring over a long time (more than 1 year) (compare with **acute**).

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) (compare with **acute exposure** and **intermediate duration exposure**).

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports, determine whether they represent an unusual disease occurrence, and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people, from a community and from health and environmental agencies, who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway (see **exposure pathway**).

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin (see **route of exposure**).

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure (**dose**) to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term (**acute exposure**), of intermediate duration, or long-term (**chronic exposure**).

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry
A system of ongoing follow-ups of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces (compare with **surface water**).

Half-life (t½)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the

human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half-life is the amount of time necessary for one-half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half-lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical (compare with **public health assessment**).

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period (contrast with **prevalence**).

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way (see **route of exposure**).

Inhalation
The act of breathing. A hazardous substance can enter the body this way (see **route of exposure**).

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year (compare with **acute exposure** and **chronic exposure**).

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal (compare with **in vivo**).

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice (compare with **in vitro**).

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of **metabolism**.

mg/kg
Milligram per kilogram.

mg/cm2
Milligram per square centimeter (of a surface).

mg/m3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects (see **reference dose**).

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, condition, or injury) is stated.

Mutagen
A substance that causes **mutations** (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL (see **National Priorities List for Uncontrolled Hazardous Waste Sites)**

Physiologically-based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment (see **exposure pathway**).

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period (contrast with **incidence**).

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health (compare with **health consultation**).

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard, no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA (See **Resource Conservation and Recovery Act (1976, 1984)**)

Receptor population
People who could come into contact with hazardous substances (see **exposure pathway**).

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases (see **exposure registry** and **disease registry**).

Remedial Investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD
See **reference dose**.

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing (**inhalation**), eating or drinking (**ingestion**), or contact with the skin (**dermal contact**).

Safety factor (see **uncertainty factor)**

SARA (see **Superfund Amendments and Reauthorization Act**)

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population (see **population**). An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment.

This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs (compare with **groundwater**).

Surveillance (see **epidemiologic surveillance**)

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people (see **prevalence survey**).

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves (see **additive effect** and **antagonistic effect**).

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents which, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people (also sometimes called a **safety factor**).

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Appendix C

Tables Excerpts from Geosyntec SAR and FS

Table 1
Summary of Detections from Subsurface Soil Samples
Confederate Park Site, Jacksonville, Florida

Parameter	CAS Number	Minimum Concentration	Maximum Concentration	Location of Maximum Concentration (Depth BLS of Sample Collection)	Detection Frequency
Surficial Aquifer					
1,2,4-Trimethylbenzene	95636	0.027	350	SB-10 (20-21)	18 / 35
1,3,5-Trimethylbenzene	108678	0.0088	120	SB-10 (20-21)	17 / 35
1-Methylnaphthalene	90120	0.079	610	SB-36 (34-35)	23 / 35
2-Methylnaphthalene	91576	0.24	1,000 J	SB-36 (34-35)	22 / 35
Acenaphthene	83329	0.039	570	SB-36 (11-12)	44 / 35
Acenaphthylene	208968	0.046	370, J	SB-36 (34-35)	19 / 35
Acetone	67641	390 I	0.39 I	SB-30 (18-19)	1 / 35
Anthracene	120127	0.1	300	SB-36 (11-12)	24 / 35
Arsenic	7440382	0.28 I	5.7	SB-13 (15-16)	27 / 35
Barium	7440393	5.0	93	SB-19 (28)	33 / 35
Benzene	71432	0.0055	95	SB-36 (34-35)	18 / 35
Benzo(a)anthracene	56553	0.079	170	SB-36 (11-12)	22 / 35
Benzo(a)pyrene	50328	0.057	140	SB-36 (11-12)	23 / 35
Benzo(b)fluoranthene	205992	0.032	120	SB-36 (11-12)	23 / 35
Benzo(g,h,i)perylene	191242	0.001	71	SB-36 (11-12)	23 / 35
Benzo(k)fluoranthene	207089	0.0042	54	SB-36 (11-12)	23 / 35
Cadmium	7440439	0.17 I	3	SB-30 (18-19)	3 / 35
Carbazole	86748	13,000 I	13 I	SB-36 (11-12)	1 / 35
Carbon disulfide	75150	14	0.014	SB-36 (44-45)	1 / 35
Chromium	7440473	1.6	30	SB-24 (33)	33 / 35
Chrysene	218019	0.32	160	SB-36 (11-12), SB-36 (34-35)	23 / 35
Cyanide, Total	57125	6.1	31	SB-10 (36-37)	3 / 35
Dibenzo(a,h)anthracene	53703	0.0	92	SB-27 (34)	20 / 35
Dibenzofuran	132649	0.029	170	SB-36 (11-12)	18 / 35
Diethyl phthalate	84662	85I V	0.15 I V	SB-33 (4-5)	2 / 35
Ethylbenzene	100414	0.035	130	SB-36 (34-35)	21 / 35
Fluoranthene	206440	0.011	490	SB-36 (11-12)	26 / 35
Fluorene	86737	0.03	410 J	SB-36 (34-35)	26 / 35
Indeno(1,2,3-cd)pyrene	193395	0.015	54	SB-36 (11-12)	24 / 35
Isopropylbenzene	98828	0.007	3	SB-36 (11-12)	13 / 35
Lead	7439921	0.64	280	SB-10 (20-21)	28 / 35
m&p-Xylene	108383	0.019	600	SB-13 (34-35)	19 / 35
Mercury	7439976	0.044	18	SB-19 (28)	9 / 35
Methyl Ethyl Ketone	78933	240 I	0.24 I	SB-30 (18-19)	1 / 35
m-Propylbenzene	103651	0.0063	0.0063	SB-14 (15-16)	1 / 35
Naphthalene	91203	0.0083	2,500	SB-36 (34-35)	27 / 35
n-Propylbenzene	103651	0.026	64	SB-27 (34)	9 / 35
o-Xylene	95476	0.016	260	SB-13 (34-35)	17 / 35
p-Cumene	99876	0.26	100	SB-10 (20-21)	11 / 35
Phenanthrene	85018	0.031	1,200 J	SB-36 (11-12), SB-36 (34-35)	26 / 35
Pyrene	129000	0.017	580	SB-36 (11-12)	26 / 35
Selenium	7782492	3.4 I	3.4 I	SB-36 (11-12)	1 / 35
Silver	7440224	0.16 I	0.62 I	SB-36 (11-12)	5 / 35
Styrene	100425	72	160	SB-36 (34-35)	9 / 35
Toluene	108883	12	240 I	SB-36 (34-35)	18 / 35
Xylenes, Total	1330207	380,000	380	SB-36 (34-35)	1 / 35

Table 1
Summary of Detections from Subsurface Soil Samples
Confederate Park Site, Jacksonville, Florida

Parameter	CAS Number	Minimum Concentration	Maximum Concentration	Location of Maximum Concentration (Depth BLS of Sample Collection)	Detection Frequency
Clay Above Hawthorn Group					
1,2,4-Trimethylbenzene	95636	0.025	0.072	SB-13 (40-41)	3 / 27
1,3,5-Trimethylbenzene	108678	0.0073	0.022	SB-13 (40-41)	3 / 27
1-Methylnaphthalene	90120	0.014	1	SB-13 (40-41)	10 / 27
2-Chlorotoluene	95498	0.011	0.011	SB-13 (40-41)	1 / 27
2-Methylnaphthalene	91576	0.0096	1.6	SB-13 (40-41)	11 / 27
Acenaphthene	83329	0.012	0.12	SB-13 (40-41)	8 / 27
Acenaphthylene	208968	0.0081	0.63	SB-13 (40-41)	9 / 27
Anthracene	120127	0.015	0.36	SB-10 (39-40)	6 / 27
Arsenic	7440382	1.3	4.9	SB-11 (38-39)	14 / 27
Barium	7440393	3.2	14	SB-11 (38-39)	20 / 27
Benzene	71432	0.0086	1.1	SB-10 (39-40)	6 / 27
Benzo(a)anthracene	56553	0.016	0.33	SB-10 (39-40)	6 / 27
Benzo(a)pyrene	50328	0.032	0.31	SB-13 (40-41)	7 / 27
Benzo(b)fluoranthene	205992	0.03	0.28	SB-13 (40-41)	7 / 27
Benzo(g,h,i)perylene	191242	0.017	0.15	SB-13 (40-41)	7 / 27
Benzo(k)fluoranthene	207089	0.016	0.17	SB-10 (39-40)	6 / 27
Chromium	7440473	1.8	25	SB-11 (38-39)	20 / 27
Chrysene	218019	0.026	0.34	SB-10 (39-40)	5 / 27
Cyanide, Total	57125	0.61	28	SB-120 (38-39) (1)	8 / 27
Dibenzo(a,h)anthracene	53703	0.027	0.26	SB-13 (40-41)	6 / 27
Dibenzofuran	132649	0.01	0.01	SB-21 (36)	1 / 27
Ethylbenzene	100414	0.013	0.2	SB-13 (40-41)	5 / 27
Fluoranthene	206440	0.0081	0.66	SB-10 (39-40)	6 / 27
Fluorene	86737	0.0	0.62	SB-13 (40-41)	9 / 27
Indeno(1,2,3-cd)pyrene	193395	0.014	0.11	SB-10 (39-40)/SB-13 (40-41)	5 / 27
Isopropylbenzene	98828	0.0061	0.0061	SB-13 (40-41)	1 / 27
Lead	7439921	0.8	2.8	SB-11 (38-39)	18 / 27
m&p-Xylene	108383	0.092	0.42	SB-13 (40-41)	5 / 27
Naphthalene	91203	0.009	4.4	SB-13 (40-41)	15 / 27
o-Xylene	95476	0.042	0.38	SB-21 (36)	5 / 27
Phenanthrene	85018	0.015	2.2	SB-10 (39-40)	10 / 27
Pyrene	129000	0.013	0.84	SB-10 (39-40)	8 / 27
Styrene	100425	0.011	0.052	SB-13 (40-41)	3 / 27
Toluene	108883	0.13	1.4	SB-11 (38-39)	5 / 27

Table 1
Summary of Detections from Subsurface Soil Samples
Confederate Park Site, Jacksonville, Florida

Parameter	CAS Number	Minimum Concentration	Maximum Concentration	Location of Maximum Concentration (Depth BLS of Sample Collection)	Detection Frequency
Phase IV and V					
1-Methylnaphthalene	90120	-	491	SB-41 (35)	-
2-Methylnaphthalene	91576	-	708	SB-41 (35)	-
Acenaphthene	83329	-	732	SB-41 (35)	-
Acenaphthylene	208968	-	190	SB-41 (35)	-
Anthracene	120127	-	133	SB-41 (35)	-
Arsenic	7440382	-	18.3, a	SB-41 (35)	-
Benzo(a)anthracene	56553	-	133	SB-41 (35)	-
Benzo(a)pyrene	50328	-	122	SB-41 (35)	-
Benzo(b)fluoranthene	205992	-	88.8	SB-41 (35)	-
Benzo(g,h,i)perylene	191242	-	33.4	SB-41 (35)	-
Benzo(k)fluoranthene	207089	-	34.2	SB-41 (35)	-
Cadmium	7440439	-	0.32	SB-41 (35)	-
Chromium	7440473	-	7.4	SB-41 (35)	-
Chrysene	218019	-	136	SB-41 (35)	-
Dibenzo(a,h)anthracene	53703	-	9.38	SB-41 (35)	-
Dibenzofuran	132649	-	30	SB-41 (35)	-
Fluoranthene	206440	-	286	SB-41 (35)	-
Fluorene	86737	-	314	SB-41 (35)	-
Indeno(1,2,3-cd)pyrene	193395	-	417	SB-41 (35)	-
Lead	7439921	-	88	SB-41 (35)	-
Naphthalene	91203	-	139	SB-41 (35)	-
Phenanthrene	85018	-	848	SB-41 (35)	-
Pyrene	129000	-	386	SB-41 (35)	-
1-Methylnaphthalene	90120	-	97.8	SB-42 (16)	-
2-Methylnaphthalene	91576	-	132	SB-42 (16)	-
Acenaphthene	83329	-	125	SB-42 (16)	-
Acenaphthylene	208968	-	13.1	SB-42 (16)	-
Anthracene	120127	-	63.8	SB-42 (16)	-
Barium	7440393	-	32.6	SB-42 (16)	-
Benzo(a)anthracene	56553	-	44.3	SB-42 (16)	-
Benzo(a)pyrene	50328	-	44	SB-42 (16)	-
Benzo(b)fluoranthene	205992	-	37.3	SB-42 (16)	-
Benzo(g,h,i)perylene	191242	-	17.5	SB-42 (16)	-
Benzo(k)fluoranthene	207089	-	15.1	SB-42 (16)	-
Cyanide, Total	57125	-	1.3	SB-42 (16)	-
Chromium	7440473	-	22	SB-42 (16)	-
Chrysene	218019	-	43.4	SB-42 (16)	-
Dibenzo(a,h)anthracene	53703	-	3.87	SB-42 (16)	-
Dibenzofuran	132649	-	8.83	SB-42 (16)	-
Fluoranthene	206440	-	110	SB-42 (16)	-
Fluorene	86737	-	76.5	SB-42 (16)	-
Indeno(1,2,3-cd)pyrene	193395	-	20.6	SB-42 (16)	-
Naphthalene	91203	-	155	SB-42 (16)	-
Phenanthrene	85018	-	221	SB-42 (16)	-
Pyrene	129000	-	136	SB-42 (16)	-

