GEO/09-222
Final

U.S. Army Corps of Engineers
Louisville District

Feasibility Study
Former Hanna City Air Force Station
Hanna City, Peoria County, Illinois

Prepared for
U.S. Army Corps of Engineers, Louisville District
Contract No. W912QR-04-D-0030 Delivery Order No. 0019 and
Contract No. W912QR-08-D-0014 Delivery Order No. 0003

Prepared by
GEO Consultants, LLC
325 Kentucky Avenue
Kevil, Kentucky 42053

September 2012

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Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, Kentucky 40202

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

GEO Consultants, LLC (GEO) completed the Final Feasibility Study for the Former Hanna City Air Force Station in Hanna City, Illinois. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project as defined in GEO's Corporate Quality Control Plan. During the independent technical review, compliance with established policy, principles and procedures, and using justified and valid assumptions was verified. This included review of technical scope, assumptions, technical methods, procedures, and materials used in analyses, appropriateness of data, reasonableness of results, including whether the product meets the customer's needs consistent with the law and existing USACE policy.

Katherine Sheedy, P.G.
Project Manager

9/26/12
Date

Natalie Magill, Ph.D.
Independent Technical Review Team Member

9/26/12
Date

Kim Morris
Quality Assurance Manager

9/26/12
Date

Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from the independent technical review of the project have been considered.

Larry Copeland, P.E.
Program Manager, GEO Consultants, LLC

9/27/12
Date

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AOPC	area of potential concern
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
DERP	Defense Environmental Response Program
DoD	Department of Defense
EU	Exposure Unit
FAA	Federal Aviation Administration
ft.	feet/foot
FRTR	Federal Remediation Technologies Roundtable
FS	Feasibility Study
FUDS	Formerly Used Defense Site
gal.	gallon(s)
GEO	GEO Consultants, LLC
GSA	General Services Administration
HCAFS	Former Hanna City Air Force Station
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IDoC	Illinois Department of Corrections
Illinois EPA	Illinois Environmental Protection Agency
ILCR	incremental lifetime cancer risk
in.	inch(es)
ITRC	Interstate Technology and Regulatory Council
mg/kg	milligrams per kilogram
mi.	mile(s)
NCP	National Contingency Plan
NTU	nephelometric turbidity units
O&M	operation and maintenance
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
RAO	remedial action objective
RI	Remedial Investigation
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SSI	Supplemental Site Inspection
TACO	Tiered Approach to Correction Action Objectives
TBC	to-be-considered
TtEC	TetraTech EC, Inc.
µg/kg	micrograms per kilogram

µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
yd^3	cubic yard

FOREWORD

Groundwater sampling at the former Hanna City Air Force Station (HCAFS) has shown metal concentrations that exceeded Illinois Environmental Protection Agency's (Illinois EPA) Tiered Approach to Corrective Action Objectives (TACO) groundwater criteria during sampling events conducted in 1996 and 2006 as part of Site Inspection and the Supplemental Site Inspection (SSI) (Tetra Tech 2008), and in 2008 as part of the Remedial Investigation (RI, GEO 2009). It was noted that concentrations were higher in unfiltered groundwater samples when compared with filtered samples, which indicates that elevated metals were associated with suspended particulates. Furthermore, metals concentrations were higher in the 1996/2006 samples when compared to the 2008 samples. Turbidity measurements for the 1996 and 2006 groundwater sampling events are not available. However, in their SSI report, Tetra Tech (2008) mentioned that the 1996 groundwater samples were "noted as containing some degree of silt" and their own samples were described as "being muddy, due to the fact the well had to be pumped to dryness several times prior to obtaining a sample" (see Tetra Tech's Executive summary). Based on the turbidity measurements collected in 2008, aluminum concentrations may be used as an indicator for suspended solids. The highest Al concentrations [10,000 and 6280 micrograms per liter (µg/L)] in the 2008 samples are associated with the highest turbidity measurements [2000 and 512 nephelometric turbidity units (NTU)]. Thus, although turbidity measurements for the 1996 and 2006 groundwater samples are not available, it is reasonable to infer from the 2008 turbidity and aluminum data that the high aluminum concentrations in the 1996 and 2006 samples (with a maximum of 59,000 µg/L) indicate that the samples were very turbid and laden with solids that resulted in elevated concentrations of other metals.

Based on the above discussion of the effect of turbidity/suspended solids on the groundwater sampling results, a risk assessment was performed using only the more reliable 2008 data. In the 2008 data set only aluminum, iron and manganese have exceedances of the TACO Class I groundwater objective. Arsenic is no longer a chemical of potential concern based on the 2008 data because the highest detected concentration (5.4 µg/L) is below the groundwater screening criterion of 10 µg/L (corresponding to the Maximum Contaminant Level for this metal). As such, there are no incremental carcinogenic risks associated with the groundwater at HCAFS based on the 2008 data. Note that in the 1996 and 2006 data all the arsenic concentrations were below the TACO Class I groundwater objective of 50 µg/L. The exceedances of the TACO Class I objective for aluminum and iron in the unfiltered sample from sampling point HCVWGW0401 and aluminum in the unfiltered sample from HCCCGW0601 are also the result of unusual turbidity in those samples, as shown by the high turbidity readings for those two samples (2000 NTU at HCVWGW0401 and 512 NTU at HCCCGW0601). The duplicate sample from sampling point HCVWGW04 was likely less turbid than the primary sample and the concentrations of aluminum and iron for the unfiltered duplicate sample are below the TACO Class I objective. These observations suggest that the exceedances of the unfiltered samples from these locations should be considered biased high because of excessive turbidity and not representative of groundwater quality. These results were considered in the risk assessment using the 2008 data.

The following table shows the results of a quantitative risk assessment using the 2008 data and the maximum detected concentrations for aluminum, iron, and manganese in unfiltered samples as the exposure point concentration:

Chemical of Potential Concern		Exposure Point Concentration (mg/L)	Chemical-specific Hazard Index	
			Resident Adult	Resident Child
Metals				
Aluminum	7429-90-5	10.6	2.9E-01	6.8E-01
Iron	7439-89-6	10	3.9E-01	9.2E-01
Manganese	7439-96-5	0.54	9.1E-01	1.9E+00
Total Hazard Index from Groundwater			**1.6E+00**	**3.5E+00**

The hazard indices are still greater than 1.0 for both resident child and adult. The largest contributor to this hazard is manganese, exceeding 1 for the resident child.

The manganese concentrations in groundwater do not appear to be related to sampling issues and the presence of particulates as described above because manganese in filtered samples also exceeded the TACO Class I objective (150 µg/L). As presented in the RI report (GEO 2009), the widespread exceedances of the TACO Class I manganese objective are the result of the presence of naturally occurring manganese and manganese/iron concretions in the soils that were observed during drilling for the collection of soil samples in 2008. The characteristic occurrence of manganese and iron manganese nodules is consistent with the on-site soils as described by the Soil Survey of Peoria County and has also been confirmed through discussions (referenced in the RI) with personnel from the Illinois Geologic and Water Surveys. Other than storage of coal and coal ash, there are no known operations at HCAFS that would have been a source for elevated manganese in groundwater.

At the conclusion of the RI, the U.S. Army Corps of Engineers (USACE) and Illinois EPA had agreed that a background study for groundwater would be prudent to confirm that manganese concentrations and other elevated metals are due to natural sources. However, upon further discussions, it was decided that collection of samples upgradient of the HCAFS areas of concern would require the samples be collected along the northern boundary of the HCAFS will, in fact, not answer the question as to the natural/background source of manganese in the groundwater samples conducted to date. This concern is based on the fact that, as discussed in the RI, dissolution of manganese is dependent on oxidation/reduction conditions and the presence of a source of manganese which, in this case, is the manganese concretions in the soil. It is not possible to confirm that the background locations will or will not be reflective of the same oxidation/reduction conditions found at the 2008 sampling locations or that the soil in these locations will include the manganese nodules present at the 2008 locations. Oxidation/reduction conditions are affected by a number of factors, including groundwater saturation and recharge from infiltration which can vary seasonally and spatially even within short distances such as on the HCAFS property. For example, the HCAFS property is bounded to the north by an agricultural field which is likely being irrigated. Thus, the northern area of the property may be receiving an influx of potentially aerated groundwater from the agricultural field to the north. On the other hand, groundwater directly beneath the site may be receiving less recharge from rainwater because of paved areas. Thus, the geochemical conditions along the northern property line may not be comparable to conditions in the areas of concern such that any observed differences between the background and on-site samples may be due to inherent geochemical differences rather than anthropogenic effects.

Based on the results of the risk assessment referenced above, the concern that background sampling would not be definitive relative to further documenting the natural occurrence of manganese in on site ground water, the very limited yield of shallow wells at HCAFS, and the presence of public water in the area, the USACE and Illinois EPA have agreed to not conduct further sampling and to drop ground water from further consideration on the grounds that groundwater poses no risk to human health or the environment as a result of Department of Defense (DoD) activities at HCAFS.

EXECUTIVE SUMMARY

GEO Consultants LLC (GEO) has completed a Feasibility Study (FS) for the Former Hanna City Air Force Station (HCAFS), Hanna City, Peoria County, Illinois. GEO conducted this study under contract to the U.S. Army Corps of Engineers (USACE), Louisville District. This FS evaluates the effectiveness and costs associated with conducting a remedial action to address the contamination identified in the soils at the site.

The purpose of this FS is to develop and evaluate a list of potential remedial response alternatives associated with releases of hazardous chemicals resulting from past Department of Defense (DoD) activities at the HCAFS that could be used to reduce the risk to human health and the environment. The FS also compares the various remedial alternatives and provides technical and cost related information that is needed to select the most cost-effective remedial alternative that provides adequate protection of public health, welfare, and the environment.