Table 1
Summary of Detections from Subsurface Soil Samples
Confederate Park Site, Jacksonville, Florida

Parameter	CAS Number	Minimum Concentration	Maximum Concentration	Location of Maximum Concentration (Depth BLS of Sample Collection)	Detection Frequency
1-Methylnaphthalene	90120	-	189	SB-43 (14.5)	-
2-Methylnaphthalene	91576	-	194	SB-43 (14.5)	-
Acenaphthene	83329	-	382	SB-43 (14.5)	-
Acenaphthylene	208968	-	28.8	SB-43 (14.5)	-
Anthracene	120127	-	144	SB-43 (14.5)	-
Barium	7440393	-	20.1	SB-43 (14.5)	-
Benzo(a)anthracene	56553	-	96.7	SB-43 (14.5)	-
Benzo(a)pyrene	50328	-	98.9	SB-43 (14.5)	-
Benzo(b)fluoranthene	205992	-	71.9	SB-43 (14.5)	-
Benzo(g,h,i)perylene	191242	-	32.3	SB-43 (14.5)	-
Benzo(k)fluoranthene	207089	-	29.4	SB-43 (14.5)	-
Cyanide, Total	57125	-	0.27	SB-43 (14.5)	-
Chromium	7440473	-	2.9	SB-43 (14.5)	-
Chrysene	218019	-	94.9	SB-43 (14.5)	-
Dibenzo(a,h)anthracene	53703	-	7.73	SB-43 (14.5)	-
Dibenzofuran	132649	-	23.7	SB-43 (14.5)	-
Fluoranthene	206440	-	252	SB-43 (14.5)	-
Fluorene	86737	-	178	SB-43 (14.5)	-
Indeno(1,2,3-cd)pyrene	193395	-	33.5	SB-43 (14.5)	-
Naphthalene	91203	-	38.6	SB-43 (14.5)	-
Phenanthrene	85018	-	668	SB-43 (14.5)	-
Pyrene	129000	-	351	SB-43 (14.5)	-
Anthracene	120127	-	150	SB-44 (10.5)	-
Arsenic	7440382	-	5.7, a	SB-44 (10.5)	-
Barium	7440393	-	215	SB-44 (10.5)	-
Benzo(a)anthracene	56553	-	291	SB-44 (10.5)	-
Benzo(a)pyrene	50328	-	285	SB-44 (10.5)	-
Benzo(b)fluoranthene	205992	-	415	SB-44 (10.5)	-
Benzo(g,h,i)perylene	191242	-	131	SB-44 (10.5)	-
Benzo(k)fluoranthene	207089	-	131	SB-44 (10.5)	-
Cadmium	7440439	-	1.1	SB-44 (10.5)	-
Carbazole	86748	-	82	SB-44 (10.5)	-
Chromium	7440473	-	11.1	SB-44 (10.5)	-
Chrysene	218019	-	308	SB-44 (10.5)	-
Dibenzo(a,h)anthracene	53703	-	39.5	SB-44 (10.5)	-
Dibenzofuran	132649	-	77.2	SB-44 (10.5)	-
Fluoranthene	206440	-	761	SB-44 (10.5)	-
Indeno(1,2,3-cd)pyrene	193395	-	163	SB-44 (10.5)	-
Lead	7439921	-	708, a	SB-44 (10.5)	-
Mercury	7439976	-	0.16	SB-44 (10.5)	-
Phenanthrene	85018	-	712	SB-44 (10.5)	-
Pyrene	129000	-	555	SB-44 (10.5)	-

Table 1
Summary of Detections from Subsurface Soil Samples
Confederate Park Site, Jacksonville, Florida

Parameter	CAS Number	Minimum Concentration	Maximum Concentration	Location of Maximum Concentration (Depth BLS of Sample Collection)	Detection Frequency
Acenaphthene	83329	-	13.7	MW-30D (18)	-
Acetone	67641	-	0.318, b	MW-30D (18)	-
Anthracene	120127	-	150	MW-30D (18)	-
Arsenic	7440382	-	5.2	MW-30D (18)	-
Barium	7440393	-	194	MW-30D (18)	-
Benzo(a)anthracene	56553	-	9.59	MW-30D (18)	-
Benzo(a)pyrene	50328	-	10.5	MW-30D (18)	-
Benzo(b)fluoranthene	205992	-	12	MW-30D (18)	-
Benzo(g,h,i)perylene	191242	-	6.1	MW-30D (18)	-
Benzo(k)fluoranthene	207089	-	3.5	MW-30D (18)	-
Cadmium	7440439	-	1.5	MW-30D (18)	-
Carbazole	86748	-	82	MW-30D (18)	-
Chromium	7440473	-	11.5	MW-30D (18)	-
Chrysene	218019	-	10.4	MW-30D (18)	-
Cyanide, Total	57125	-		MW-30D (18)	-
Dibenzo(a,h)anthracene	53703	-	1.29	MW-30D (18)	-
Fluoranthene	206440	-	23.4	MW-30D (18)	-
Indeno(1,2,3-cd)pyrene	193395	-	6.37	MW-30D (18)	-
Lead	7439921	-	596	MW-30D (18)	-
Mercury	7439976	-	6.3	MW-30D (18)	-
Phenanthrene	85018	-	25.9	MW-30D (18)	-
Pyrene	129000	-	26.7	MW-30D (18)	-
Silver	7440224	-	1.2	MW-30D (18)	-

Notes:
1. Sample duplicate.
2. All units are mg/kg.
3. a = Elevated detection limit due to matrix interference.

Table 2
Groundwater Analytical Results
November and December 2010; March and May 2011; and October 2013
Confederate Park Site, Jacksonville, Florida

Sample ID:	Units	FDEP GCTL	CAPMW-1D	CAPMW-2DD	CAPMW-2DD	MW-27D	CAPMW-3DD	CAPMW-4D	CAPMW-4D	CAPMW-4H	CAPPZ-4DD	CPW-1	CPW-1	CPW-4	IMW-1	IMW-1
Lab Sample ID:			F78191-3	F78915-3	F78915-3	FA9410-10	F78230-11	F78230-9	FA9410-1	FA9410-2	FA9410-6	F78191-4	FA9410-5	F78142-7	F78915-5	FA9410-16
Date Sampled:			11/17/2010	12/20/2010	12/20/2010	10/22/2013	11/19/2010	11/19/2010	10/21/2013	10/21/2013	10/21/2013	11/17/2010	10/21/2013	11/15/2010	12/20/2010	10/23/2013
Volatiles (SW846 8260B)																
Acetone	ug/l	6300	10 U	10 U	10 U	NA	10 U	100 U	NA	NA	NA	10 U	NA	10 U	10 U	NA
Benzene	ug/l	1	0.20 U	0.20 U	0.20 U	0.21U	0.20 U	**263**	**189**	0.21U	0.21U	0.20 U	0.21U	0.20 U	0.20 U	0.21U
Bromodichloromethane	ug/l	0.6	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
Bromoform	ug/l	4.4	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
Chlorobenzene	ug/l	100	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
Chloroethane	ug/l	12	0.50 U	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	NA
Chloroform	ug/l	70	0.22 U	0.22 U	0.22 U	NA	0.22 U	2.2 U	NA	NA	NA	0.22 U	NA	0.22 U	0.22 U	NA
Carbon disulfide	ug/l	700	0.50 U	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	NA
Carbon tetrachloride	ug/l	3	0.25 U	0.25 U	0.25 U	NA	0.25 U	2.5 U	NA	NA	NA	0.25 U	NA	0.25 U	0.25 U	NA
1,1-Dichloroethane	ug/l	70	0.25 U	0.25 U	0.25 U	NA	0.25 U	2.5 U	NA	NA	NA	0.25 U	NA	0.25 U	0.25 U	NA
1,1-Dichloroethylene	ug/l	7	0.23 U	0.23 U	0.23 U	NA	0.23 U	2.3 U	NA	NA	NA	0.23 U	NA	0.23 U	0.23 U	NA
1,2-Dichloroethane	ug/l	3	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
1,2-Dichloropropane	ug/l	5	0.25 U	0.25 U	0.25 U	NA	0.25 U	2.5 U	NA	NA	NA	0.25 U	NA	0.25 U	0.25 U	NA
Dibromochloromethane	ug/l	0.4	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
cis-1,2-Dichloroethylene	ug/l	70	0.26 U	0.26 U	0.26 U	NA	0.26 U	2.6 U	NA	NA	NA	0.26 U	NA	0.26 U	0.26 U	NA
cis-1,3-Dichloropropene	ug/l	-	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
trans-1,2-Dichloroethylene	ug/l	100	0.35 U	0.35 U	0.35 U	NA	0.35 U	3.5 U	NA	NA	NA	0.35 U	NA	0.35 U	0.35 U	NA
trans-1,3-Dichloropropene	ug/l	-	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
Ethylbenzene	ug/l	30	0.20 U	0.20 U	0.20 U	0.29U	0.20 U	**734**	**670**	2.7	0.29U	0.20 U	0.29U	0.20 U	0.20 U	0.29U
2-Hexanone	ug/l	280	4.0 U	4.0 U	4.0 U	NA	4.0 U	40 U	NA	NA	NA	4.0 U	NA	4.0 U	4.0 U	NA
4-Methyl-2-pentanone	ug/l	560	2.0 U	2.0 U	2.0 U	NA	2.0 U	20 U	NA	NA	NA	2.0 U	NA	2.0 U	2.0 U	NA
Methyl bromide	ug/l	9.8	0.50 U	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	NA
Methyl chloride	ug/l	2.7	0.50 U	0.50 U	0.50 U	NA	0.50 U	5.0 U	NA	NA	NA	0.50 U	NA	0.50 U	0.50 U	NA
Methylene chloride	ug/l	5	2.0 U	2.0 U	2.0 U	NA	2.0 U	20 U	NA	NA	NA	2.0 U	NA	2.0 U	2.0 U	NA
Methyl ethyl ketone	ug/l	4200	2.0 U	2.0 U	2.0 U	NA	2.0 U	20 U	NA	NA	NA	2.0 U	NA	2.0 U	2.0 U	NA
Styrene	ug/l	100	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
1,1,1-Trichloroethane	ug/l	200	0.20 U	0.20 U	0.20 U	NA	0.20 U	2.0 U	NA	NA	NA	0.20 U	NA	0.20 U	0.20 U	NA
1,1,2,2-Tetrachloroethane	ug/l	0.2	0.23 U	0.23 U	0.23 U	NA	0.23 U	2.3 U	NA	NA	NA	0.23 U	NA	0.23 U	0.23 U	NA
1,1,2-Trichloroethane	ug/l	5	0.22 U	0.22 U	0.22 U	NA	0.22 U	2.2 U	NA	NA	NA	0.22 U	NA	0.22 U	0.22 U	NA
Tetrachloroethylene	ug/l	3	0.25 U	0.25 U	0.25 U	NA	0.25 U	2.5 U	NA	NA	NA	0.25 U	NA	0.25 U	0.25 U	NA
Toluene	ug/l	40	0.20 U	0.20 U	0.20 U	0.20U	0.20 U	2.0 U	3.1I	1.6	0.20U	0.20 U	0.20U	0.20 U	0.20 U	0.20U
Trichloroethylene	ug/l	3	0.26 U	0.26 U	0.26 U	NA	0.26 U	2.6 U	NA	NA	NA	0.26 U	NA	0.26 U	0.26 U	NA
Vinyl chloride	ug/l	1	0.22 U	0.22 U	0.22 U	NA	0.22 U	2.2 U	NA	NA	NA	0.22 U	NA	0.22 U	0.22 U	NA
Xylene (total)	ug/l	20	0.52 U	0.52 U	0.52 U	0.50U	0.52 U	**232**	**135**	0.50U	0.50U	0.52 U	0.50U	0.52 U	0.52 U	0.50U
Methyl Tert Butyl Ether (MTBE)	ug/l	20	NA	NA	NA	0.21U	NA	NA	2.1U	0.21U	0.21U	NA	0.21U	NA	NA	0.21U
Semi-volatiles (SW846 8310)																
Acenaphthene	ug/l	20	0.79 U	0.77 U	0.77 U	**20.5**	10.3	**205**	**222**	2	0.74U	0.79 U	0.74U	**22.7**	**30**	18
Acenaphlene	ug/l	210	0.79 U	0.77 U	0.77 U	0.75U	0.79 U	32 U	76U	0.74U	0.74U	0.79 U	0.74U	0.77 U	0.76 U	0.75U
Anthracene	ug/l	2100	0.79 U	0.77 U	0.77 U	0.75U	0.79 U	32 U	76U	0.74U	0.74U	0.79 U	0.74U	1.6 I	0.76 U	0.75U
Benzo(a)anthracene	ug/l	0.05	0.040 U	0.038 U	0.038 U	**0.35**	0.040 U	1.6 U	3.8U	0.037U	0.037U	0.040 U	0.037U	**0.26**	0.038 U	0.037U
Benzo(a)pyrene	ug/l	0.2	0.040 U	0.038 U	0.038 U	0.078I	0.040 U	1.6 U	3.8U	0.068I	0.037U	0.040 U	0.037U	**0.21**	0.038 U	0.037U
Benzo(b)fluoranthene	ug/l	0.05	0.040 U	0.038 U	0.038 U	0.037U	0.040 U	1.6 U	3.8U	0.037U	0.037U	0.040 U	0.037U	**0.055 I**	0.038 U	0.037U
Benzo(g,h,i)perylene	ug/l	210	0.040 U	0.038 U	0.038 U	0.037U	0.040 U	1.6 U	3.8U	0.073I	0.037U	0.040 U	0.037U	0.075 I	0.038 U	0.037U
Benzo(k)fluoranthene	ug/l	0.5	0.040 U	0.038 U	0.038 U	0.037U	0.040 U	1.6 U	3.8U	0.037U	0.037U	0.040 U	0.037U	0.038 U	0.038 U	0.037U
Chrysene	ug/l	4.8	0.40 U	0.38 U	0.38 U	0.37U	0.40 U	16 U	38U	0.37U	0.37U	0.40 U	0.37U	0.38 U	0.38 U	0.37U
Dibenzo(a,h)anthracene	ug/l	0.005	0.040 U	0.038 U	0.038 U	0.037U	0.040 U	1.6 U	3.8U	0.037U	0.037U	0.040 U	0.037U	0.038 U	0.038 U	0.037U
Fluoranthene	ug/l	280	0.40 U	0.38 U	0.38 U	0.69I	0.58 I	16 U	38U	0.37U	0.37U	0.40 U	0.37U	4.6	0.38 U	0.37U
Fluorene	ug/l	280	0.79 U	0.77 U	0.77 U	0.75U	3.8	65.7 I	76U	0.74U	0.74U	0.79 U	0.74U	0.77 U	0.76 U	0.75U
Indeno(1,2,3-cd)pyrene	ug/l	0.05	0.040 U	0.038 U	0.038 U	0.037U	0.040 U	1.6 U	3.8U	0.037U	0.037U	0.040 U	0.037U	**0.059 I**	0.038 U	0.037U
Naphthalene	ug/l	14	0.79 U	0.77 U	0.77 U	0.75U	3.1	**8380**	**9060**	**66**	0.74U	0.79 U	0.74U	0.77 U	0.76 U	0.75U
1-Methylnaphthalene	ug/l	28	0.40 U	0.38 U	0.38 U	0.37U	4.1	**661**	**618**	6.1	0.37U	0.40 U	0.37U	0.38 U	0.38 U	0.37U
2-Methylnaphthalene	ug/l	28	0.40 U	0.38 U	0.38 U	0.37U	1.2 I	**653**	**739**	8.2	0.37U	0.40 U	0.37U	0.38 U	0.38 U	0.37U
Phenanthrene	ug/l	210	0.79 U	0.77 U	0.77 U	0.75U	0.79 U	53.3 I	76U	0.74U	0.74U	0.79 U	0.74U	0.77 U	0.76 U	0.75U
Pyrene	ug/l	210	0.40 U	0.38 U	0.38 U	5.1	1.0 I	16 U	38U	0.37U	0.37U	0.40 U	0.37U	6.3	0.38 U	0.37U
Metals																
Arsenic	ug/l	10	2.0 U	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	NA	NA	2.0 U	NA	2.0 U	2.0 U	NA
Barium	ug/l	2000	66.5 I	35.7 I	35.7 I	NA	28.5 I	47.1 I	NA	NA	NA	66.4 I	NA	343	243	NA
Cadmium	ug/l	5	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	NA	NA	1.0 U	NA	1.0 U	1.0 U	NA
Chromium	ug/l	100	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	NA	NA	1.1 I	NA	1.0 U	1.0 U	NA
Lead	ug/l	15	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	NA	NA	1.0 U	NA	2.5 I	1.0 U	NA
Mercury	ug/l	2	0.050 U	0.050 U	0.050 U	NA	0.050 U	0.050 U	NA	NA	NA	0.050 U	NA	0.050 U	0.050 U	NA
Selenium	ug/l	50	2.0 U	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	NA	NA	2.0 U	NA	2.0 U	2.0 U	NA
Silver	ug/l	100	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	NA	NA	1.0 U	NA	1.0 U	1.0 U	NA
General Chemistry																
Cyanide, Total	mg/l	0.2	0.0050 U	0.0050 U	0.0050 U	NA	0.0050 U	0.0050 U	NA	NA	NA	0.0050 U	NA	0.0050 U	0.0050 U	NA