Site Description. The HCAFS is a 42.89-acre parcel located approximately 10 miles west of the city of Peoria and two miles west of the Village of Hanna City in Peoria County, Illinois. The property is located in Section 4 of Township 8 North, Range 6 East in the Logan Township. The site can be reached from Peoria, Illinois by traveling west on State Highway 116 (Farmington Road), through Hanna City, Illinois, then north onto the site access road. As a result of third-party use of the property that may have resulted in environmental contamination issues and current use of a portion of the site by the Federal Aviation Administration (FAA), only 38.456 acres of the site are included in this current investigation. This 38.456 acre portion, Tract 1, was occupied by the Illinois Department of Corrections (IDoC) Hanna City Work Camp and was used as a minimum security prison until it was closed in October 2002. The Illinois Senate passed a bill in April 2008 that would transfer the property to Peoria County for use as a facility for inmates with mental illness or a minimum security work release facility; the use of the site for this purpose has not yet been finalized and the future use of the site is not known.

Regulatory Status. The HCAFS is real property that was formerly owned by the U.S. Government and operated by DoD. In 1968, the property was declared excess to the needs of the U.S. Air Force and was transferred to the General Services Administration in 1969. The entire site was assigned to the Department of Health, Education, and Welfare. In November 1969 the property was disposed of as three separate tracts through quitclaim deeds. The major portion of the HCAFS is the 38.456 parcel known as Tract 1. Tract 1 was transferred from control of the federal government to the IDoC prior to October 17, 1986, and since July 10, 2009 the property has been owned by Peoria County. Therefore, this site meets the definition of a Formerly Used Defense Site (FUDS). USACE is taking action as the lead agency on the site for DoD defined by the Defense Environmental Response Program (DERP), as authorized in the *U.S. Code* [USC (10 USC 2701 et seq.)]. This law authorizes DoD to take action at *"each facility or site which was under the jurisdiction of the Secretary and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances"* [10 USC 2701 c 16(A)].

Tract 2, 3.364 acres, was quitclaimed to the Village of Hanna City. As a result of previous investigations, the lagoon on this tract has been categorized as having Potentially Responsible Parties (PRP) issues under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 9607(a) (3) and, therefore, was not part of the Remedial Investigation (RI) and is not part of this FS. Tract 3, consisting of 1.03 fee acres and containing the radar tower and three related buildings, was transferred to the FAA and consequently, Tract 3 was not included in the RI or in this FS.

Site Investigations Prior to Remedial Investigation. In 1992, USACE, Chicago District conducted a preliminary evaluation of the HCAFS consisting of site reconnaissance and interviews with both former and current site personnel at that time. Areas of potential concern (AOPCs) that required further study were identified.

Five underground storage tanks were excavated and removed during 1997 to 2002 by IDoC. At least one of the tank locations is yet to be closed as a regulatory issue and IDoC is responsible for regulatory closeout.

In 1996, Parsons performed a Site Inspection (SI) at specific areas at the HCAFS [as cited by TetraTech EC, Inc. (TtEC) 2008]. The areas included the seven AOPCs [i.e., three Coal Ash Storage Areas (A, B, and C), Main Entrance, Vehicle Wash Rack, Maintenance Building, and Paint Shed]. The other areas included in the SI were the Tile Field, the Septic Tank, and the lagoon associated with the Former Village of Hanna City Water Treatment System [the water supply well associated with the treatment system was taken out of use in 1987 by the Illinois Environmental Protection Agency (Illinois EPA) due to elevated levels of naturally occurring radon]. Further investigations of the lagoon ceased in 2002 due to PRP issues. Consequently, the lagoon was not included in the Supplemental Site Inspection (SSI), RI, or FS. In response to Illinois EPA's request for additional sampling, TtEC conducted an SSI in April 2006.

Based on the results of the SI and SSI, the contaminants of concern were identified as:

- Polycyclic aromatic hydrocarbons (PAHs) in surface soil in all areas of concern and in subsurface soil at the vehicle wash rack;
- Arsenic in the subsurface soil at Coal Storage Areas A, B, and C and the Paint Shed; and
- Metals in groundwater for the site as a whole.

Remedial Investigation Activities. An RI was initiated in 2008 to determine the nature and extent of the contamination in the areas of concern. The RI field and related activities included collection of surface soil samples on August 25, 2008 and surface and subsurface soil and groundwater samples from November 18 to 20, 2008.

Results of groundwater analysis showed that all metals that exceeded the Illinois Class I Groundwater Remediation Objectives [(IAC) Section 742, Tiered Approach to Corrective Action Objectives (TACO)] criteria, with the exception of manganese, were found only in the unfiltered samples and, therefore, are associated with suspended particulates. Manganese concretions are common in the soil types that occur at the HCAFS and regionally are generally associated with soils developed from coal bearing rocks such as those that form the bedrock deposits at HCAFS. Lead was reported above the criteria in previous investigations, but was not reported above the detection limit in the groundwater samples collected for this RI.

Analysis of surface soil samples for PAHs show reported concentrations above TACO Tier 1 Residential Soil Criteria for benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, chrysene and dibenzo(a,h)anthracene. Sources of PAHs in soil include road runoff, accumulation of snow along road sides after plowing, as well as vehicular emissions, incomplete burning of coal, and petroleum spills. There are possible sources of PAHs specific to individual Exposure Units (EUs), including residual contamination from coal storage. However, as concluded in the RI, road runoff, melting of plowed snow, and vehicular emissions appears to be a site-wide source.

Subsurface soil samples were collected for PAH analysis at the Vehicle Wash Rack EU. The only exceedances of the TACO Tier 1 criteria identified are for benzo(a)pyrene in only the 4 to 5 feet below ground surface (bgs) sample interval at two locations. Based on the low levels of PAHs found in the remaining subsurface samples the RI concluded that the exceedances identified in previous investigations were isolated occurrences.

Arsenic concentrations were found in the subsurface soil in previous investigations. Additional subsurface soil samples were collected and analyzed for arsenic during the RI at the Coal Storage Areas A, B, and C, and the Paint Shed. The arsenic concentrations in 12 of the 58 samples analyzed exceeded 13 milligrams/kilogram, which is the background concentration for arsenic for metropolitan areas in Illinois established in TACO soil criteria. However, the average of the concentrations reported for each EU is below this background concentration. Since there is no known source of arsenic associated with site use and the average arsenic concentrations are below background concentrations, the conclusion of the RI was that the arsenic reported from the subsurface soil samples represents naturally occurring conditions.

Assessment of Risks. A baseline Human Health Risk Assessment (HHRA) was conducted to evaluate potential human health risks resulting from exposure to soil and groundwater contamination if no remedial action is taken at the HCAFS. The potentially exposed populations that were evaluated were commercial/industrial workers and adult and child residents if the HCAFS becomes available for unrestricted land use. Based on the HHRA, the risk from exposure to soil at the Coal Area C EU is greater than 10^{-4} (the upper value of the National Contingency Plan [NCP] risk range) for the resident adult and child receptors, and the resident adult receptor from exposure to soil at the Vehicle Wash Rack. All other risks from the other EUs, as well as all risks to the commercial/industrial receptors were below 10^{-4}. Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10^{-4}, which is primarily from arsenic. Note that the arsenic is probably associated with naturally occurring suspended solids, and that there are no carcinogenic chemicals of potential concern in the filtered groundwater samples.

A Screening Level Ecological Risk Assessment (SLERA) was performed during the RI to evaluate ecological risks from current and potential future exposure to contamination at the HCAFS if no remedial action is taken, and to determine if a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. The conclusion of the SLERA was that the chemicals of potential ecological concern for the HCAFS are lead and zinc in surface soil. Several additional factors were also considered in the evaluation of the risk posed by lead and zinc:

- There are no records of federal or State-listed threatened or endangered species within 0.5 miles of the HCAFS and the receptor groups found at the HCAFS consist of common, widely distributed species.
- The hazard quotients are conservative or comparable to background ecological risks. The hazard quotients were calculated using maximum detected concentrations rather than average concentrations.
- The median values for lead and zinc in surface were below the respective TACO (Appendix A, Table G, metropolitan areas) background values for metro areas and, in addition, the maximum detected concentrations used were outliers.
- The risks from lead and zinc are elevated in localized areas, but on average are comparable or below the TACO regional background values.

Based on the above considerations, no baseline ecological risk assessment was conducted as part of the RI.

Remedial Action Objectives (RAOs). The RAOs were developed based on the following:

- The risk posed by metals in groundwater is the result of occurrence of manganese and iron which are characteristic of groundwater from the formation present at the site. The high turbidity of the samples collected during the SI and SSI resulting in elevated concentrations of other metals was caused by the sampling methods used. Groundwater is not used as a water source in this area because formation yield is unacceptable and potable water is supplied by a private company. Therefore, groundwater is not considered an exposure route and is not included in the RAOs.
- The RI concluded that contaminants found in the subsurface soil are either isolated occurrences or naturally occurring in the geologic formation present at the HCAFS. On that basis, the subsurface soils are not considered in the development of RAOs.
- The risk assessment, conducted as part of the RI, determined that the PAH concentrations in surface soil posed an unacceptable risk to human health. There were no other surface soil constituents that were found to exceed screening criteria for the risk assessment. Because of the risk posed by PAHs in surface soil, surface soil will be addressed in the RAOs.

Benzo(a)pyrene is used as the benchmark for comparison with remedial objectives as it is the most consistently occurring PAH on the site and has the lowest remediation objectives. Therefore, remediation of soil containing benzo(a)pyrene above the identified objective would assure that all other PAHs found above their respective objectives would also be remediated.

Two sets of Preliminary Remediation Goals (PRGs) were developed for comparison purposes:

The Set 1 PRGs are based on TACO residential criteria and are shown in Table 2-11. This set of PRGs reflects a target risk of $1x10^{-6}$, which is more protective than required by the NCP.

The Set 2 PRGs for surface soils (also shown in Table 2-11) are based on the minimum of the TACO industrial/commercial and construction worker criteria for ingestion and inhalation, as delineated in TACO Appendix B, Table B. These objectives are protective of receptors under current land use and expected future land use. Based on communication with County personnel, it is unlikely that the property will be transferred to private ownership for residential or agricultural development. However, to evaluate the proposed remediation objectives under unrestricted land use, the residential risk levels for the preliminary remediation objectives were calculated using the TACO residential criteria in TACO Appendix B, Table A (which reflect a risk level of 10^{-6}). With the exception of naphthalene, the calculated residential risk levels for the proposed Set 2 remediation objectives are greater than 10^{-6}, but below 10^{-5}, and are well below the upper limit of the NCP target risk range (10^{-4}). For naphthalene, the residential risk level for the preliminary remediation goal is well below 10^{-6}. Therefore, the Set 2 PRGs will be protective of receptors under current land use, and will also be protective of residential users should the property be converted to residential use in the future. Since these remediation objectives are also protective of possible residential users, land use restrictions would not be required.