Table 2
Groundwater Analytical Results
November and December 2010; March and May 2011; and October 2013
Confederate Park Site, Jacksonville, Florida

Sample ID:	Units	FDEP GCTL	MW-1 (EHT)	MW-1EHT	MW-2 (EHT)	MW-3(EHT)	MW-5D	MW-14	MW-21	MW-22	MW-24D	MW-24D	MW-24S	MW-24S	MW-25S	MW-26S
Lab Sample ID:			F78230-7	FA9410-15	F78230-10	F78230-8	F78191-5	F78230-1	F78142-8	F78915-6	F78142-12	FA9410-13	F78142-11	FA9410-12	FA9410-12	F78230-4
Date Sampled:			11/19/2010	10/23/2013	11/19/2010	11/19/2010	11/18/2010	11/18/2010	11/15/2010	12/20/2010	11/17/2010	10/23/2013	11/17/2010	10/23/2013	10/23/2013	11/18/2010
Volatiles (SW846 8260B)																
Acetone	ug/l	6300	10 U	NA	10 U	10 U	10 U	10 U	10 U	20.3 I	10 U	NA	10 U	NA	NA	10 U
Benzene	ug/l	1	**3.9**	0.21U	**1.6**	0.20 U	0.20 U	0.20 U	**1.2**	0.20 U	0.20 U	0.21U	0.20 U	0.21U	0.21U	0.20 U
Bromodichloromethane	ug/l	0.6	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
Bromoform	ug/l	4.4	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
Chlorobenzene	ug/l	100	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
Chloroethane	ug/l	12	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA	0.50 U
Chloroform	ug/l	70	0.22 U	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	NA	0.22 U	NA	NA	0.22 U
Carbon disulfide	ug/l	700	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA	0.50 U
Carbon tetrachloride	ug/l	3	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA	0.25 U
1,1-Dichloroethane	ug/l	70	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA	0.25 U
1,1-Dichloroethylene	ug/l	7	0.23 U	NA	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	NA	0.23 U	NA	NA	0.23 U
1,2-Dichloroethane	ug/l	3	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
1,2-Dichloropropane	ug/l	5	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA	0.25 U
Dibromochloromethane	ug/l	0.4	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
cis-1,2-Dichloroethylene	ug/l	70	0.26 U	NA	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	NA	0.26 U	NA	NA	0.26 U
cis-1,3-Dichloropropene	ug/l	-	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
trans-1,2-Dichloroethylene	ug/l	100	0.35 U	NA	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	NA	0.35 U	NA	NA	0.35 U
trans-1,3-Dichloropropene	ug/l	-	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
Ethylbenzene	ug/l	30	6.6	0.29U	0.31 I	0.20 U	18.1	0.20 U	1.2	0.20 U	0.20 U	0.29U	0.20 U	0.29U	0.29U	0.20 U
2-Hexanone	ug/l	280	4.0 U	NA	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	NA	4.0 U	NA	NA	4.0 U
4-Methyl-2-pentanone	ug/l	560	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA	2.0 U
Methyl bromide	ug/l	9.8	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA	0.50 U
Methyl chloride	ug/l	2.7	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA	0.50 U
Methylene chloride	ug/l	5	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA	2.0 U
Methyl ethyl ketone	ug/l	4200	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA	2.0 U
Styrene	ug/l	100	0.20 U	NA	0.20 U	0.20 U	8.6	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
1,1,1-Trichloroethane	ug/l	200	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA	0.20 U
1,1,2,2-Tetrachloroethane	ug/l	0.2	0.23 U	NA	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	NA	0.23 U	NA	NA	0.23 U
1,1,2-Trichloroethane	ug/l	5	0.22 U	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	NA	0.22 U	NA	NA	0.22 U
Tetrachloroethylene	ug/l	3	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA	0.25 U
Toluene	ug/l	40	0.65 I	0.20U	0.20 U	0.20 U	27	0.20 U	0.20 U	0.20 U	0.20 U	0.20U	0.20 U	0.20U	0.20U	0.20 U
Trichloroethylene	ug/l	3	0.26 U	NA	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	NA	0.26 U	NA	NA	0.26 U
Vinyl chloride	ug/l	1	0.22 U	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	NA	0.22 U	NA	NA	0.22 U
Xylene (total)	ug/l	20	7.7	0.50U	1.9 I	0.52 U	**53**	0.52 U	4	0.52 U	0.52 U	0.50U	0.52 U	0.50U	0.50U	0.52 U
Methyl Tert Butyl Ether (MTBE)	ug/l	20	NA	0.21U	NA	NA	NA	NA	NA	NA	NA	0.21U	NA	0.21U	0.21U	NA
Semi-volatiles (SW846 8310)																
Acenaphthene	ug/l	20	**111**	0.75U	**160**	0.79 U	**53.7**	0.76 U	**216**	6	0.77 U	0.75U	0.76 U	0.75U	0.75U	0.78 U
Acenaphlene	ug/l	210	4.0 U	0.75U	0.79 U	0.79 U	55.3	0.76 U	16.1	0.80 U	0.77 U	0.75U	0.76 U	0.75U	0.75U	0.78 U
Anthracene	ug/l	2100	4.0 U	0.75U	2.8	0.79 U	7.8 U	0.76 U	16.1	0.80 U	0.77 U	0.75U	0.76 U	0.75U	0.75U	0.78 U
Benzo(a)anthracene	ug/l	0.05	0.20 U	0.037U	**0.16 I**	0.040 U	0.39 U	0.038 U	**4.8**	**0.18 I**	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Benzo(a)pyrene	ug/l	0.2	0.20 U	0.037U	0.069 I	0.040 U	0.39 U	0.038 U	**8**	0.17 I	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Benzo(b)fluoranthene	ug/l	0.05	0.20 U	0.037U	0.040 U	0.040 U	0.39 U	0.038 U	**3**	**0.11 I**	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Benzo(g,h,i)perylene	ug/l	210	0.20 U	0.037U	0.081 I	0.040 U	0.39 U	0.038 U	2.9	0.072 I	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Benzo(k)fluoranthene	ug/l	0.5	0.20 U	0.037U	0.040 U	0.040 U	0.39 U	0.038 U	**0.82**	0.040 U	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Chrysene	ug/l	4.8	2.0 U	0.37U	0.40 U	0.40 U	3.9 U	0.38 U	**6.8 I**	0.40 U	0.38 U	0.37U	0.38 U	0.37U	0.37U	0.39 U
Dibenzo(a,h)anthracene	ug/l	0.005	0.20 U	0.037U	0.040 U	0.040 U	0.39 U	0.038 U	**0.36 I**	0.040 U	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Fluoranthene	ug/l	280	2.0 U	0.37U	4.2	0.40 U	9.8 I	0.38 U	21.3	1.1 I	0.38 U	0.37U	0.38 U	0.37U	0.37U	0.39 U
Fluorene	ug/l	280	7.8 I	0.75U	21.1	0.79 U	8.5 I	0.76 U	65	0.80 U	0.77 U	0.75U	0.76 U	0.75U	0.75U	0.78 U
Indeno(1,2,3-cd)pyrene	ug/l	0.05	0.20 U	0.037U	0.040 U	0.040 U	0.39 U	0.038 U	**2.3**	**0.079 I**	0.038 U	0.037U	0.038 U	0.037U	0.037U	0.039 U
Naphthalene	ug/l	14	**370**	0.75U	0.79 U	1.2 I	**742**	0.76 U	3.3 I	0.80 U	0.77 U	0.75U	0.76 U	0.75U	0.75U	3.1
1-Methylnaphthalene	ug/l	28	**50.6**	0.37U	**58.4**	0.40 U	**59.5**	0.38 U	**71.7**	0.40 U	0.38 U	0.37U	0.38 U	0.37U	0.37U	0.39 U
2-Methylnaphthalene	ug/l	28	**40.5**	0.37U	4.7	0.40 U	19.9 I	0.38 U	12.6	0.40 U	0.38 U	0.37U	0.38 U	0.37U	0.37U	0.39 U
Phenanthrene	ug/l	210	4.0 U	0.75U	5.8	0.79 U	7.8 U	0.76 U	73.8	0.80 U	0.77 U	0.75U	0.76 U	0.75U	0.75U	0.78 U
Pyrene	ug/l	210	2.0 U	0.37U	4.6	0.91 I	16.1 I	1.8 I	24.6	1.5 I	0.38 U	0.37U	0.38 U	0.37U	0.37U	0.39 U
Metals																
Arsenic	ug/l	10	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.6 I	2.0 U	NA	2.0 U	NA	NA	2.1 I
Barium	ug/l	2000	37.8 I	NA	25.3 I	42.5 I	84.0 I	38.6 I	363	392	39.3 I	NA	98.8 I	NA	NA	303
Cadmium	ug/l	5	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	NA	1.0 U
Chromium	ug/l	100	1.0 U	NA	1.0 I	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	NA	1.0 U
Lead	ug/l	15	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	2.5 I	1.0 U	1.0 U	NA	1.0 U	NA	NA	1.0 U
Mercury	ug/l	2	0.050 U	NA	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	NA	0.050 U	NA	NA	0.050 U
Selenium	ug/l	50	2.5 I	NA	2.0 U	4.9 I	2.0 U	2.0 I	3.0 I	2.0 U	2.0 I	NA	7.5 I	NA	NA	3.6 I
Silver	ug/l	100	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	NA	NA	1.0 U
General Chemistry																
Cyanide, Total	mg/l	0.2	0.081	NA	0.0061 I	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	NA	0.0050 U	NA	NA	0.0050 U

Table 2
Groundwater Analytical Results
November and December 2010; March and May 2011; and October 2013
Confederate Park Site, Jacksonville, Florida