Applicable or Relevant and Appropriate Requirements (ARARs). TACO provides quantitative risk based remediation goals and methods for developing alternate goals for soil and groundwater.

Other laws and regulations that are applicable solely as a result of the remedial or construction activity will be observed.

Extent of Contamination. The vertical extent of contamination has been well documented as extending from the ground surface to 1 foot (ft) bgs. The lateral extent of contamination is less well-defined.

Preliminary calculations indicate that the volume of soil to be remediated to meet the Set 1 PRG would be approximately 2577 cubic yards (yd^3), while the volume of soil to be removed to meet the Set 2 PRG is 305 yd^3.

Identification and Screening of Remedial Technologies. Remediation of contaminants can be accomplished using both administrative and engineered controls. Administrative controls could be in the form of fencing and signs identifying the area as a restricted area, and deed restrictions placed in property ownership documents detailing the allowed uses for the site and restrictions on site activities (e.g., no-dig). The technologies generally applicable to contaminated surface soils include; the construction of an engineered barrier over the area of contamination to prohibit contact with the contaminated media; in-situ or ex-situ treatment of the soil; and removal and off-site treatment or disposal of the soil.

Engineered barriers were not retained for further consideration primarily because such barrier(s) would require both institutional control and on-going maintenance. Since the site is now owned by Peoria County, either the County would have to agree to maintain the barrier(s) or DoD would have to maintain involvement with the site in order to ensure the barrier(s) remained intact and functional. In addition, the distribution of contaminants is such that multiple barriers would be needed. Based on these factors, engineered barriers were not considered practical solutions.

Technologies using in-situ treatment of the soil were not retained for further consideration. The heterogeneity and low permeability of the soil limits the potential effectiveness of in-situ technologies. In addition, the distribution of contaminants would require the installation of individual systems for each of the areas to be treated. Tilling and treatment of the soil is considered an ex-situ technology because the soil would be disturbed in the tilling process.

Technologies using ex-situ treatment of the soil were also not retained for further consideration. The volume of soil to be treated is too small to make these treatment technologies cost effective. In addition, the non-contiguous distribution of contaminated soil will increase the cost to excavate and move the soil to the treatment location.

Remedial Alternatives. Based on the established RAOs, site conditions, waste characteristics, volume of contaminated soil requiring remediation, and the presumed remedy of containment for the site, three potential remedial alternatives were evaluated. They are:

Alternative 1 – No action – The no action response is identified for the purpose of establishing a baseline against which other alternatives are compared. There would be no preventive or remedial action implemented as a result of the no action response, and the current contamination at the site would continue unabated. Consideration of the no action response is required by the NCP.

Alternative 2 – Removal of Surface Soil Exceeding the Set 1 PRG – The removal would be accomplished by excavation of the surface soil (0 – 1 ft. bgs) that has been determined to have PAH concentrations above the Set 1PRG. Removal of soil containing benzo(a)pyrene above the objective would ensure that all other PAHs found above their respective objectives would also be removed. Implementation of this alternative would result in soil being removed from all five EUs. The exact volume of soil removed will be based on the data collected to date and the data collected during sampling and analysis to be conducted as part of remedial design. This sampling will be conducted prior to removal actions to determine that the soil at the boundary of the removal area(s) does not exceed the Set 1 PRGs. Should the results of the this sampling show that this objective has not yet been achieved, soil removal will be extended until the objective has been achieved. The sampling plan for sampling and details of removal and disposal implementation will be developed as part of the design documents.

Alternative 3 – Removal of Surface Soil Exceeding the Set 2 PRG – The removal would be accomplished by excavation of the surface soil (0 – 1 ft. bgs) that has been determined to have PAH concentrations above the Set 2 PRGs. Removal of soil containing benzo(a)pyrene above the objective would ensure that all other PAHs found above their respective objectives would also be removed.

Similar to Alternative 2, sampling will be conducted to determine that the soil at the boundary of the removal area(s) does not exceed the Set 2 PRGs. Should the results of the sampling show that this objective has not yet been achieved, soil removal will be extended until the objective has been achieved. A number of the removal area locations are close to, or bounded by, roads. It should be noted that removal will not extend under roads or in such proximity to roads that the integrity of the roads is undermined. The sampling plan for sampling, details of removal, and disposal implementation will be developed as part of the design documents.

Evaluation of Alternatives. The selected alternatives were evaluated against the nine CERCLA criteria and National Environmental Policy Act considerations. In order to establish priority among the screening criteria, they are separated into three groups. The first two criteria listed are threshold criteria, and must be satisfied by the remedial action alternative being considered. The next five criteria are secondary criteria used as balancing criteria among those alternatives that satisfy the threshold criteria. The last two criteria are not evaluated during the FS. State and community acceptance is evaluated during the public comment period of the proposed plan, and a responsiveness summary is incorporated into the decision document. The criteria that were included in the evaluation are described below:

Overall Protection of Human Health and the Environment – Each alternative was assessed to determine if it can adequately protect human health and the environment from unacceptable risks posed by contaminants present at the site. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. Alternative 1 does not meet the threshold criteria of protecting human health and the environment. Both Alternatives 2 and 3 meet the criteria.

Compliance with ARARs – Alternative 1 does not achieve the RAOs and does not comply with chemical-specific ARARs for the site contaminants as contained in TACO. Alternatives 2 and 3 do achieve the RAOs, the respective PRGs, and reduce the human health risk to levels that are acceptable.

Long-Term Effectiveness and Permanence – Alternative 1 would not be effective in mitigating the potential exposure of receptors to the contaminants at the site and provides no long-term effectiveness or permanence. Alternative 2 and Alternative 3 permanently eliminate the long-term health risks at the site by effectively removing the contaminants from the HCAFS.

Reduction of Mobility, Volume, or Toxicity through Treatment – Alternative 1 provides no reduction of mobility, volume or toxicity. Alternative 2 and Alternative 3 remove the contaminants from HCAFS. Disposal of the soil does not reduce the mobility, volume, or toxicity of the contaminants. Disposal removes the contaminants to an approved facility where the potential for mobilization is controlled.

Short-Term Effectiveness – Since Alternative 1 includes no remedial action, there are no short-term benefits or impacts associated with this alternative. Both Alternatives 2 and 3 would require real-time and personnel monitoring to ensure that correct personnel protective equipment is used and that there is a safe working environment during excavation. Alternatives 2 and 3 would also result in short-term noise during excavation.

Implementability – Because Alternative 1 does not include any remedial action it can be implemented immediately. Alternative 2 and Alternative 3 rely on a widely used and established method for site remediation. Conditions external to the site, such as equipment availability, materials, and services present no problem at this time.

Cost – Alternative 1 has no cost unless a five year review is required. The cost of the five year review would be approximately $20,000. The cost for Alternative 2 is $502,398 to achieve the remediation objective. Alternative 3 would cost $134,980 to achieve the remediation objective. The costs for Alternatives 2 and 3 assume disposal without treatment as the final disposition of the contaminated soil.

Comparative Analysis of Alternatives. The objective of this analysis is to compare and contrast the alternatives so that decision makers may select a preferred alternative.

Alternative 1 does not provide protection of human health and the environment and does not meet ARARs. Alternatives 2 and 3 do satisfy these evaluation factors. Alternatives 2 and 3 do move the contaminated soil to a controlled, regulated disposal facility. Alternatives 2 and 3 do not reduce the mobility, volume, or toxicity of the contaminants but do remove the contaminants from the HCAFS. Alternatives 2 and 3 will involve short-term noise and will require short-term monitoring to ensure the health and safety of remediation workers. The time frame for completing implementation of Alternative 2 or Alternative 3 is approximately one year.

The cost for Alternative 3 is 27% of the cost of Alternative 2.

1. FACILITY OPERATING HISTORY

GEO Consultants, LLC (GEO) completed a Feasibility Study (FS) for the Former Hanna City Air Force Station (HCAFS), Hanna City, Peoria County, Illinois. GEO conducted this study under contract to the U.S. Army Corps of Engineers (USACE), Louisville District. This FS evaluates the effectiveness and costs associated with conducting a remedial action to address the contamination identified in the soils at the site.

The information included in this report on the regulatory status, physical setting, and operating history of the site were derived from previous reports on the HCAFS including *Final Supplemental Site Investigation, Former Hanna Air Force Station, Hanna City, Peoria County, Illinois* [TetraTech EC, Inc. (TtEC) 2008] and *Final Remedial Investigation Report, Former Hanna City Air Force Station, Hanna City, Illinois* (GEO 2010).

1.1 PURPOSE AND ORGANIZATION OF REPORT

The purpose of this FS is to develop and evaluate a list of potential remedial response alternatives associated with releases of hazardous chemicals resulting from past Department of Defense (DoD) activities at the HCAFS that could be used to reduce the risk to human health and the environment. The FS also compares the various remedial alternatives and provides technical and cost related information that is needed to select the most cost-effective remedial alternative to provide adequate protection of public health, welfare, and the environment.

This FS report was prepared in accordance with the U.S. Environmental Protection Agency (USEPA) guidance document *Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Interim Final,* (USEPA 1988). This FS report presents a summary of the existing site characterization information, explains the development of remedial alternatives, and provides a detailed analysis of the selected alternatives.

- Section 1 – contains the regulatory framework and site background information including the general site description, operating history, and the environmental setting of the HCAFS.
- Section 2 – contains site characterization information, including previous investigations, the nature and extent of contamination, and an evaluation of site risks. This section also includes a discussion of the objectives of the remedial action, which addresses the risks posed by the contamination at the site to human health and the environment, and establishes the remediation goals for the media of concern (soils).
- Section 3 – presents the identification and screening of potential remedial measures.
- Section 4 – presents the selection process for determining which remedial measures are applicable for the site.
- Section 5 – presents a detailed analysis of the selected remedial measures.
- Section 6 – presents a comparative analysis of the selected remedial alternatives.
- Section 7 – presents the references used in developing and completing the FS.

1.2 REGULATORY FRAMWORK

The HCAFS is real property that was formerly owned by the U.S. Government and operated by the DoD. In 1968, the property was declared excess to the needs of the U.S. Air Force (USAF) and was transferred to the General Services Administration (GSA) in 1969. The entire site (42.89 acres) was assigned to the Department of Health, Education, and Welfare. In November 1969 the property was disposed of as three separate tracts through quitclaim deeds. The major portion of the HCAFS is the 38.456 acre parcel identified as Tract 1. Tract 1 was transferred from control of the federal government prior to October 17, 1986, and is now owned by another entity; on July 10, 2009 the property was transferred to Peoria County. Therefore, this site meets the definition of a Formerly Used Defense Site (FUDS). USACE is taking action as the lead agency on the site for DoD under the Defense Environmental Response Program (DERP), as authorized in the *U.S. Code* (USC) (10 USC 2701 et seq.). This law authorizes DoD to take action at *"each facility or site which was under the jurisdiction of the Secretary and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances"* [10 USC 2701 c 16(A)].

Tract 2, 3.364 acres, was quitclaimed to the Village of Hanna City. As a result of previous investigations, the lagoon on this tract was categorized as having Potentially Responsible Party (PRP) issues under CERCLA, Section 9607(a) and, therefore, was not part of the Remedial Investigation (RI) and is not part of this FS. Tract 3, consisting of 1.03 fee acres and containing the radar tower and three related buildings, was transferred to the Federal Aviation Administration (FAA). Tract 3 was not included in the RI or in this FS.

CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, which introduced the DERP statute into CERCLA. CERCLA authorized implementation of the National Contingency Plan (NCP) to respond to releases of hazardous or potentially hazardous materials to the environment. The DERP statute, as included in SARA, authorizes the DoD to perform cleanup actions under CERCLA and the NCP.

1.3 BACKGROUND INFORMATION

1.3.1 Site Description and Operating History

The HCAFS is a 42.89-acre parcel located approximately 10 miles (mi.) west of the city of Peoria and two mi. west of Hanna City in Peoria County, Illinois (Figure 1-1). The property is located in Section 4 of Township 8 North, Range 6 East in the Logan Township. The site can be reached from Peoria, Illinois by traveling west on State Highway 116 (Farmington Road), through Hanna City, Illinois, then north onto the site access road. The current and historic site layout is shown on Figure 1-2. The locations of the tracts discussed below are also shown on this figure.

The U.S. Government acquired the property for use by the USAF as a radar tracking and investigation facility from 1952 to 1968. In 1968, the property was declared as excess to the needs of the USAF. The property was then surplused to the GSA in 1969, and the entire site was assigned to the Department of Health, Education, and Welfare. In November 1969, the property was disposed of as three separate tracts through quitclaim deeds as follows:

- Tract 1, 38.456 acres (including 30 buildings), was quitclaimed to the State of Illinois. The Illinois Department of Corrections (IDoC) Hanna City Work Camp, a minimum security prison, occupied Tract 1. The site includes approximately 30 unused one and two-story buildings, poorly maintained roads and parking lots, and scrub vegetation. Building construction is brick, block, veneer, or metal. In accordance with Public Act 95-0982 of the Illinois General Assembly, on July 10, 2009, the property was transferred to Peoria County for public use. As of August 2011, the property is being used, at irregular intervals, by the Peoria County Sheriff's Office for Special Weapons and Tactics and other law enforcement training. According to the County, this use is expected to continue. Based on conversations with Peoria County officials, the possible use of the property for a nursing home or public housing are no longer considered viable options.

- Tract 2, consisting of 1.03 fee acres and containing the radar tower and three related buildings (Buildings 402, 404, and 409), was transferred to the FAA. The FAA currently uses this tract of land as a navigation facility. Tract 2 is not addressed in this FS and was not included in the RI.
- Tract 3, 3.364 acres (including a water supply well, water treatment plant and lagoon, and Buildings 201, 203, 207, and 208) was quitclaimed to the Village of Hanna City. The Village of Hanna City operated this tract as a water supply well and water treatment facility until 1987, when the water supply well was closed by the Illinois Environmental Protection Agency (Illinois EPA) due to elevated levels of naturally occurring radon. No operations are presently ongoing at Tract 3.

Based on an April 1998 aerial photograph and field visits conducted in August and November 2008, the area surrounding the HCAFS is predominantly agricultural and open land, with wooded areas located primarily along stream banks. There are also scattered residences in the surrounding area. The nearest residence is immediately across State Highway 116 (Farmington Road) from the site. At the time of the 2000 census, the population of Hanna City was 1013 in 398 households. In July 2007, the population was 980.

The site lies on relatively flat ground with elevations ranging from approximately 740 to 756 ft. above mean sea level and is located on top of a gentle north-south trending ridge. As shown on Figure 1-2, there are two settling ponds and a water treatment lagoon on Tract 2, which has not been operational since the Hanna City Water Supply was shut down in 1987. As noted above, neither the water treatment lagoon nor the settling ponds were investigated in the RI due to PRP issues. There are some paved areas, but the majority of the site is not paved and the paving that does exist is in poor condition with many cracks and broken areas. There are currently no full-time residents or employees on the Tract 1 portion of the site. The County has stated (August 2011) that the current use of the site for law enforcement training will continue in the future.

1.3.2 Environmental Setting

Based on information from the Illinois Water survey (as reported by the Illinois Agricultural Statistics Service), Illinois' climate is continental with cold, generally dry winters, and warm, humid summers. The climate experiences frequent, short duration, but relatively large magnitude fluctuations in temperature, humidity, precipitation, and wind direction. Annual precipitation in Hanna City is 34.89 inches, with an average snowfall of 26.3 inches. The record year for precipitation for the area was 1990, when 55.35 inches were recorded in Peoria. The driest year on record is 1988, when 22.16 inches were recorded. The record snowfall recorded at Peoria was 52.3 inches, which occurred in 1977. In 2004, 186 days were recorded as fair. There were 210 fair days in 2005, 208 fair days in 2006, and 219 fair days in 2007.

All of Peoria County is in the Illinois River drainage basin. The city of Peoria, 10 mi. east of the HCAFS, is the largest city on the Illinois River. Approximately 0.25 mi. northwest of the site is the head of an unnamed tributary of Nixon Run, which flows north and then east to the Kickapoo Creek. Near the head of the tributary is a dammed reservoir, which appears to be a farm pond. Southeast of the site there is a south flowing unnamed tributary of Copperas Creek, which eventually feeds Canton Lake approximately 23 mi. south of Hanna City. Surface water on the northwest and western portions of the site appears to flow toward the tributary of Nixon Run, while on the eastern portion of the site, surface water appears to flow to the tributary of Copperas Creek.

1.3.2.1 Geology and Soil

The HCAFS lies in the Illinoian Till Plain physiographic province. The Illinoian and Wisconsin glacial stages formed most of the present surface materials and landforms in the area. The underlying geology is Pennsylvanian bedrock overlain by glacial deposits, which are overlain by loess (windblown silt). The Pennsylvanian age Modesto Formation bedrock in the vicinity of the site consists of shale, sandstone, and limestone with occasional thin seams of coal. This bedrock formation is approximately 180 ft. thick and has low permeability. The glacial deposits that immediately overlie bedrock in the region are part of the Glasford formation and consist of glacial outwash. The surficial materials are loess deposits that are divided into two layers; the bottom layer is the Roxana silt and the top layer is the Peoria silt. These layers are described as silt, silt loam, and silty clay loam; dark gray to yellowish brown; massive; soft to friable; non-calcareous in the uppermost part and generally calcareous in lower part. The loess units are weakly cemented with a typical reported thickness of 3 to 20 ft.. Ferro-manganese oxide concretions are described as common. These two lithologies are derived by wind erosion from outwash deposits and blanket upland areas. This description is consistent with the surficial material encountered during drilling at the HCAFS.

Borings drilled for the RI encountered silty clay that generally ranged from brown to dark brown in color. Manganese concretions were widely observed in this material. Based on site-specific boring logs and conversations with Dr. C. Pius Weibel [Illinois State Geological Survey (2009, personal communication)] it cannot be determined if the Roxana and Peoria silts are present above the Glasford, or if the Glasford alone is present above the bedrock. The occurrence of manganese nodules is consistent with the published descriptions of the Roxana and Peoria silts, but is also consistent with the Glasford formation. Such nodules were formed at the top of the Glasford by weathering of the Glasford during the Sangamon Interglacial episode (Weibel 2009, personal communication). Based on logs of wells drilled in the vicinity of the HCAFS and obtained from the Illinois Geologic Survey, the reported depth to bedrock ranges from 20 to 34 ft. below ground surface (bgs). Multiple coal seams are described interbedded with the predominant shale in the Modesto Formation.

According to the Soil Survey of Peoria County, Illinois (USDA Undated), the soils that cover most of the HCAFS are Ipava silt loam and Sable silty clay loam. Tama silt loam is found in a small area in the northwest corner of the site. The Ipava series and Sable series soils are both somewhat poorly to poorly drained soils formed in loess. Ipava series soils have, below a depth of 31 in., iron-manganese concretions and masses of oxidized iron found in the matrix and iron-manganese staining. The Sable series soil is slightly acidic with very weakly cemented iron-manganese concretions throughout. Below a depth of 23 in., the soil is neutral with iron-manganese accumulations and iron depletions in the matrix. Boring logs completed for subsurface soil sampling, as part of the RI, also noted the presence of occasional gray mottling, iron, and manganese concretions in the subsoil.

1.3.2.2 Hydrogeology

A water supply well and water treatment facility was operated on the HCAFS by the Village of Hanna City until 1987, when the water supply well was closed by the Illinois EPA due to elevated levels of naturally occurring radon. No information relative to the construction or hydrogeology of the well has been found. On March 1, 2005, the Village of Hanna City passed Ordinance Number 5-03-01 which prohibits the use of groundwater for potable water supply in the Village. The HCAFS is not located in the Village and it could not be determined if the prohibition extends to the HCAFS. The HCAFS and surrounding area are served by public water.