Sample ID:	Units	FDEP GCTL	MW-27D	MW-27S	MW-28D	MW-28S	MW-28S	MW-29D	MW-29D	MW-29S	MW-30D	MW-30D	MW-30S	MW-30S	MW-30S	MW-31D
Lab Sample ID:			FA9410-10	F78142-1	FA9410-4	F81995-2	FA9410-3	F78191-1	FA9410-7	F78191-2	F78191-6	FA9410-8	F78142-5	F78915-1	FA9410-9	F78142-4
Date Sampled:			10/22/2013	11/16/2010	10/21/2013	5/2/2011	10/21/2013	11/17/2010	10/21/2013	11/17/2010	11/17/2010	10/22/2013	11/16/2010	12/20/2010	10/22/2013	11/15/2010
Volatiles (SW846 8260B)																
Acetone	ug/l	6300	NA	10 U	NA	10 U	NA	10 U	NA	10 U	10 U	NA	10 U	10 U	NA	10 U
Benzene	ug/l	1	0.21U	0.20 U	0.21U	0.20 U	0.21U	0.20 U	0.21U	0.20 U	0.20 U	0.21U	0.20 U	0.20 U	0.21U	0.20 U
Bromodichloromethane	ug/l	0.6	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
Bromoform	ug/l	4.4	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
Chlorobenzene	ug/l	100	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
Chloroethane	ug/l	12	NA	0.50 U	NA	0.50 U	NA	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U
Chloroform	ug/l	70	NA	0.22 U	NA	0.22 U	NA	0.22 U	NA	0.22 U	0.22 U	NA	0.22 U	0.22 U	NA	0.97 I
Carbon disulfide	ug/l	700	NA	0.50 U	NA	0.50 U	NA	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U
Carbon tetrachloride	ug/l	3	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U
1,1-Dichloroethane	ug/l	70	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U
1,1-Dichloroethylene	ug/l	7	NA	0.23 U	NA	0.23 U	NA	0.23 U	NA	0.23 U	0.23 U	NA	0.23 U	0.23 U	NA	0.23 U
1,2-Dichloroethane	ug/l	3	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
1,2-Dichloropropane	ug/l	5	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U
Dibromochloromethane	ug/l	0.4	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
cis-1,2-Dichloroethylene	ug/l	70	NA	0.26 U	NA	0.26 U	NA	0.26 U	NA	0.26 U	0.26 U	NA	0.26 U	0.26 U	NA	0.26 U
cis-1,3-Dichloropropene	ug/l	-	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
trans-1,2-Dichloroethylene	ug/l	100	NA	0.35 U	NA	0.35 U	NA	0.35 U	NA	0.35 U	0.35 U	NA	0.35 U	0.35 U	NA	0.35 U
trans-1,3-Dichloropropene	ug/l	-	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
Ethylbenzene	ug/l	30	0.29U	5.5	0.29U	0.20 U	0.29U	0.20 U	0.29U	0.20 U	0.20 U	0.29U	0.20 U	0.20 U	0.29U	0.20 U
2-Hexanone	ug/l	280	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	4.0 U	NA	4.0 U	4.0 U	NA	4.0 U
4-Methyl-2-pentanone	ug/l	560	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U
Methyl bromide	ug/l	9.8	NA	0.50 U	NA	0.50 U	NA	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U
Methyl chloride	ug/l	2.7	NA	0.50 U	NA	0.50 U	NA	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U	0.50 U	NA	0.50 U
Methylene chloride	ug/l	5	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U
Methyl ethyl ketone	ug/l	4200	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U
Styrene	ug/l	100	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
1,1,1-Trichloroethane	ug/l	200	NA	0.20 U	NA	0.20 U	NA	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U	0.20 U	NA	0.20 U
1,1,2,2-Tetrachloroethane	ug/l	0.2	NA	0.23 U	NA	0.23 U	NA	0.23 U	NA	0.23 U	0.23 U	NA	0.23 U	0.23 U	NA	0.23 U
1,1,2-Trichloroethane	ug/l	5	NA	0.22 U	NA	0.22 U	NA	0.22 U	NA	0.22 U	0.22 U	NA	0.22 U	0.22 U	NA	0.22 U
Tetrachloroethylene	ug/l	3	NA	0.25 U	NA	0.25 U	NA	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U
Toluene	ug/l	40	0.20U	0.20 U	0.20U	0.20 U	0.49I	0.20 U	0.20U	0.20 U	0.20 U	0.20U	0.20 U	0.20 U	0.20U	0.20 U
Trichloroethylene	ug/l	3	NA	0.26 U	NA	0.26 U	NA	0.26 U	NA	0.26 U	0.26 U	NA	0.26 U	0.26 U	NA	0.26 U
Vinyl chloride	ug/l	1	NA	0.22 U	NA	0.22 U	NA	0.22 U	NA	0.22 U	0.22 U	NA	0.22 U	0.22 U	NA	0.22 U
Xylene (total)	ug/l	20	0.50U	0.52 U	0.50U	0.52 U	0.50U	0.52 U	0.50U	0.52 U	0.52 U	0.50U	0.52 U	0.52 U	0.50U	0.52 U
Methyl Tert Butyl Ether (MTBE)	ug/l	20	0.21U	NA	0.21U	NA	0.21U	NA	0.21U	NA	NA	0.21U	NA	NA	0.26I	NA
Semi-volatiles (SW846 8310)																
Acenaphthene	ug/l	20	**20.5**	**41.6**	0.74U	0.78 U	0.74U	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.94 I
Acenaphlene	ug/l	210	0.75U	0.78 U	0.74U	0.78 U	0.74U	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.78 U
Anthracene	ug/l	2100	0.75U	1.8 I	0.74U	0.78 U	0.74U	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.78 U
Benzo(a)anthracene	ug/l	0.05	**0.35**	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	**0.070 I**	0.038 U	0.037U	0.039 U
Benzo(a)pyrene	ug/l	0.2	0.078I	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	**0.25**	0.038 U	0.037U	0.039 U
Benzo(b)fluoranthene	ug/l	0.05	0.037U	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	**0.073 I**	0.038 U	0.037U	0.039 U
Benzo(g,h,i)perylene	ug/l	210	0.037U	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	0.078 I	0.038 U	0.037U	0.039 U
Benzo(k)fluoranthene	ug/l	0.5	0.037U	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	0.039 U	0.038 U	0.037U	0.039 U
Chrysene	ug/l	4.8	0.37U	0.39 U	0.37U	0.39 U	0.37U	0.40 U	0.37U	0.40 U	0.39 U	0.37U	0.39 U	0.38 U	0.37U	0.39 U
Dibenzo(a,h)anthracene	ug/l	0.005	0.037U	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	0.039 U	0.038 U	0.037U	0.039 U
Fluoranthene	ug/l	280	0.69I	1.4 I	0.37U	0.39 U	0.37U	0.40 U	0.37U	0.40 U	0.39 U	0.37U	0.39 U	0.38 U	0.37U	0.39 U
Fluorene	ug/l	280	0.75U	0.78 U	0.74U	0.78 U	0.74U	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.78 U
Indeno(1,2,3-cd)pyrene	ug/l	0.05	0.037U	0.039 U	0.037U	0.039 U	0.037U	0.040 U	0.037U	0.040 U	0.039 U	0.037U	**0.075 I**	0.038 U	0.037U	0.039 U
Naphthalene	ug/l	14	0.75U	1.2 I	6.5	0.78 U	6.5	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.78 U
1-Methylnaphthalene	ug/l	28	0.37U	0.91 I	0.37U	0.39 U	0.37U	0.40 U	0.37U	0.40 U	0.39 U	0.37U	0.39 U	0.38 U	0.37U	0.39 U
2-Methylnaphthalene	ug/l	28	0.37U	0.39 U	0.37U	0.39 U	0.37U	0.40 U	0.37U	0.40 U	0.39 U	0.37U	0.39 U	0.38 U	0.37U	0.39 U
Phenanthrene	ug/l	210	0.75U	0.85 I	0.74U	0.78 U	0.74U	0.79 U	0.74U	0.79 U	0.78 U	0.75U	0.78 U	0.77 U	0.75U	0.78 U
Pyrene	ug/l	210	5.1	1.4 I	0.37U	0.39 U	0.37U	0.40 U	0.37U	0.40 U	0.39 U	0.37U	0.39 U	0.38 U	0.37U	0.39 U
Metals																
Arsenic	ug/l	10	NA	2.0 U	NA	2.0 U	NA	2.5 I	NA	2.0 U	2.0 U	NA	2.0 U	2.0 U	NA	2.0 U
Barium	ug/l	2000	NA	144 I	NA	90.0 I	NA	113 I	NA	129 I	57.4 I	NA	313	295	NA	46.8 I
Cadmium	ug/l	5	NA	1.0 U	NA	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	1.0 U
Chromium	ug/l	100	NA	2.0 U [a]	NA	1.1 I	NA	1.0 U	NA	1.0 U	1.0 U	NA	4.3 I	1.0 U	NA	1.0 U
Lead	ug/l	15	NA	1.3 I	NA	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	NA	**63.6**	9.1	NA	1.0 U
Mercury	ug/l	2	NA	0.050 U	NA	0.050 U	NA	0.050 U	NA	0.050 U	0.050 U	NA	0.050 U	0.050 U	NA	0.050 U
Selenium	ug/l	50	NA	4.0 U [a]	NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U	NA	4.5 I	2.3 I	NA	3.7 I
Silver	ug/l	100	NA	1.0 U	NA	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA	1.0 U
General Chemistry																
Cyanide, Total	mg/l	0.2	NA	0.0050 U	NA	0.0050 U	NA	0.0050 U	NA	0.0050 U	0.0050 U	NA	0.0050 U	0.0050 U	NA	0.0050 U

Table 2
Groundwater Analytical Results
November and December 2010; March and May 2011; and October 2013
Confederate Park Site, Jacksonville, Florida