The water table at the site ranged in depth from 0.7 to 10 ft, bgs during previous investigations. The site is located on a gentle, north-south trending ridge, that forms a shallow groundwater divide. Shallow groundwater flow on the eastern portion of the site is towards the southeast and on the western portion of the site to the southwest, mimicking the surface topography. Groundwater gradients across the site averaged 0.095 ft. The loess deposits have a low permeability and yield very little water. During the probe sampling conducted in 2006, as part of the Supplemental Site Inspection (SSI), recharge was observed to be adequate to yield sufficient water for collecting samples for organics and inorganics analyses. During groundwater sampling conducted for the RI in 2008, the temporary wells pumped dry during well purging.

According to the National Cooperative Soil Survey, the saturated hydraulic conductivity of the soil types found at the Hanna City facility ranges from 1.4 to $14x10^{-6}$ centimeters per second.

1.3.2.3 Ecology

In November 2008, EnviroScience, Inc., under subcontract to GEO, conducted an Ecological Assessment of the HCAFS. The site consists mainly of new field habitat with landscaped trees and shrubs. There were three wetland areas observed at the site. Wetlands A and B are the former water treatment ponds and have not been in use since the Hanna City Work Camp was shut down in 2002. Both ponds had standing water in November 2008 that was likely from accumulating surface runoff. The 0.29 acre northern pond (Wetland A) and the 0.15 acre southern pond (Wetland B) have palustrine emergent vegetation consisting of cattails and floating vegetation consisting of duckweed. There were no visible outlets for the pond water. Filter beds located south of Wetlands A and B were dry during the site visit. The third wetland area (Wetland C) is the lagoon, south of the former water treatment facility, which has been overgrown with palustrine emergent vegetation. As noted previously, this lagoon was not considered in the RI, nor in this FS because of PRP issues.

Terrestrial habitats at the HCAFS site consist of open fallow fields with landscape trees and shrubs. Dominant plants include Kentucky bluegrass, goldenrod, dandelion, and aster. There are no wooded or scrub-shrub areas on the site. Animals observed during the site visit include several common bird species (dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows) and eastern cottontail rabbits. The Indiana bat (*Myotis sodalist*) is included in the federally endangered list for Peoria County. However, trees located on-site do not contain suitable habitat for this species.

There are no important ecological resources at, or within, 0.5 mi. of the HCAFS. Terrestrial habitats at the HCAFS consist of formerly mowed lawns that are now open fallow fields. Aquatic habitats consist of former wastewater treatment ponds that have standing water with floating and palustrine emergent vegetation, and a lagoon overgrown with palustrine emergent vegetation.

2. NATURE AND EXTENT OF CONTAMINATION

No known records exist concerning disposal activities or use of hazardous, toxic, or radioactive waste materials at the site during the period when it was used by the USAF; however, possible contaminant sources have been identified. Possible sources include the three Coal Storage Areas. Five underground storage tanks (USTs) used for storing oil, gasohol, and diesel fuel were closed and removed from the site by the IDoC, which retains regulatory responsibility for the tanks. In addition to possible residual contamination from the tanks, there was a contaminated soil storage area that is assumed to have been used for the temporary storage of soil after excavation(s), during tank removal. Other possible anthropogenic sources of contaminants include runoff from on-site roads and Farmington Road, and snow melt from plowed snow piled along the edges of these roads. These sources, and the nature and extent of contamination, are discussed in this section.

2.1 PREVIOUS INVESTIGATIONS

The following is a summary of investigations and studies performed at the site. This information has been summarized from the *Final Supplemental Site Investigation, Former Hanna Air Force Station, Hanna City, Peoria County, Illinois* (TtEC 2008) and the *Final Work Plan, Former Hanna City Air Force Station, Remedial Investigation/Feasibility Study/Proposed Plan/Record of Decision Project* (GEO 2008). The results and conclusions of the previous investigations were used to develop the approach taken in the RI.

2.1.1 Preliminary Assessment

In 1992, USACE, Chicago District conducted a Preliminary Assessment (PA) of the HCAFS, which consisted of site reconnaissance and interviews with former and current site personnel. Twelve areas of potential concern (AOPCs) were identified that required further study. The PA report was not available for review, but it was referenced in TtEC (2008).

2.1.2 Underground Storage Tank Removal

IDoC removed four USTs (the locations of which are shown on Figure 2-1) that existed on-site when the property was conveyed to the State of Illinois (TtEC 2008).

- One 1500 gallon (gal.) gasoline UST was removed near the Control Room (Building 202) and one 2000 gal. gasoline UST was removed near the Maintenance Building (Building 206). The IDoC report did not indicate if releases had occurred or if closure of both sites was requested for both of these tanks.
- One 500 gal. diesel fuel UST was removed from near the former Housing Unit 3 (Building 305). Xylene and polycyclic aromatic hydrocarbons (PAHs) were detected in both confirmatory soil samples. This tank was replaced with a new steel, double-walled 500 gal. diesel UST. The area was over excavated and confirmatory samples did not detect residual petroleum contaminants remaining within the excavation. Additionally, four groundwater monitoring wells were installed around the excavation and sample results did not detect petroleum constituents above regulatory levels. Closure of the site was requested in 1998. One 1500 gal. gasoline UST was removed from near the Motor Pool (Building 307) and benzene, toluene, ethylbenzene, and xylene were detected at concentrations above the cleanup objectives in the excavation floor sample. The area was over excavated and five groundwater monitoring wells were installed around the excavation and sampled during four

events. With the exception of benzene in one monitoring well, petroleum constituents were not found above regulatory action levels.

Due to the beneficial use of the USTs by IDoC, further investigation and remediation of the former tank locations were ineligible for funding under DoD's DERP FUDS program. Therefore, the tank sites were considered as "no DoD action identified" sites.

In 2003, a 9725 gal. diesel UST was removed from the FAA navigational facility. This tank was closed in 2006. Since the FAA facility is not part of the HCAFS for the purposes of the RI and this FS, this UST will not be discussed further.

2.1.3 Site-Inspection and Supplemental Site Inspection

In 1996 Parsons performed a Site Inspection (SI) at specific areas at the HCAFS and one background area (TtEC 2008). The summary presented here includes only the seven AOPCs being investigated for the RI and this FS [i.e., three Coal Storage Areas (A, B, and C), Main Entrance, Vehicle Wash Rack, Maintenance Building, and Paint Shed]. Soil and groundwater samples were collected from the areas using a direct push probe. Soil samples were analyzed for volatile organic compounds (VOCs), metals, PAHs, pesticides, polychlorinated biphenyls (PCBs), and basic soil parameters (percent solids, pH, moisture content, ash content, organic carbon content, bulk density and specific gravity). Groundwater samples were analyzed for VOCs, PAHs, pesticides, PCBs, and metals (total and dissolved).

In response to Illinois EPA's request for additional sampling, TtEC conducted an SSI in April 2006 (TtEC 2008). Soil and groundwater samples were collected and analyzed for the same suite of compounds as the SI samples, with the exception of pesticides.

The analytical results from the SI and SSI were compared to Illinois EPA's Tiered Approach to Corrective Action Objectives (TACO) (IAC Section 742) criteria. The major findings were as follows:

- Pesticides were detected only in one surface soil sample at levels significantly below the TACO Tier 1 residential criteria. No pesticides were detected in any of the groundwater samples.
- PCBs were not detected in any of the groundwater and soil samples collected during the SI and SSI. Detection limits for the analytical methods used were below TACO Tier 1 criteria.
- A number of VOCs were detected in the soil and groundwater samples collected during the SI and SSI, but all measured concentrations were below the TACO Tier 1 residential criteria. On that basis, VOCs were ruled out as chemicals of potential concern (COPCs) for groundwater at the HCAFS.
- PAHs were detected in the soil and groundwater samples collected during the SI and SSI. None of the groundwater detections exceeded the TACO Class I groundwater criteria. However, a number of PAHs exceeded the TACO residential soil criteria for surface and subsurface soils. The PAHs with the lowest Tier 1 residential criteria are benzo(a)pyrene and dibenzo(a,h)anthracene and the criteria were exceeded most frequently for these two compounds.
- Of the metals measured in the surface and subsurface soil samples, exceedances were observed in two soil subsurface soil samples collected in Coal Area A. The construction worker inhalation criterion for mercury was exceeded in two surface soil samples. Concentrations of arsenic in unfiltered groundwater did not exceed the TACO Tier 1 Class I groundwater criterion. Metals in unfiltered groundwater samples that exceeded TACO groundwater criteria include aluminum, iron, lead, manganese, and vanadium. Filtered

groundwater samples analyzed during the SI show significantly reduced aluminum concentrations when compared with the associated unfiltered groundwater samples. Iron, lead, manganese, and vanadium in these filtered groundwater samples are below the TACO Class I groundwater criteria (with the exception of manganese in the filtered sample from Coal Area C). Since aluminum is typically associated with suspended particulates (e.g., clay minerals), the comparative results suggest that the elevated levels of iron, lead, manganese, and vanadium are likely associated with particulates in the groundwater samples. Given the soil and groundwater results from the SI and SSI, metals were considered to be COPCs at the HCAFS.

- All analytes were below TACO residential soil and Class I groundwater criteria in soil and groundwater samples collected from the Tile Field/Septic Tank. Thus, this area was no longer considered an AOPC.

Based on the results of the SI and SSI, PAHs were identified as a COPC in all exposure units (EUs) in the surface soil, and in the subsurface soil at the Vehicle Wash Rack EU. PAHs were eliminated as COPCs in groundwater as none of these analytes were reported at a concentration that exceeded the TACO Class I groundwater criteria. Metals were identified as a COPC in groundwater, and arsenic was identified as a COPC in subsurface soil in the Coal Storage Areas.

2.2 REMEDIAL INVESTIGATION

Tract 1 of the HCAFS was investigated during the HCAFS RI to determine the nature and extent of contamination in the surface soil, subsurface soil, and groundwater that had been identified during the SI and SSI. The identified areas of concern were: groundwater (metals), the Coal Storage Areas (arsenic in subsurface soils), all of the EUs (PAHs in surface soils), and the Vehicle Wash Rack EU (PAHs in the subsurface soil).