Sample ID:	Units	FDEP GCTL	MW-31S	MW-31S	MW-32D	MW-32S	MW-33D	MW-34D	MW-1PVI	MW-2PVI	MW-35D	MW-35D	MW-35S	MW-35S	MW-35S
Lab Sample ID:			F78142-3	FA9410-20	F78142-9	F78142-10	F78230-6	F78230-3	F78915-8	F78915-7	F81254-1	FA9606-2	F81254-2	F81995-1	FA9606-2
Date Sampled:			11/15/2010	10/23/2013	11/16/2010	11/16/2010	11/18/2010	11/18/2010	12/21/2010	12/21/2010	3/31/2011	10/31/2013	3/31/2011	5/2/2011	10/31/2013
Volatiles (SW846 8260B)															
Acetone	ug/l	6300	10 U	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	10 U	NA	NA
Benzene	ug/l	1	0.20 U	0.21U	0.20 U	0.20 U	0.20 U	0.20 U	0.42 I	**1.4**	0.20U	0.21U	0.20U	NA	0.21U
Bromodichloromethane	ug/l	0.6	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1	NA	0.24I	NA	NA
Bromoform	ug/l	4.4	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
Chlorobenzene	ug/l	100	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
Chloroethane	ug/l	12	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA
Chloroform	ug/l	70	0.22 U	NA	2.2	0.22 U	2.7	2.9	0.22 U	0.22 U	10.8	NA	11	NA	NA
Carbon disulfide	ug/l	700	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.67 I	0.50 U	0.50 U	NA	0.50 U	NA	NA
Carbon tetrachloride	ug/l	3	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA
1,1-Dichloroethane	ug/l	70	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA
1,1-Dichloroethylene	ug/l	7	0.23 U	NA	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	NA	0.23 U	NA	NA
1,2-Dichloroethane	ug/l	3	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
1,2-Dichloropropane	ug/l	5	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA
Dibromochloromethane	ug/l	0.4	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.29I	NA	0.20U	NA	NA
cis-1,2-Dichloroethylene	ug/l	70	0.26 U	NA	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	NA	0.26 U	NA	NA
cis-1,3-Dichloropropene	ug/l	-	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
trans-1,2-Dichloroethylene	ug/l	100	0.35 U	NA	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	NA	0.35 U	NA	NA
trans-1,3-Dichloropropene	ug/l	-	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
Ethylbenzene	ug/l	30	0.20 U	0.29U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	25.3	0.20U	0.29U	0.20U	NA	0.29U
2-Hexanone	ug/l	280	4.0 U	NA	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	NA	4.0 U	NA	NA
4-Methyl-2-pentanone	ug/l	560	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA
Methyl bromide	ug/l	9.8	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	NA	0.50 U	NA	NA
Methyl chloride	ug/l	2.7	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	1.1 I	0.50 U	0.50 U	NA	0.50 U	NA	NA
Methylene chloride	ug/l	5	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA
Methyl ethyl ketone	ug/l	4200	2.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA	2.0 U	NA	NA
Styrene	ug/l	100	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
1,1,1-Trichloroethane	ug/l	200	0.20 U	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	NA	0.20 U	NA	NA
1,1,2,2-Tetrachloroethane	ug/l	0.2	0.23 U	NA	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	NA	0.23 U	NA	NA
1,1,2-Trichloroethane	ug/l	5	0.22 U	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	NA	0.22 U	NA	NA
Tetrachloroethylene	ug/l	3	0.25 U	NA	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NA	0.25 U	NA	NA
Toluene	ug/l	40	0.20 U	0.20U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.6	0.20U	0.20U	0.20U	NA	0.20U
Trichloroethylene	ug/l	3	0.26 U	NA	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	NA	0.26 U	NA	NA
Vinyl chloride	ug/l	1	0.22 U	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	NA	0.22 U	NA	NA
Xylene (total)	ug/l	20	0.52 U	0.50U	0.52 U	0.52 U	0.52 U	0.52 U	0.52 U	**20.1**	0.52U	0.50U	0.52U	NA	0.50U
Methyl Tert Butyl Ether (MTBE)	ug/l	20	NA	0.21U	NA	NA	NA	NA	NA	NA	NA	0.21U	NA	NA	0.21U
Semi-volatiles (SW846 8310)															
Acenaphthene	ug/l	20	3.4	0.75U	0.78 U	0.78 U	0.79 U	1.7 I	5.9	**200**	0.76U	0.80 U	0.76U	0.78U	0.75 U
Acenaphlene	ug/l	210	0.80 U	0.75U	0.78 U	0.78 U	0.79 U	0.78 U	1.2 I	0.78 U	0.76U	0.80 U	0.76U	0.78 U	0.75 U
Anthracene	ug/l	2100	0.80 U	0.75U	0.78 U	0.78 U	0.79 U	0.78 U	2	12.7	0.76U	0.80 U	0.76U	0.78 U	0.75 U
Benzo(a)anthracene	ug/l	0.05	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**3.7**	**0.15 I**	0.038U	0.040 U	**0.25**	0.039 U	0.038 U
Benzo(a)pyrene	ug/l	0.2	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**5.3**	0.061 I	0.038U	0.040 U	0.04I	0.039 U	0.038 U
Benzo(b)fluoranthene	ug/l	0.05	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**2.3**	0.039 U	0.038U	0.040 U	**0.26**	0.039 U	0.038 U
Benzo(g,h,i)perylene	ug/l	210	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	3.3	0.039 U	0.038U	0.040 U	0.095I	0.039 U	0.038 U
Benzo(k)fluoranthene	ug/l	0.5	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**0.82**	0.039 U	0.038U	0.040 U	0.16I	0.039 U	0.038 U
Chrysene	ug/l	4.8	0.40 U	0.37U	0.39 U	0.39 U	0.40 U	0.39 U	4	0.39 U	0.38U	0.40 U	0.38U	0.39 U	0.38 U
Dibenzo(a,h)anthracene	ug/l	0.005	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**0.46**	0.039 U	0.038U	0.040 U	**0.096I**	0.039 U	0.038 U
Fluoranthene	ug/l	280	0.40 U	0.37U	0.39 U	0.39 U	0.40 U	0.39 U	12.6	8.2	0.38U	0.40 U	0.38U	0.39 U	0.38 U
Fluorene	ug/l	280	0.80 U	0.75U	0.78 U	0.78 U	0.79 U	0.79 I	1.4 I	45.1	0.76U	0.80 U	0.76U	0.78U	0.75 U
Indeno(1,2,3-cd)pyrene	ug/l	0.05	0.040 U	0.037U	0.039 U	0.039 U	0.040 U	0.039 U	**3.3**	0.039 U	0.038U	0.040 U	**0.14I**	0.039 U	0.038 U
Naphthalene	ug/l	14	0.80 U	0.75U	0.78 U	3.8	5.7	5.1	3.1	**82.2**	0.76U	0.80 U	0.76U	0.78U	0.75 U
1-Methylnaphthalene	ug/l	28	0.40 U	0.37U	0.39 U	1.6 I	0.40 U	1.6 I	1.1 I	**116**	0.38U	0.40 U	0.38U	0.39U	0.38 U
2-Methylnaphthalene	ug/l	28	0.40 U	0.37U	0.39 U	1.4 I	0.40 U	0.72 I	0.54 I	14.5	0.38U	0.40 U	0.38U	0.39U	0.38 U
Phenanthrene	ug/l	210	0.80 U	0.75U	0.78 U	1.1 I	0.79 U	0.78 U	3	49.2	0.76U	0.80 U	0.76U	0.78 U	0.75 U
Pyrene	ug/l	210	0.40 U	0.37U	0.39 U	0.39 U	0.40 U	0.39 U	16.4	7.8	0.38U	0.40 U	0.38U	0.39 U	0.38 U
Metals															
Arsenic	ug/l	10	2.0 U	NA	2.0 U	4.8 I	2.0 U	2.0 U	2.6 I	7.7 I	2.0U	NA	2.0U	NA	NA
Barium	ug/l	2000	29.7 I	NA	55.3 I	10.8 I	22.8 I	22.0 I	117 I	35.4 I	43.9I	NA	53.4I	NA	NA
Cadmium	ug/l	5	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0U	NA	1.0U	NA	NA
Chromium	ug/l	100	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 I	15.8	1.0 U	1.0U	NA	1.3I	NA	NA
Lead	ug/l	15	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	**108**	1.2 I	1.0U	NA	1.0U	NA	NA
Mercury	ug/l	2	0.050 U	NA	0.050 U	0.050 U	0.050 U	0.050 U	1	0.050 U	0.050U	NA	0.050U	NA	NA
Selenium	ug/l	50	3.5 I	NA	2.0 U	4.9 I	2.0 I	2.0 U	2.0 U	2.0 U	2.0U	NA	3.2I	NA	NA
Silver	ug/l	100	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0U	NA	1.0U	NA	NA
General Chemistry															
Cyanide, Total	mg/l	0.2	0.0050 U	NA	0.0050 U	0.0064 I	0.0050 U	0.0050 U	0.0050 U	0.022	0.0050U	NA	0.0050U	NA	NA

Notes:
1. FDEP = Florida Department of Environmental Protection.
2. GCTL = Groundwater Cleanup Target Level as defined in 62-777, Florida Administrative Code
3. µg/l = micrograms per liter.
4. a = Elevated detection limit due to matrix interference
5. Bold and highlight indicates GCTL exceedance
6. -- = Not analyzed.
7. MW-1 is MW-1EHT.
8. MW-2 is MW-2EHT.

Table 3
Summary of Detected Sediment Results
April 2004 and December 2010
Confederate Park, Jacksonville, Florida

Sample ID	CAS Number	Parameter	Units	FDEP SQAG TEL	FDEP SQAG PEL	Result
SED-1	83329	Acenaphthene	µg/kg	6.71	88.9	**2,900**
SED-1	208968	Acenaphthylene	µg/kg	5.87	128	**270**
SED-1	120127	Anthracene	µg/kg	46.9	245	**220**
SED-1	56553	Benzo(a)anthracene	µg/kg	74.8	693	**1,400**
SED-1	50328	Benzo(a)pyrene	µg/kg	88.8	763	**1,200**
SED-1	205992	Benzo(b)fluoranthene	µg/kg	-	-	670
SED-1	191242	Benzo(g,h,i)perylene	µg/kg	-	-	550
SED-1	207089	Benzo(k)fluoranthene	µg/kg	-	-	940
SED-1	218019	Chrysene	µg/kg	108	846	**1,500**
SED-1	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**140**
SED-1	206440	Fluoranthene	µg/kg	113	1,494	**2,800**
SED-1	86737	Fluorene	µg/kg	21.2	144	**760**
SED-1	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	560
SED-1	85018	Phenanthrene	µg/kg	86.7	544	**410**
SED-1	129000	Pyrene	µg/kg	153	1,398	**4,600**
SED-2	83329	Acenaphthene	µg/kg	6.71	88.9	**230**
SED-2	208968	Acenaphthylene	µg/kg	5.87	128	**170**
SED-2	120127	Anthracene	µg/kg	46.9	245	**220**
SED-2	56553	Benzo(a)anthracene	µg/kg	74.8	693	**1,200**
SED-2	50328	Benzo(a)pyrene	µg/kg	88.8	763	**1,200**
SED-2	205992	Benzo(b)fluoranthene	µg/kg	-	-	1,500
SED-2	191242	Benzo(g,h,i)perylene	µg/kg	-	-	900
SED-2	207089	Benzo(k)fluoranthene	µg/kg	-	-	1,400
SED-2	218019	Chrysene	µg/kg	108	846	**1,500**
SED-2	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**170**
SED-2	206440	Fluoranthene	µg/kg	113	1,494	**1,800**
SED-2	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	1,000
SED-2	85018	Phenanthrene	µg/kg	86.7	544	**850**
SED-2	129000	Pyrene	µg/kg	153	1,398	**2,600**
SED-3	90120	1-Methylnaphthalene	µg/kg	-	-	440
SED-3	91576	2-Methylnaphthalene	µg/kg	20.2	201	**210**
SED-3	83329	Acenaphthene	µg/kg	6.71	88.9	**13,000**
SED-3	208968	Acenaphthylene	µg/kg	5.87	128	**650**
SED-3	120127	Anthracene	µg/kg	46.9	245	**1,200**
SED-3	56553	Benzo(a)anthracene	µg/kg	74.8	693	**3,700**
SED-3	50328	Benzo(a)pyrene	µg/kg	88.8	763	**3,100**
SED-3	205992	Benzo(b)fluoranthene	µg/kg	-	-	2,400
SED-3	191242	Benzo(g,h,i)perylene	µg/kg	-	-	1,200
SED-3	207089	Benzo(k)fluoranthene	µg/kg	-	-	2,400
SED-3	218019	Chrysene	µg/kg	108	846	**4,100**
SED-3	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**220**
SED-3	206440	Fluoranthene	µg/kg	113	1,494	**9,000**
SED-3	86737	Fluorene	µg/kg	21.2	144	**5,000**
SED-3	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	1,600
SED-3	98828	Isopropylbenzene	µg/kg	-	-	1,300
SED-3	91203	Naphthalene	µg/kg	34.6	391	**290**
SED-3	85018	Phenanthrene	µg/kg	86.7	544	**14,000**
SED-3	129000	Pyrene	µg/kg	153	1,398	**11,000**
SED-3	135988	sec-Butylbenzene	µg/kg	-	-	660
SED-4	83329	Acenaphthene	µg/kg	6.71	88.9	**1,700**
SED-4	208968	Acenaphthylene	µg/kg	5.87	128	**45**
SED-4	56553	Benzo(a)anthracene	µg/kg	74.8	693	**390**
SED-4	50328	Benzo(a)pyrene	µg/kg	88.8	763	**440**
SED-4	205992	Benzo(b)fluoranthene	µg/kg	-	-	540
SED-4	191242	Benzo(g,h,i)perylene	µg/kg	-	-	290
SED-4	207089	Benzo(k)fluoranthene	µg/kg	-	-	430
SED-4	218019	Chrysene	µg/kg	108	846	**610**
SED-4	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**54**
SED-4	206440	Fluoranthene	µg/kg	113	1,494	**950**
SED-4	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	360
SED-4	85018	Phenanthrene	µg/kg	86.7	544	**240**
SED-4	129000	Pyrene	µg/kg	153	1,398	**960**
SED-5	90120	1-Methylnaphthalene	µg/kg	-	-	120
SED-5	91576	2-Methylnaphthalene	µg/kg	20.2	201	**150**
SED-5	83329	Acenaphthene	µg/kg	6.71	88.9	**2,600**
SED-5	208968	Acenaphthylene	µg/kg	5.87	128	**96**
SED-5	120127	Anthracene	µg/kg	46.9	245	**620**
SED-5	56553	Benzo(a)anthracene	µg/kg	74.8	693	**1,700**
SED-5	50328	Benzo(a)pyrene	µg/kg	88.8	763	**1,300**
SED-5	205992	Benzo(b)fluoranthene	µg/kg	-	-	1,900
SED-5	191242	Benzo(g,h,i)perylene	µg/kg	-	-	320
SED-5	207089	Benzo(k)fluoranthene	µg/kg	-	-	1,600
SED-5	218019	Chrysene	µg/kg	108	846	**2,000**
SED-5	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**90**
SED-5	132649	Dibenzofuran	µg/kg	-	-	3,000
SED-5	206440	Fluoranthene	µg/kg	113	1,494	**4,700**
SED-5	86737	Fluorene	µg/kg	21.2	144	**250**

Table 3
Summary of Detected Sediment Results
April 2004 and December 2010
Confederate Park, Jacksonville, Florida