The field program design was based on the results of the previous studies. The RI Work Plan (GEO 2008) identified six EUs for investigation. EUs are defined as the likely area in which a receptor will be affected by a potential contaminant in a given medium. Groundwater was considered as one EU for the entire site. For investigation of surface and subsurface soils, five EUs were designated: Coal Area A, Coal Area B, Coal Area C (including Coal Area C, the Maintenance Building, and the Paint Shed), the Vehicle Wash Rack, and the Main Entrance.

2.2.1 Groundwater

The objective of the RI groundwater sampling was to collect samples to provide data that would supplement information gathered during the SI and SSI in order to support a baseline risk assessment based on the combined data. For groundwater, the entire site was considered as one EU for all site receptors. The RI groundwater results, combined with the groundwater data from the SI and SSI from the Coal Areas, Vehicle Wash Rack and Paint Shed AOPCs, were used to arrive at exposure estimates for the groundwater pathway. Groundwater samples were also analyzed to confirm that metals found in groundwater during the SI and SSI were associated with suspended particles, and were not dissolved constituents. Groundwater sampling locations are shown on Figure 2-2.

2.2.1.1 Metals

In November 2008, GEO installed three temporary monitoring wells at the Vehicle Wash Rack, four at the Paint Shed, and one at each of the three Coal Storage Areas. Duplicate filtered and unfiltered samples were collected at Vehicle Wash Rack temporary monitoring well GW04 to confirm the hypothesis that metals in ground water are associated with suspended particulates. The analysis results were compared to the lower of the Illinois EPA TACO Class I groundwater criteria and the USEPA maximum contaminant level. The results presented in Table 2-1 show that, with the exception of the filtered duplicate sample location HCVWGW04 collected from the Vehicle Wash Rack, both filtered and unfiltered samples from the Vehicle Wash and Coal Storage Area A exceed the Illinois Class I Groundwater Remediation Objectives for manganese. Both the filtered and unfiltered samples from Coal Storage Area B were below the criteria. The unfiltered sample from Coal Area C exceeded the criteria for aluminum and manganese; the results from the filtered sample were below the criteria for both of these metals. In all cases, the manganese concentration was lower in the filtered samples than in the unfiltered samples from the same location. The only other analysis result that exceeds the standard was the result for aluminum from the unfiltered sample from location HCVWGW04 at the Vehicle Wash Rack; the result of analysis of the filtered sample is below the standard. The results for barium and iron are below the standard and show small to substantially decreased concentrations in the filtered samples relative to the unfiltered samples.

Analysis results for filtered samples collected during the RI showed that the Illinois TACO Class I Groundwater Remediation Objective criterion for lead was not exceeded. With one exception, all the lead results from both the filtered and unfiltered samples were reported as not found above the detection limit. The lead concentration reported for the unfiltered sample from Vehicle Wash Rack location HCVWGW04 is 3.7 micrograms per liter (µg/L), which is above the detection limit but below the standard.

The samples collected from the Vehicle Wash Rack were analyzed only for lead and in none of the samples collected for the RI were the results above the detection limit.

2.2.2 Surface Soil

Based on previous investigations, the COPCs in surface soil at HCAFS were PAHs. As described in the RI (GEO 2010), in order to determine the extent of surface soil contamination and to support the baseline risk assessment, GEO collected surface soil samples at Coal Area A (8 samples), Coal Area B (11 samples), Coal Area C EU (21 samples), the Vehicle Wash Rack (8 samples), and the Main Entrance (7 samples). The analysis results for these samples are presented on Tables 2-2 through 2-6. Sample locations and exceedances of human health screening criteria are shown on Figures 2-3 through 2-7.

The PAHs that have reported concentrations above the criteria for residential soils were benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, chrysene and dibenzo(a,h)anthracene. The criterion for chrysene was also exceeded for three samples collected previous to the RI at the Coal Area C EU; none of the samples collected at this EU during the RI exceeded the criterion for chrysene. Sources of PAHs in soil include road runoff, accumulation of snow along road sides after plowing, as well as incomplete burning of coal, and petroleum spills (Al-Turki 2009, Lopes and Dionne 1998). There are possible sources of PAHs specific to individual EUs; however, the road runoff and melting of plowed snow appear to be site-wide sources.

In the Coal Area A EU, the concentration of total PAHs ranged from 191.4 to 34,994 micrograms per kilogram (µg/kg). As shown on Table 2-2, one sample had no reported results above the criteria. The highest concentrations of total PAHs were reported from two samples that were collected within 20 ft. of each other in the area that is thought to be the location of the coal storage pile (Figure 2-3). The RI concluded that possible sources of the higher levels of PAH at these locations are residual contamination from coal storage, road runoff, and plowed snow.

The reported results from samples collected in the Coal Area B EU for total PAHs ranged from 191.4 to 33,550 µg/kg (Table 2-3). Benzo(a)pyrene concentrations exceed the TACO Tier 1 criteria in all samples. The results from two samples did not exceed the criteria for any other PAHs. The areal distribution of reported PAH concentrations (Figure 2-4) in the surface soil suggested that, similar to Coal Area A, the primary source of PAHs at Coal Area B is residual material from the coal storage pile. In addition, road runoff and snow melt may also be a source of PAHs in this area. Although the Maintenance Building is located in the Coal Area C EU, the drain from the building flows toward the Coal Area B EU and may affect soil quality in this EU. There is no information on use of the drain and the quality of the possible discharge.

The Coal Area C EU includes Coal Area C, the Maintenance Building, and the Paint Shed. This is also the area where a 2000 gal. gasohol UST was removed in 1993, and a stock pile of contaminated soil was located. The source of the contaminated soil is unknown but it was likely used for temporary storage of soil excavated during one of the tank removals. The total reported PAH concentrations ranged from 1072 to 243,550 µg/kg. All of the surface soil samples collected in the Coal Area C EU exceeded the TACO Tier 1 criteria for residential soil. The reported concentrations for benzo(a)pyrene and dibenzo(a,h)anthracene exceeded the respective TACO Tier 1 criteria for all samples collected (Table 2-4). This is the only EU where chrysene was found to exceed the criteria (>15,000 µg/kg in two samples). Analysis results for benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene exceeded the TACO Tier 1 criteria at 28 and 22 locations, out of 29, respectively. Criteria exceedances for other PAHs occurred in a more limited number of locations. Residual contamination from the former coal storage area is a possible source of PAHs to the surface soil. As seen on Figure 2-5, there seemed to be a general trend across this EU of higher concentrations of PAHs near parking areas and roads. The conclusion presented in the RI was that a source of PAHs to the surface soil is runoff or snow plowed to the edge of these areas. Other potential sources include the drain that emerges from the Maintenance Building, the residual contamination from the former soil pile location, and residual contamination from a former tank location.

The reported results from all samples from the Main Entrance EU (Table 2-5) exceeded the TACO Tier 1 criteria for residential soils for benzo(a)pyrene. Samples from all locations, except two, exceed the criteria for dibenzo(a,h)anthracene. The total concentration of PAHs at the sampled locations ranged from 275 to 79,881 µg/kg. Criteria exceedances for other PAHs occurred in more limited numbers of locations. The distribution of elevated PAH concentrations, seen on Figure 2-6, did not suggest a particular pattern of occurrence, although all sampling locations, because of the layout of the site, are near parking areas or roads. This area was used as the HCAFS entrance point and there are no known site activities in this area that would be associated with PAHs. Based on this, the conclusion of the RI was that the PAH concentrations at this EU likely reflect transport of PAHs onto the site from runoff and piling of plowed snow at the edges of the vehicle areas.

The reported results from all samples (Table 2-6) from the Vehicle Wash Rack EU exceeded the TACO Tier 1 criteria for residential soils for benzo(a)pyrene. Samples from all locations, except two, exceed the criteria for benzo(b)fluoranthene and dibenzo(a,h)anthracene. The total PAH concentrations ranged from 217.3 to 55,095 µg/kg. Criteria exceedances for other PAHs occurred in more limited numbers of locations. As seen on Figure 2-7, concentrations of PAHs at this EU appear to be highest adjacent to the road to Coal Area A. The lowest concentrations occurred at the greatest distance from this road. The conclusion of the RI was that the PAHs either resulted from loss of material as it was being transported to or from the Coal Areas, or from runoff or snow piles associated with the road rather than, or in addition to, vehicle wash rack operations.

2.2.3 Subsurface Soil

Subsurface soil samples were collected for PAH analysis from two sampling intervals at each of seven locations in the Vehicle Wash Rack EU (GEO 2010). The only exceedances of the USEPA Regional Screening Level (RSL) identified were for benzo(a)pyrene in the 4 to 5 ft. sample interval at two locations. The criterion for benzo(a)pyrene is 15 µg/kg, which is also the reported concentration in sample

HCVWSB04 collected at the Vehicle Wash Rack. The reported concentration in the Vehicle Wash Rack sample HCVWSB05 was 35 µg/kg. Based on the low levels of PAHs found in the remaining subsurface samples, the conclusion of the RI was that the exceedances previously identified are isolated occurrences. The analysis results are shown on Table 2-7.

In order to determine the vertical extent of elevated arsenic concentrations found in the subsurface soil in previous investigations, GEO collected soil samples at depths of 2 to 3 ft. and 4 to 5 ft. bgs. Samples from each depth were collected from seven locations at Coal Storage Area A, seven locations at Coal Storage Area B, four locations at Coal Storage Area C, and three locations at the Paint Shed. Including duplicate samples, a total of 46 samples were collected from 20 locations and analyzed for arsenic. Four samples, including one duplicate, were also analyzed for soil pH.

As shown on Table 2-8, the background arsenic concentration for counties within metropolitan areas [13 milligrams per kilogram (mg/kg)] was reached or exceeded in 12 of the 58 samples. Arsenic concentrations in the samples collected for this RI ranged from 7 mg/kg to 16.2 mg/kg. At none of the four locations where duplicate samples were collected and analyzed for arsenic were both the primary and duplicate sample analysis results above the background concentration. The conclusion of the RI was that distribution of arsenic in the subsurface soil at each of the EUs sampled did not suggest a pattern within each EU or for the site as a whole.