Sample ID	CAS Number	Parameter	Units	FDEP SQAG TEL	FDEP SQAG PEL	Result
SED-5	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	450
SED-5	91203	Naphthalene	µg/kg	34.6	391	**290**
SED-5	85018	Phenanthrene	µg/kg	86.7	544	**4,400**
SED-5	129000	Pyrene	µg/kg	153	1,398	**4,100**
SED-6	120127	Anthracene	µg/kg	46.9	245	**99**
SED-6	56553	Benzo(a)anthracene	µg/kg	74.8	693	**500**
SED-6	50328	Benzo(a)pyrene	µg/kg	88.8	763	**440**
SED-6	205992	Benzo(b)fluoranthene	µg/kg	-	-	500
SED-6	191242	Benzo(g,h,i)perylene	µg/kg	-	-	230
SED-6	207089	Benzo(k)fluoranthene	µg/kg	-	-	340
SED-6	218019	Chrysene	µg/kg	108	846	**560**
SED-6	53703	Dibenzo(a,h)anthracene	µg/kg	6.22	135	**38**
SED-6	132649	Dibenzofuran	µg/kg	-	-	65
SED-6	206440	Fluoranthene	µg/kg	113	1,494	**1,200**
SED-6	193395	Indeno(1,2,3-cd)pyrene	µg/kg	-	-	280
SED-6	85018	Phenanthrene	µg/kg	86.7	544	**380**
SED-6	129000	Pyrene	µg/kg	153	1,398	**1,000**
SD-1	50328	Benzo(a)pyrene	µg/kg	88.8	763	**915**
SD-2	50328	Benzo(a)pyrene	µg/kg	88.8	763	**198**
SD-3	50328	Benzo(a)pyrene	µg/kg	88.8	763	**872**
SED-1	7440382	Arsenic	mg/kg	7.24	41.6	2.4
SED-1	7440393	Barium	mg/kg	-	-	35
SED-1	7440473	Chromium	mg/kg	52.3	160	9.5
SED-1	7439921	Lead	mg/kg	30.2	112	**1,600**
SED-1	7439976	Mercury	mg/kg	0.13	0.696	**0.33**
SED-2	7440382	Arsenic	mg/kg	7.24	41.6	3.8
SED-2	7440393	Barium	mg/kg	-	-	170
SED-2	7440439	Cadmium	mg/kg	0.676	4.21	**2.1**
SED-2	7440473	Chromium	mg/kg	52.3	160	**59**
SED-2	7439921	Lead	mg/kg	30.2	112	**690**
SED-2	7439976	Mercury	mg/kg	0.13	0.696	**0.5**
SED-2	7440224	Silver	mg/kg	0.733	1.77	**2.1**
SED-3	7440382	Arsenic	mg/kg	7.24	41.6	4.7
SED-3	7440393	Barium	mg/kg	-	-	96
SED-3	7440439	Cadmium	mg/kg	0.676	4.21	**2.2**
SED-3	7440473	Chromium	mg/kg	52.3	160	21
SED-3	7439921	Lead	mg/kg	30.2	112	**310**
SED-3	7439976	Mercury	mg/kg	0.13	0.696	**0.54**
SED-3	7440224	Silver	mg/kg	0.733	1.77	**1.6**
SED-4	7440393	Barium	mg/kg	-	-	21
SED-4	7440473	Chromium	mg/kg	52.3	160	11
SED-4	7439921	Lead	mg/kg	30.2	112	**99**
SED-4	7439976	Mercury	mg/kg	0.13	0.696	0.03
SED-5	7440382	Arsenic	mg/kg	7.24	41.6	1.8
SED-5	7440393	Barium	mg/kg	-	-	79
SED-5	7440439	Cadmium	mg/kg	0.676	4.21	**1**
SED-5	7440473	Chromium	mg/kg	52.3	160	28
SED-5	7439921	Lead	mg/kg	30.2	112	**470**
SED-5	7439976	Mercury	mg/kg	0.13	0.696	0.12
SED-6	7440393	Barium	mg/kg	-	-	16
SED-6	7440473	Chromium	mg/kg	52.3	160	4.2
SED-6	7439921	Lead	mg/kg	30.2	112	**76**
SED-6	7439976	Mercury	mg/kg	0.13	0.696	0.075
SD-1	7440382	Arsenic	mg/kg	7.24	41.6	5.2
SD-3	7440382	Arsenic	mg/kg	7.24	41.6	4

Notes:
1. µg/kg = micrograms per kilogram.
2. mg/kg = milligrams per kilogram.
3. SED samples collected in 2004.
4. SD samples collected in 2010.
5. FDEP SQAG = Florida Department of Environmental Protection (1994) Sediment Quality Assessment Guidelines.
6. TEL = Toxic Effect Level; concentration that is not likely to be associated with adverse biological effects on aquatic organisms.
7. PEL = Probable Effect Level; lower limit of the range of concentrations that are usually or always associated with adverse biological effects.
8. "-" = value not available.
9. Bold indicates TEL exceedance.
10. Highlight indicates PEL exceedance.

References:

FDEP. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Volume 1 - Development and Evaluation of Sediment Quality Assessment Guidelines. November. Available on-line: http://www.dep.state.fl.us/water/monitoring/seds.htm

Appendix D

Flow and Transport Modeling Results

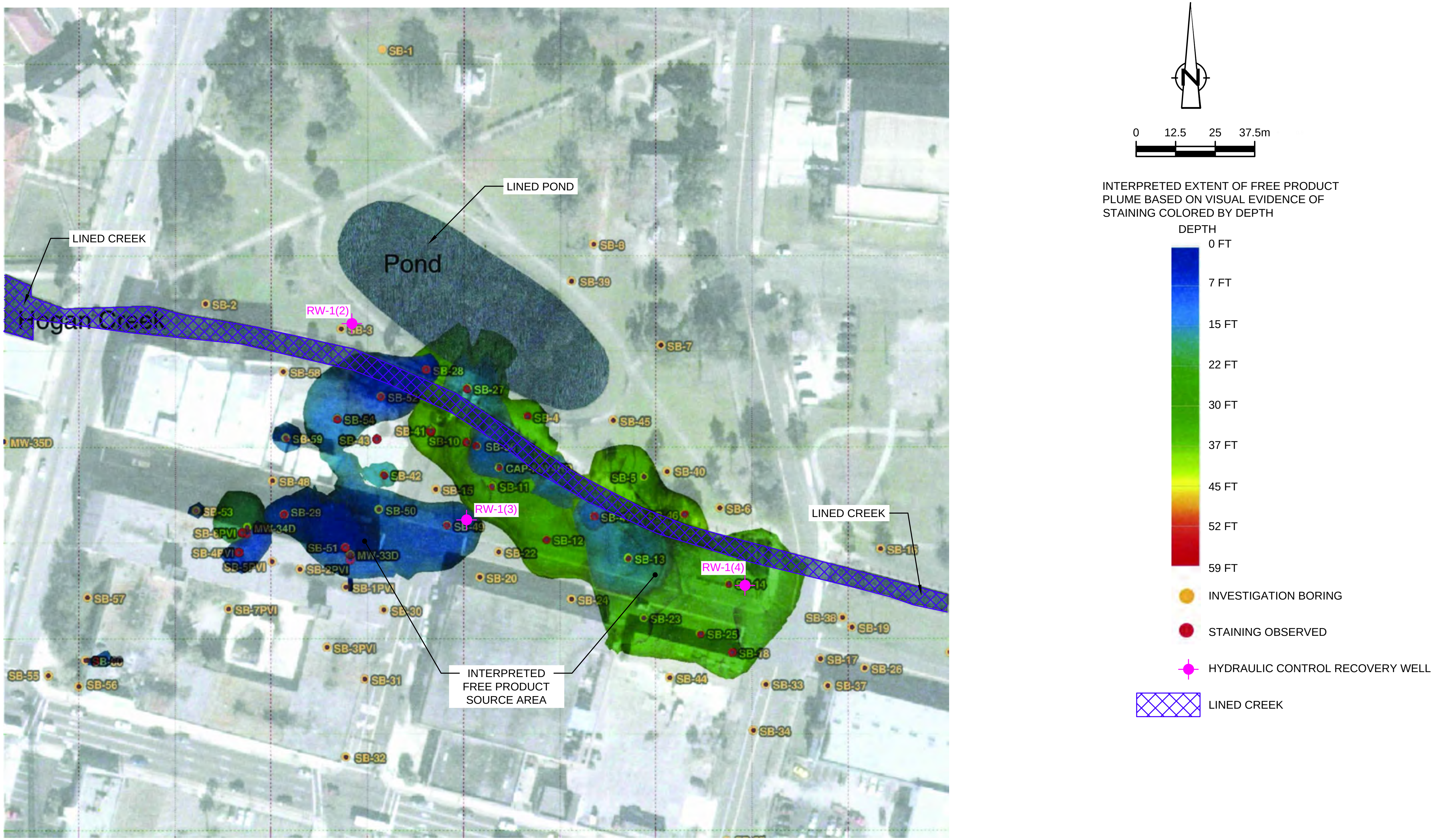


figure 1

SITE PLAN
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA009 JUN 9, 2015

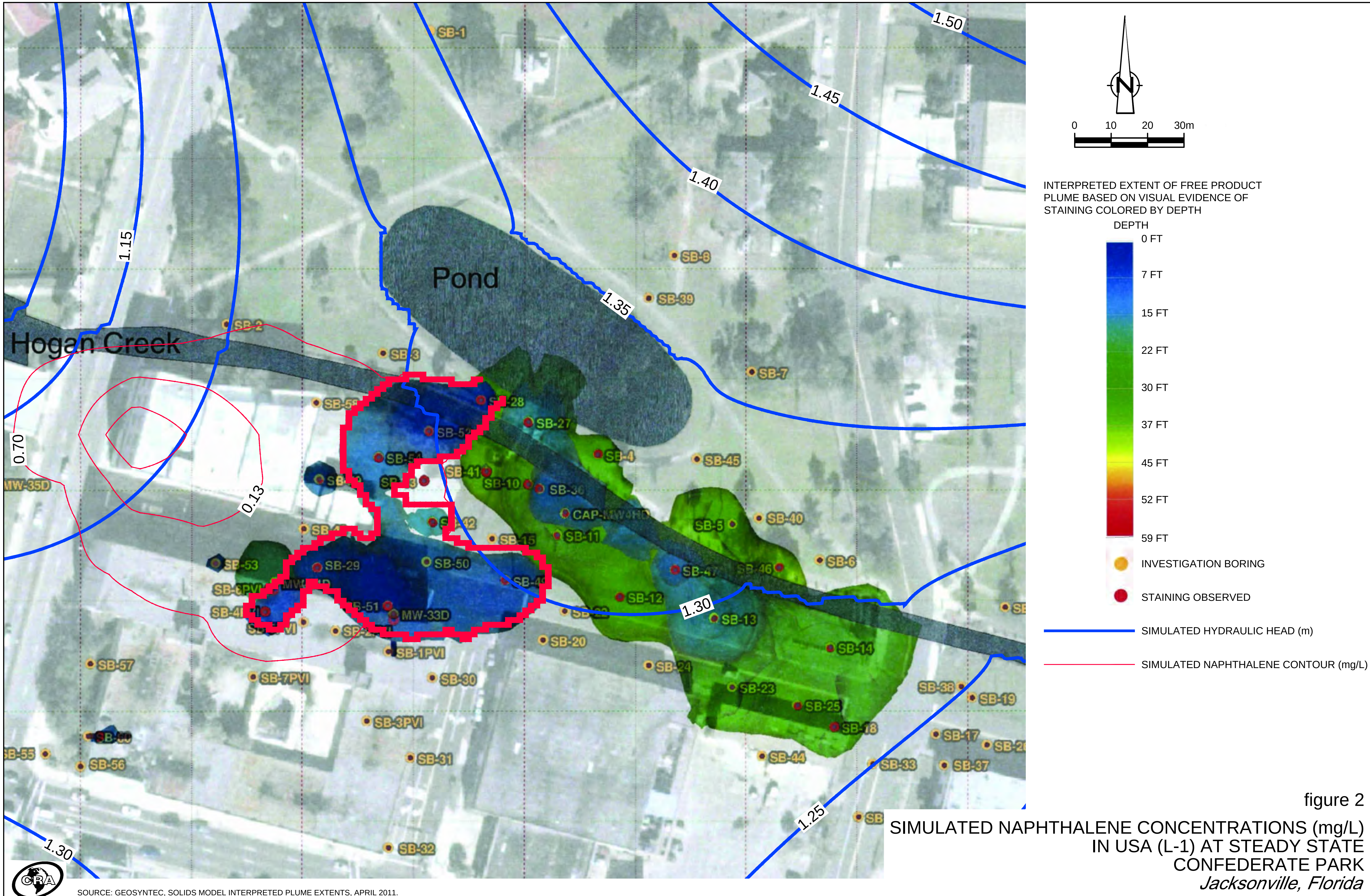


figure 2

SIMULATED NAPHTHALENE CONCENTRATIONS (mg/L)
IN USA (L-1) AT STEADY STATE
CONFEDERATE PARK
Jacksonville, Florida

90476-00(PRES001)GN-WA001 JUN 9, 2015

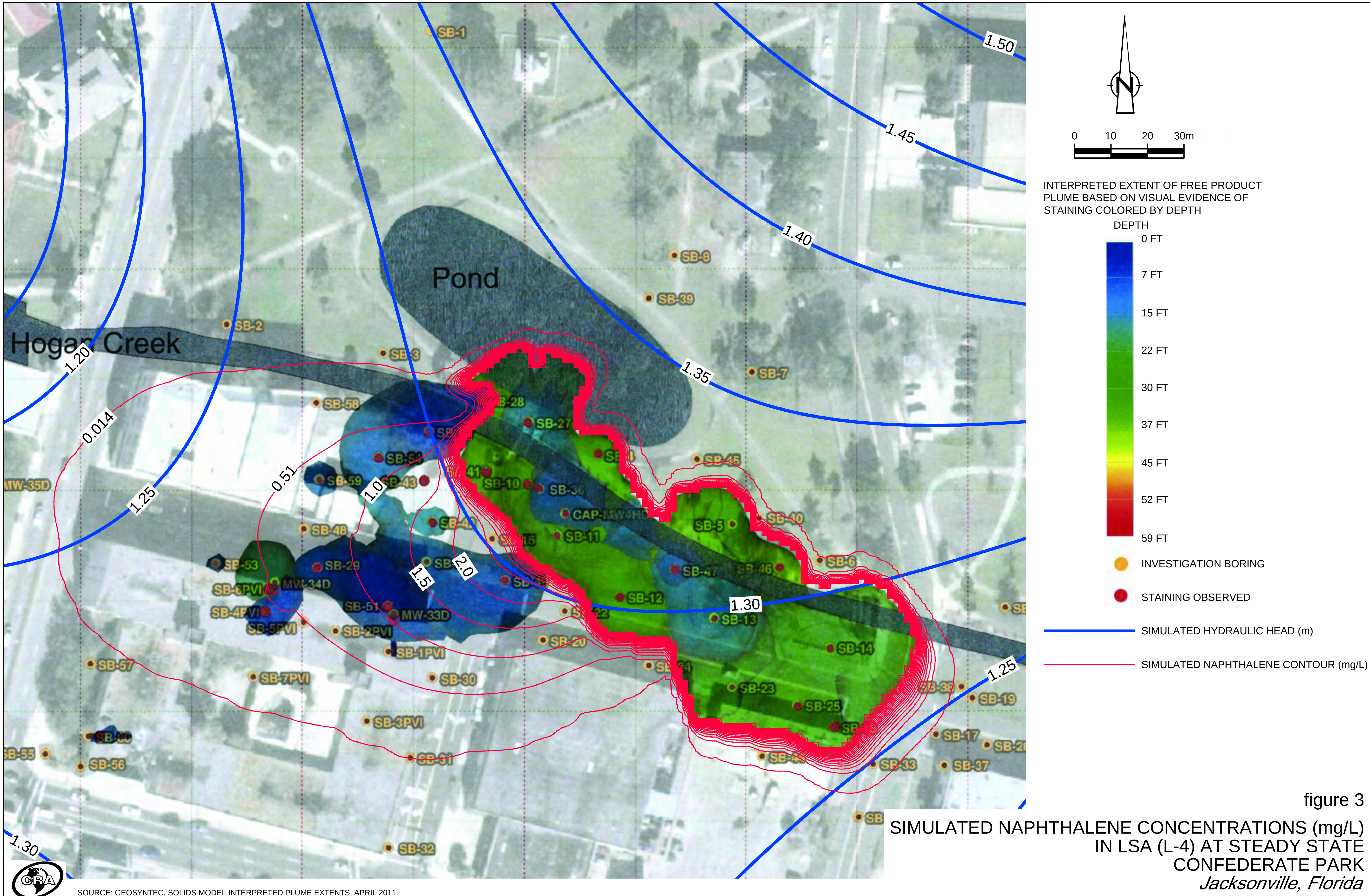


figure 3

SIMULATED NAPHTHALENE CONCENTRATIONS (mg/L)
IN LSA (L-4) AT STEADY STATE
CONFEDERATE PARK
Jacksonville, Florida

90476-00(PRES001)GN-WA002 JUN 9, 2015

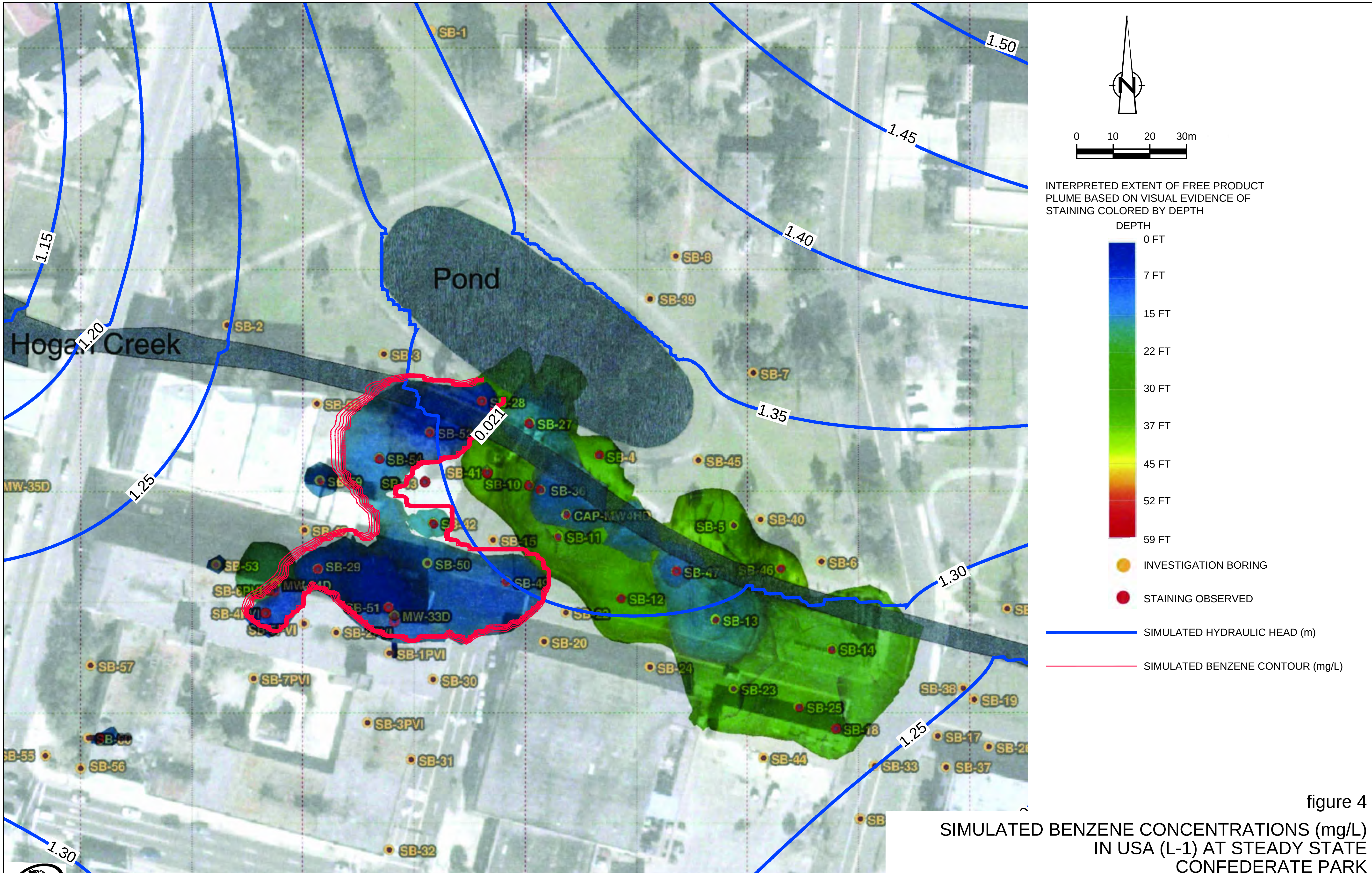


figure 4

SIMULATED BENZENE CONCENTRATIONS (mg/L)
IN USA (L-1) AT STEADY STATE
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA003 JUN 9, 2015

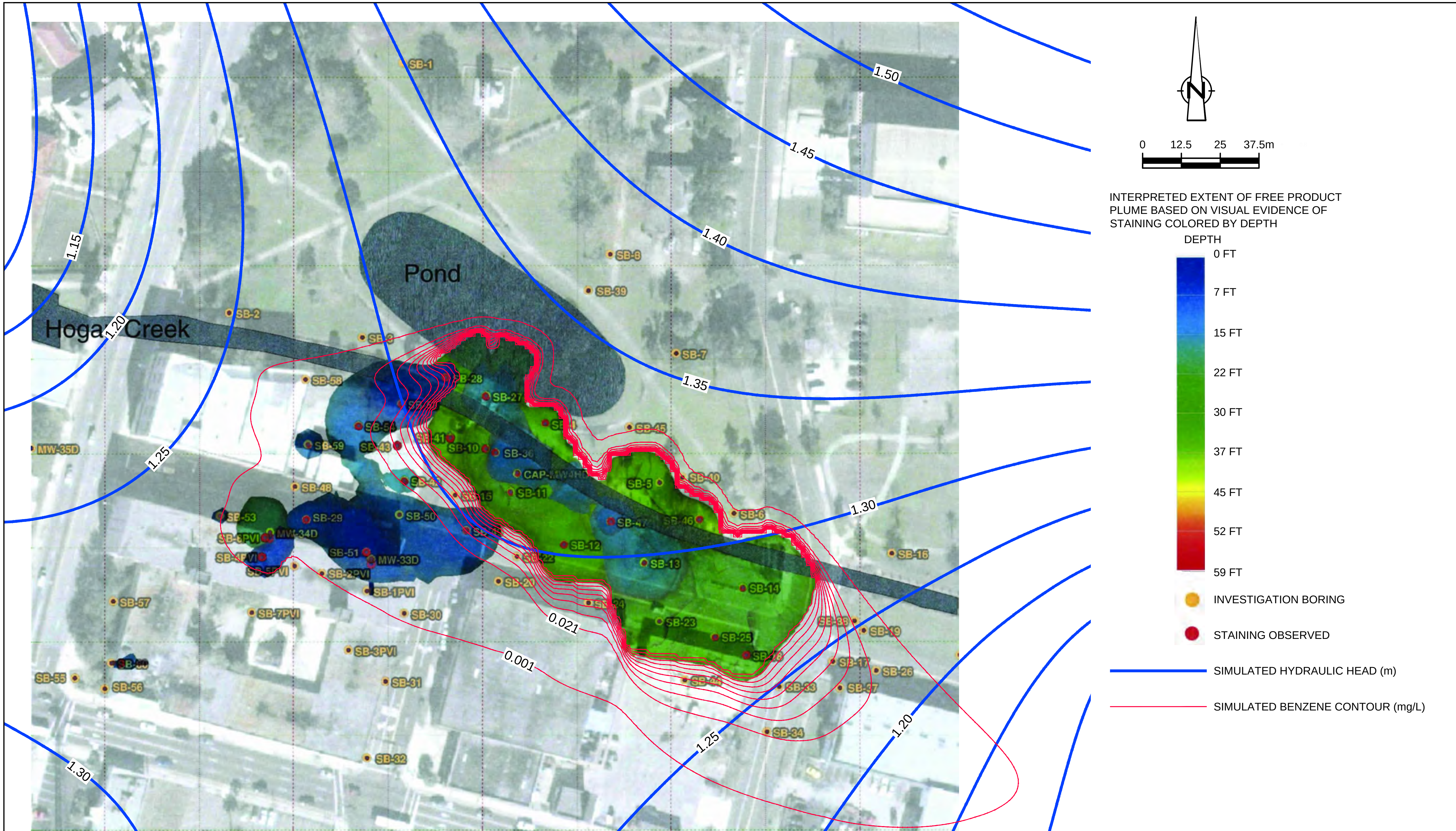


figure 5

SIMULATED BENZENE CONCENTRATIONS (mg/L)
IN LSA (L-4) AT STEADY STATE
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA004 JUN 9, 2015

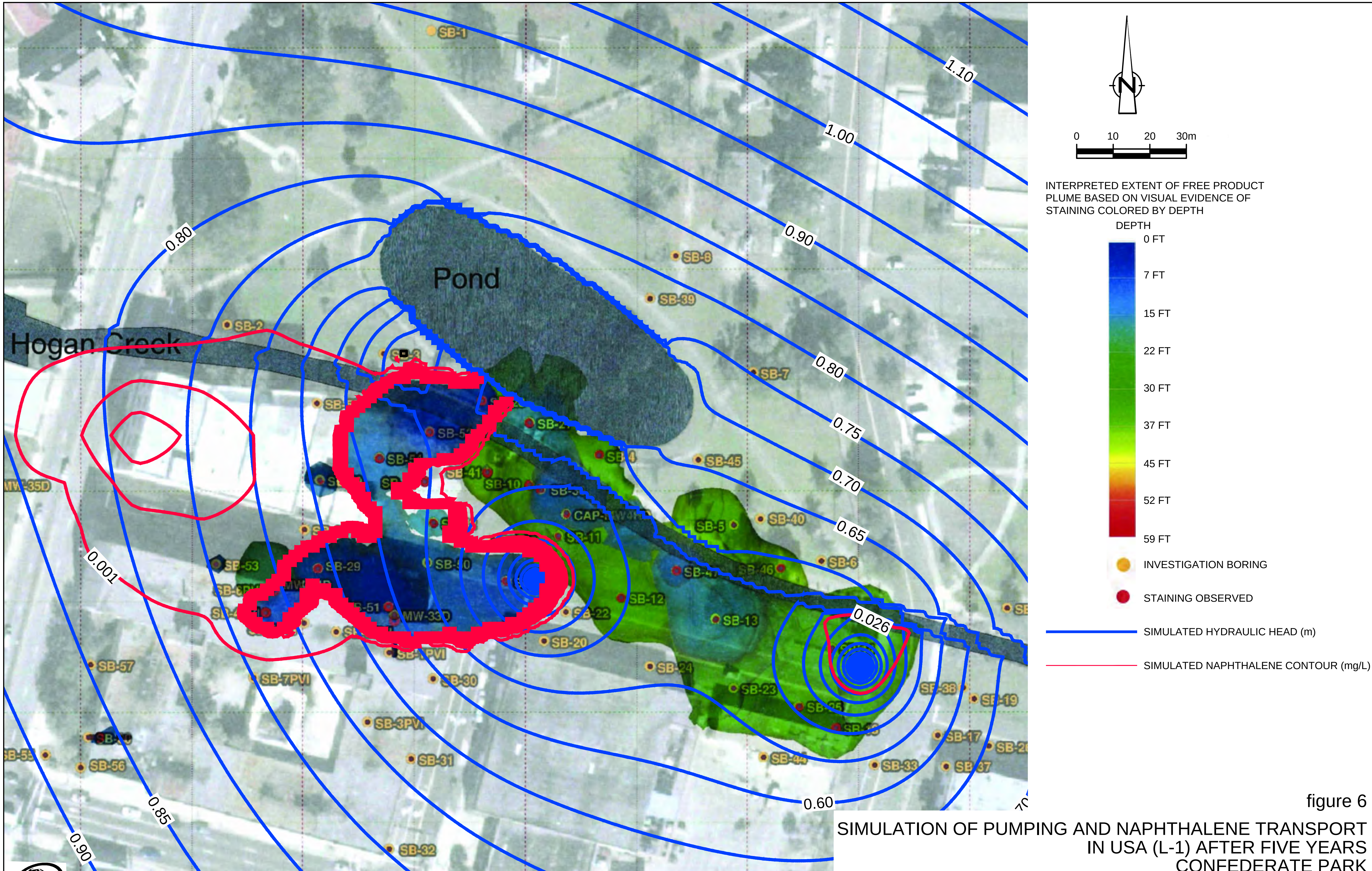


figure 6

SIMULATION OF PUMPING AND NAPHTHALENE TRANSPORT IN USA (L-1) AFTER FIVE YEARS
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA005 JUN 9, 2015