2.3 CONTAMINATION ASSESSMENT

2.3.1 Groundwater

Results of analyses of the samples collected during the RI showed that manganese exceeded the screening criteria in both filtered and unfiltered water samples. There is no known specific anthropogenic source of manganese based on the likely activities conducted at a radar tracking facility such as the HCAFS, but during soil sampling for the RI, the presence of manganese concretions was noted in the soil. Analysis for manganese in soil in 1996 at HCAFS showed that the concentration ranged from 170 mg/kg to 1110 mg/kg. Therefore, the conclusion of the RI (GEO 2010) was that natural conditions are the likely reason for the presence of elevated manganese in groundwater.

Additional constituents that were identified in groundwater samples collected for the RI, and are recognized as occasionally present in concentrations above existing regulatory criteria, were iron, aluminum, and lead. The conclusion of the RI was that, based on the available data, it is probable that the metals in surface soil are naturally occurring, although contributions of metals from site activities cannot be completely ruled out.

2.3.2 Surface Soil

Based on previous investigations and the RI, PAHs are recognized as COPCs in surface soil at the HCAFS. Sources of PAHs in soil include road runoff, accumulation of snow along road sides after plowing, pavement sealants, as well as incomplete burning of coal, vehicular emissions, and petroleum spills (Al-Turki 2009, Lopes and Dionne 1998). There are possible sources of PAHs specific to individual EUs (i.e., vehicle maintenance; coal and coal ash storage), however, road runoff, melting of plowed snow, and vehicular emissions appears to be a site-wide source. PAHs in vehicular emissions are typically adsorbed on air-borne particulate matter which can be transported greater distances from roads when compared to road runoff. This is further discussed in Section 2.8.

According to the RI, the presence of PAHs in every sample from the Coal Area A EU, even at more than 100 ft. from the storage location, suggests a diffuse source such as vehicle emissions.

In Coal Area B, the sample with the highest PAH concentrations was located in the vicinity of the suspected coal area, although it is also within a few ft. of a paved surface. The other samples with high PAHs were collected 50 ft. from the suspected coal storage area along the berm around wastewater treatment ponds. Detailed ground elevation measurements are not available for the site; however, given that the wastewater treatment facility was built in this location, it is probably the lowest spot in the area (to allow gravity feed of sewage). Thus, although there are no roads next to some of the samples with elevated PAHs, which would directly indicate road runoff, it is possible that surface water runoff (carrying road-related PAHs) drains towards this area. According to the RI, the areal distribution of reported PAH concentrations in the surface soil suggested that, similar to Coal Area A, the primary source of PAHs at Coal Area B may be residual material from the coal storage pile. However, road and surface water runoff and snow melt cannot be ruled out as sources of PAHs in this area.

At the Coal Area C EU the RI concluded that there seemed to be a general trend across the EU of higher concentrations of PAHs near parking areas and roads. This indicated the possibility that a source of PAHs to the surface soil is runoff or snow plowed to the edge of these areas. Other potential sources are a drain that emerges from the Maintenance Building, the residual contamination from the former soil pile location, and residual contamination from a former tank location. The diffuse detection of PAHs, even at locations away from the suspected coal area, the Maintenance Building, and Paint Shed also suggest vehicular emissions as a source.

According to the RI, the distribution of elevated PAH concentrations at the Main Entrance EU did not suggest a particular pattern of occurrence, although all sampling locations, because of the layout of the site, are near parking areas or roads. The highest PAHs were measured in a sample collected from the vicinity of the suspected underground fuel tank or septic tank, although this location is also within 5 to 10 ft. of a road. Furthermore, the next highest PAHs were measured in a sample that was collected more than 100 ft. from the suspected tank location, but within 5 to 10 feet of a paved surface. Thus, although leaks from a suspected tank fueling station cannot be ruled out, the RI concluded that PAH concentrations at this EU likely reflect transport of PAHs onto the site from runoff and piling of plowed snow at the edges of the vehicle areas and vehicular emissions.

Concentrations of PAHs at the Vehicle Wash Rack EU appear to be highest adjacent to the road to Coal Area A; the lowest concentrations occur at the greatest distance from this road. The RI concluded that there was the possibility of PAHs either resulting from loss of material as it was being transported to or from the Coal Area or from runoff or snow piles associated with the road rather than, or in addition to Vehicle Wash Rack operations.

2.3.3 Subsurface Soil

According to the RI, the exceedances of PAHs in the subsurface soil that were identified in previous studies were isolated occurrences. The RI also indicates the presence of natural sources, the lack of a pattern of distribution of elevated arsenic that points to specific source(s), and the absence of arsenic in the surface soil suggests the arsenic in the subsurface soil is naturally occurring.

2.4 FATE AND TRANSPORT OF CONTAMINANTS

The fate and transport of contaminants is generally due to persistence of the contaminants in the media, migration pathways available to each contaminant, and the characteristics of the migration pathways. The COPCs that were identified in the RI Work Plan (GEO 2008) were metals in groundwater, arsenic in subsurface soil at the Coal/Coal Ash Storage Areas, PAHs in the surface soil at all of the EUs, and PAHs in the subsurface soil at the Vehicle Wash Rack EU. Based on the results of sampling conducted for this RI, the most significant of these are PAHs in surface soils. In addition, metals in groundwater and arsenic in subsurface soil are also of concern.

As a result of the nature and extent of contamination and the site-specific conditions, the potential migration pathways of contaminants at the site fall into the following categories: vertical and horizontal migration through the unsaturated and saturated zones, surface transport of shallow soil contaminants via surface runoff and snow melt, and particulate re-suspension and atmospheric transport in a prevailing downwind direction or during activities that result in soil disturbance. The PAHs at the HCAFS facility have impacted surface soils and all of the migration routes are possible with the exception of groundwater migration routes. It is impossible to determine if the inorganic constituents in groundwater are naturally occurring or the result of site activities. A potential migration route for arsenic found in the subsurface soil is to groundwater via dissolution. This is unlikely since arsenic occurs in a form that is of limited solubility under site conditions.

The available pathways for PAHs in surface soils are surface transport via surface runoff and snow melt. PAHs are persistent in the soil because of their hydrophobic nature/low solubility and strong tendency to adsorb to soil. Particulate re-suspension and atmospheric transport are possible pathways for PAHs in both surface and subsurface soils from coal storage areas or if the soil is disturbed by excavation or tilling. Surface soils containing PAHs could be subject to atmospheric transport when the soils are disturbed and dust is produced. Arsenic in subsurface soils would also be subject to atmospheric transport if the soil is disturbed.

Migration in groundwater is a pathway for manganese since manganese occurs in the dissolved phase. It is also a potential pathway for iron, should iron become soluble. Manganese in groundwater is subject to diffusion and advection. However, diffusion is the movement of dissolved contaminants from areas of high concentration to areas of low concentration and concentrations of manganese are generally evenly distributed in the groundwater of the site. The same would be true for iron if site conditions change and iron becomes soluble. The use of groundwater for water supply is not permitted in the Village of Hanna City due to issues unrelated to HCAFS; therefore, there is no downgradient human receptor.

2.5 EVALUATION OF RISK

2.5.1 Human Health Risk Assessment

A baseline Human Health Risk Assessment (HHRA) was conducted as part of the RI (GEO 2010) to evaluate potential human health risks resulting from exposure to soil and groundwater contamination if no remedial action is taken at the HCAFS. Data collected from the SI, SSI, and RI were aggregated according to the following environmental media: surface soil (defined as soil from 0 to 0.5 ft. bgs), subsurface soil (defined as soil from depths greater than 0.5 ft. bgs), and groundwater. In evaluating risk from soil contamination, Coal Area A, Coal Area B, the Vehicle Wash Rack and Main Entrance were each considered as separate EUs. Because of their proximity to each other, Coal Area C, the Maintenance Building, and the Paint Shed were combined into one EU. To evaluate risks from groundwater, the entire site was considered as a single EU.

The risk assessment focused on COPCs in areas where chemical analyses from the SI and SSI exceeded human health screening criteria. Specifically, the HHRA evaluated carcinogenic risks and non-carcinogenic hazards from PAHs in surface soils at all EUs, PAHs in subsurface soil at the Vehicle Wash Rack EU, arsenic in subsurface soil at the three Coal Area EUs, and metals in groundwater. To identify COPCs that were to be carried through the quantitative HHRA, data was compared against human health screening criteria that consisted of the TACO background concentrations for metals or the lowest of the TACO and USEPA RSL criteria for soil, and the lowest of the TACO groundwater criteria, Illinois and federal drinking water standards for groundwater. PAHs with consistent exceedances in surface soil among the EUs were benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. A similar set of PAHs was observed to have exceedances in subsurface soil at the Vehicle Wash Rack EU, although concentrations were much lower than in the surface soil and there were many non-detects. Arsenic concentrations in a number of subsurface soil samples exceeded the TACO background concentration for arsenic in metropolitan areas (13 mg/kg), which was used as the screening criterion. For unfiltered groundwater from the SI, SSI, and RI, there were exceedances for aluminum, arsenic, iron, lead, magnesium, manganese, and vanadium. The elevated metals in the unfiltered groundwater samples were likely associated with suspended solids, based on analyses of filtered groundwater samples, for which exceedances were only observed for manganese.

Based on the most recent land use as a correctional facility, the site receptor considered in the HHRA was a commercial/industrial worker. An unrestricted land use scenario was incorporated in the risk assessment by including residential receptors (adult and child). In the conceptual site risk model, it was assumed that there were completed pathways from surface and subsurface soil to all four site receptors and from groundwater to residential receptors. These completed pathways were then included in the HHRA.

The calculated incremental lifetime cancer risks (ILCRs), shown on Table 2-9, were compared against the NCP risk range (10^{-4} to 10^{-6}) for setting remediation goals (USEPA 1990) which is consistent with the risk range found in TACO guidance (Illinois EPA Undated). For all EUs considered in the HHRA, incremental carcinogenic risks from surface and subsurface soil for commercial/industrial workers were below 10^{-4}, the risk level considered unacceptable by TACO regulations. The ILCR for the commercial/industrial worker, ranged from $2.5\text{x}10^{-5}$ at the Main Entrance EU to $7.4\text{x}10^{-5}$ at the Coal Area C EU. Under unrestricted land use, ILCR from exposure to soil at the Coal Area C EU were above 10^{-4} for the residential adult ($2.7\text{x}10^{-4}$) and child receptors ($1.9\text{x}10^{-4}$); approximately 90% of these risks are from exposure to PAHs in surface soil. At the Vehicle Wash Rack EU, the ILCR exceeded 10^{-4} only for the residential adult ($1.2\text{x}10^{-4}$). Carcinogenic risks for the residential receptors are below 10^{-4} at the Coal Area A, Coal Area B and Main Entrance EUs.