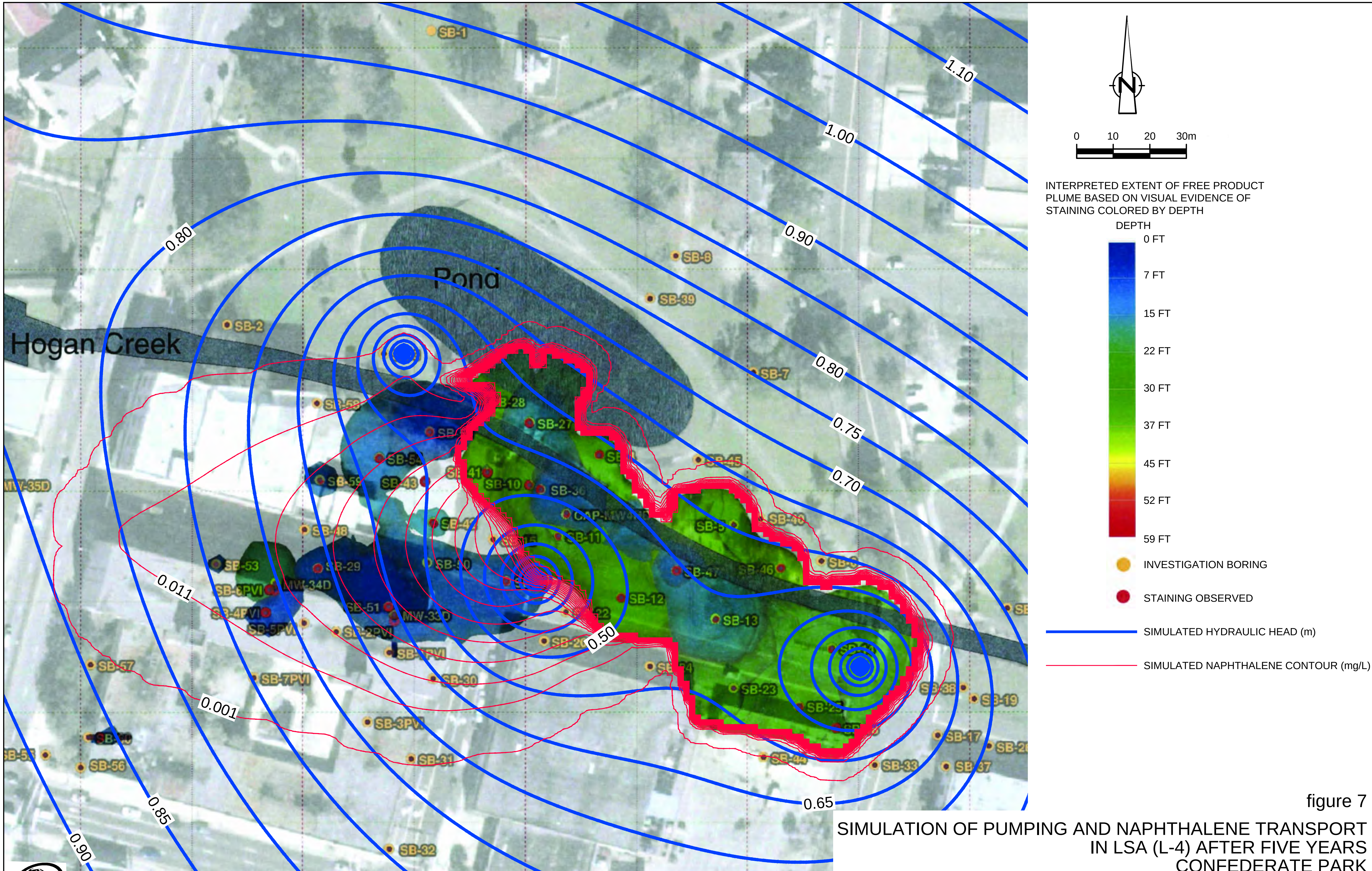


figure 7

SIMULATION OF PUMPING AND NAPHTHALENE TRANSPORT IN LSA (L-4) AFTER FIVE YEARS
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA006 JUN 9, 2015

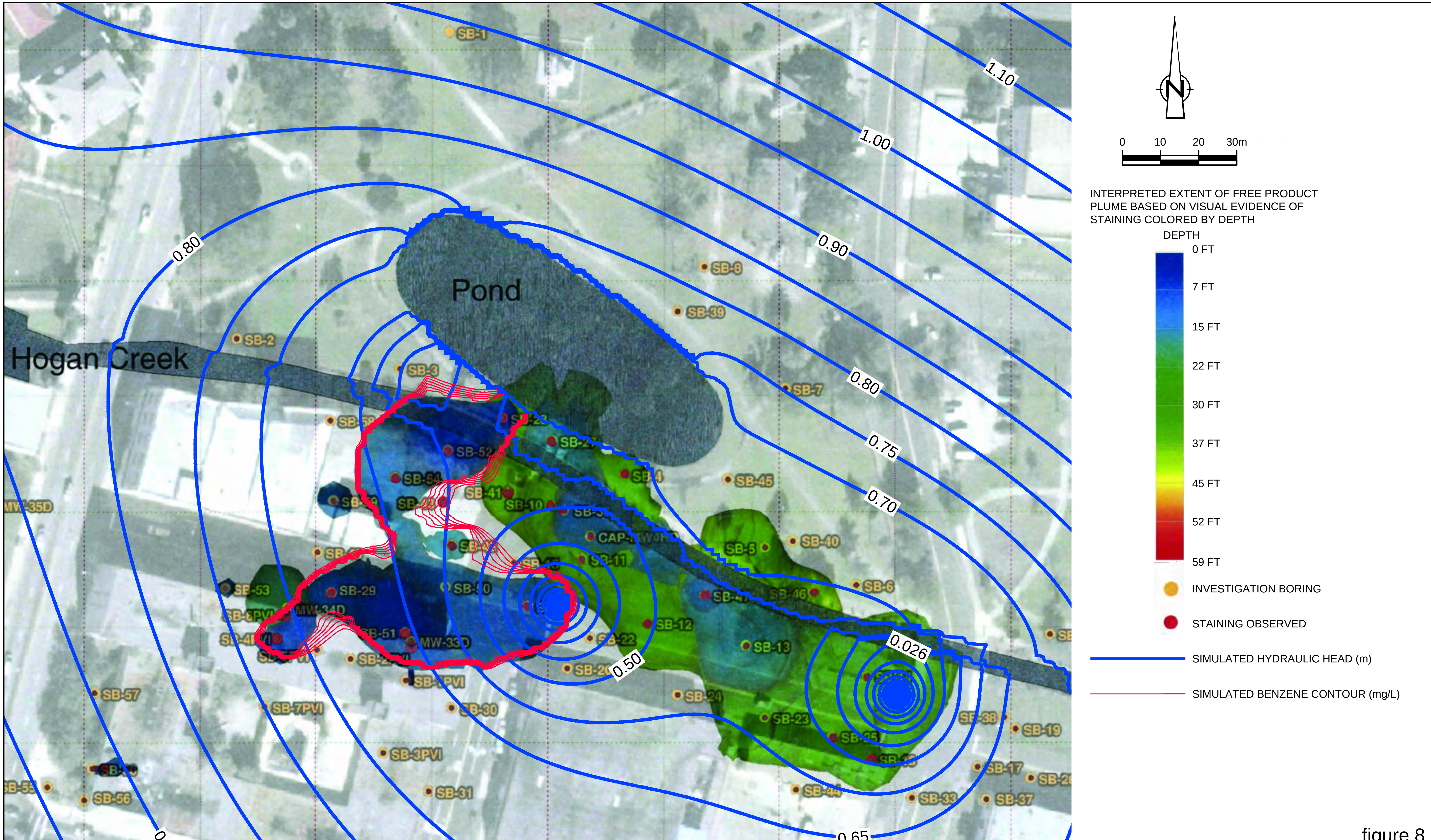
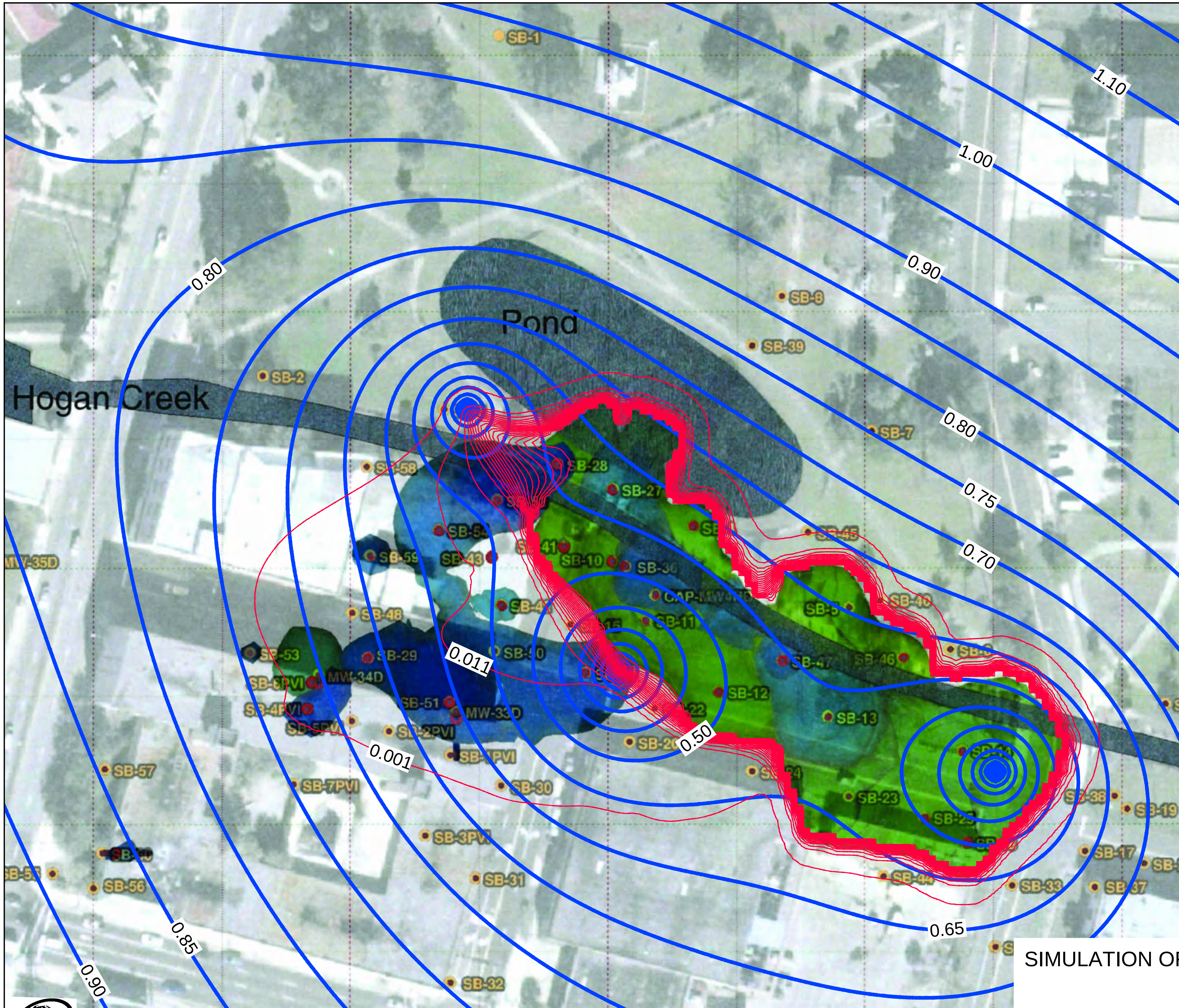


figure 8

SIMULATION OF PUMPING AND BENZENE TRANSPORT IN USA (L-1) AFTER FIVE YEARS
CONFEDERATE PARK
Jacksonville, Florida

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA007 JUN 9, 2015



INTERPRETED EXTENT OF FREE PRODUCT PLUME BASED ON VISUAL EVIDENCE OF STAINING COLORED BY DEPTH

DEPTH

0 FT
7 FT
15 FT
22 FT
30 FT
37 FT
45 FT
52 FT
59 FT

INVESTIGATION BORING

STAINING OBSERVED

SIMULATED HYDRAULIC HEAD (m)

SIMULATED BENZENE CONTOUR (mg/L)

figure 9

SIMULATION OF PUMPING AND BENZENE TRANSPORT IN LSA (L-4) AFTER FIVE YEARS
CONFEDERATE PARK
Jacksonville, Florida

CRA

SOURCE: GEOSYNTEC, SOLIDS MODEL INTERPRETED PLUME EXTENTS, APRIL 2011.

90476-00(PRES001)GN-WA008 JUN 9, 2015

Appendix E

Potential Gallery Infiltration Locations

JEA

COJ


Jacksonville
© 2013 Google
Google
1994
Imagery Date: 1/22/2013 30°20'02.82" N 81°39'14.59" W elev 2 ft eye alt