COPCs are those chemicals for which the chemical-specific ILCR exceeds 10^{-5}. Under land use as a correctional facility, the only COPC in surface soil at all EUs is benzo(a)pyrene. Under unrestricted land use, the COPCs in surface soil at the Coal Area A, Coal Area B, Vehicle Wash Rack and Main Entrance include benzo(a)pyrene and dibenzo(a,h)anthracene. At the Coal Area C EU, there are more unrestricted land use COPCs in surface soil; these include benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene. In subsurface soil, arsenic is only a COPC at the Coal Area EUs, and only under unrestricted land use. There are no COPCs in subsurface soil at the Vehicle Wash Rack EU.

The hazard indices (HIs) from surface soil cannot be calculated because there are no non-carcinogenic toxicity values available for PAHs. The HIs from arsenic in subsurface soil are below one for all site receptors.

Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10^{-4}, primarily from arsenic. Note that the arsenic is probably associated with suspended solids, and that there are no carcinogenic COPCs in the filtered groundwater samples.

The HIs from unfiltered groundwater for the residential receptors are greater than one, with hazard quotients (HQs) for every metal exceeding one. The HIs from filtered groundwater are less than one, with dissolved manganese being the only contributor to this hazard. A summary of the ILCRs are shown on Table 2-9.

2.5.2 Screening Level Ecological Risk Assessment

As part of the RI, a Screening Level Ecological Risk Assessment (SLERA) was performed to evaluate ecological risks from current and potential future exposure to contamination at the HCAFS if no remedial action is taken, and to determine if a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. In contrast to the HHRA, where risks were evaluated for each AOPC, the EU for this SLERA is defined as the entire 42.89 acres formerly occupied by the HCAFS.

As part of a screening level problem formulation, a field ecological reconnaissance was conducted by EnviroScience, Inc., under subcontract to GEO, on November 18, 2008, to document habitats and observe wildlife within and around the HCAFS, and to identify designated wetlands and critical or sensitive habitat for threatened and endangered species. The area surrounding the HCAFS is designated as an agricultural zone with no sensitive areas within a 0.5 mi. radius. The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Inventory sites, dedicated Illinois Nature Preserves, or registered land and water reserves in the vicinity of the site. The ecological conceptual site risk model developed for the site assumes that the primary contaminant sources are surface and subsurface soil, and there are completed pathways from these sources to plants, soil invertebrates, and avian and mammalian wildlife. Groundwater was not considered a medium of concern for environmental risk because the depth to the water table over most of the site is greater than 4 feet. Although the HHRA focused on PAHs and arsenic in soil, the SLERA considered all chemical analyses from the SI and SSI, as well as the RI. Thus, in addition to PAHs and arsenic, the SLERA included an evaluation of ecological risks from VOCs, PCBs, and all metals in soil at the HCAFS.

The RI concluded that there are no ecological risks from low molecular weight (PAHs with less than four rings) PAHs. Hazard calculations for three types of mammals (herbivore, ground insectivore, and carnivore) show hazards from exposure to high-molecular weight PAHs to be greater than one for the mammalian ground insectivore (shrew) and less than one for mammalian herbivores (vole) and carnivores (weasel).

The concentration of metals in surface soil and subsurface soil at the HCAFS were compared with regional background data sets compiled by Illinois EPA (TACO Appendix A, Table G, metropolitan areas) to determine if site concentrations fall within a range that is typical of background conditions. Using the maximum detected concentration as the exposure concentration and the ecological soil screening level as toxicity values, hazards calculated for arsenic were below one for all four ecological receptors, indicating this metal is not a chemical of potential ecological concern (COPEC). Hazards from exposure to manganese are greater than one for plants and soil invertebrates, but less than one for avian and mammalian wildlife. However manganese has been shown to be natural occurring in the soil at the HCAFS. Thus, manganese can also be eliminated as a COPEC. For lead, HQ ranged from 0.08 for mammalian herbivores, to 8.45 for avian ground insectivore. Hazards from zinc are also greatest for the avian and ground insectivores, while hazards for herbivores and carnivores are less than one. The SLERA concluded that even though zinc and lead were present at levels above ecological screening criteria, further action to address ecological risk was not warranted based on the following:

- There are no records of federally or State-listed threatened or endangered species within 0.5 mi. of the HCAFS and the receptor groups found at the HCAFS consist of common, widely distributed species.
- The hazard quotients are conservative or comparable to background ecological risks. The hazard quotients were calculated using maximum detected concentrations rather than average concentrations.
- The median values for lead and zinc in surface were below the respective TACO (Appendix A, Table G, metropolitan areas) background values for metro areas and, in addition, the maximum detected concentrations used were outliers.

The risks from lead and zinc are elevated in localized areas, but on average are comparable or below the TACO regional background values.

2.6 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Applicable requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant remedial action, location, or other circumstance found at a site. The term *promulgated* means that the standards are of general applicability and are legally enforceable.

Relevant and appropriate requirements pertain to those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility citing laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site and that their use is well-suited to the particular site.

Based on the statutory requirements, the remedial actions developed for this FS will be analyzed for compliance with federal and state environmental regulations. This process involves the initial identification of potential requirements, the evaluation of the potential requirements for applicability or relevance and appropriateness, and finally a determination of the ability of the remedial alternatives to achieve the Applicable or Relevant and Appropriate Requirements (ARARs).

USEPA defines three classifications of requirements in the ARAR determination process.

- Chemical-specific – requirements that set protective remediation goals for contaminants of concern (COCs).
- Location-specific – requirements that restrict remedial actions based on the characteristics of the site or its immediate surroundings.
- Action-specific – requirements that set controls or restrictions on the design, implementation, and performance levels of activities related to the management of hazardous substances, pollutants, or contaminants.

Chemical-specific ARARs include those laws and regulations governing the release of materials possessing certain chemical or physical characteristics, or containing specified chemical compounds. Chemical-specific requirements set health or risk based concentration limits or ranges in various media for specific hazardous substances or contaminants. These requirements provide protective site remediation levels as a basis for calculating remediation goals for the COCs in the designated media.

Location-specific ARARs are design requirements or activity restrictions based on the geographical or physical positions of the site and its surrounding area. Location-specific requirements set restrictions on the types of remedial activities that can be performed based on site specific characteristics. An example would be restrictions applicable in the vicinity of wetlands. No location-specific ARARs have been identified for HCAFS.

Action-specific ARARs are technology based, establishing performance, design, or other similar action-specific controls or regulations for the activities related to the management of hazardous substances or pollutants. Action-specific requirements are initiated by the particular remedial action alternatives that are selected to accomplish the cleanup of hazardous wastes. Off-site activities specific to the remedial work at HCAFS will comply with Federal and Illinois laws governing off-site transportation, handling, and disposal of excavated soil.

Remedial alternatives to address the risks associated with the hazardous substances present at the site will be evaluated with respect to compliance with ARARs. Applicable standards and regulations that result from remedial or construction activities will be followed. Based on investigations conducted as part of the SI, SSI, and RI, there are no location-specific ARARs that affect the site. The potential chemical-specific and action-specific ARARs are presented in Table 2-10.

2.7 REMEDIAL ACTION OBJECTIVES

Based on previous investigations and the RI, the initial media of concern were surface soil, subsurface soil, and groundwater. The subsections below describe, by media, the Remedial Action Objectives (RAOs) for the HCAFS and the basis for their development.

2.7.1 Surface Soil

The results of the SI and SSI indicated that the PAHs in surface soil exceeded the TACO Tier I criteria. This was confirmed by the sampling and analysis conducted for the RI. Based on the analytical data, there are some patterns of PAH distribution noted. The highest concentrations of PAHs were generally found adjacent to roads, near the former locations of coal storage areas, and near former UST locations. Neither the distribution of PAHs nor site records indicate a specific source for PAHs in the surface soil.

The risk assessment, conducted as part of the RI, determined that the PAH concentrations in surface soil posed a risk to human health ranging from $9.2\times10^{-7,}$ for a commercial/industrial worker, to $4.7\times10^{-4,}$ for a resident adult. There were no other surface soil constituents that were found to exceed screening criteria for the risk assessment. Because of the risk posed by PAHs in surface soil, surface soil will be addressed in the RAOs.

2.7.2 Subsurface Soil

The RI concluded that contaminants found in the subsurface soil are either isolated occurrences or naturally occurring. On that basis, the subsurface soils are not considered in the development of remedial objectives.

2.7.3 Groundwater

Groundwater will not be considered in the RAOs for the following reasons, as documented in the RI (GEO 2010):

- The presence of metals, especially manganese, in groundwater is a natural occurrence and is not related to use of the HCAFS.
- Shallow groundwater is not a source of potable water due to the low permeability of the material.

2.7.4 Remedial Action Objectives

Site-specific RAOs relate to potential exposure routes and specific contaminated media, such as soil or groundwater, and are used to identify target areas of remediation and contaminant concentrations. They require an understanding of the contaminants in their respective media and are based on the evaluation of risk to human health and the environment, protection of groundwater, information gathered during the RI, applicable guidance documents, and federal and state ARARs. RAOs are as specific as possible without unduly limiting the range of alternatives that can be developed for detailed evaluation.

The findings of the risk assessment indicated that an unacceptable human health risk was present at this site for surface soils, subsurface soils, and groundwater. There does not appear to be a threat of uncontrolled release from the site, although there is the potential for migration of PAHs in surface soil via wind erosion and runoff. The loess deposits from which the groundwater samples were collected are probably not sufficiently conductive to support domestic water supply wells. Furthermore, an ordinance from the Village of Hanna City prohibits the use of groundwater for potable water supply because commercial land use in the Village (not associated with the HCAFS) had resulted in groundwater quality not meeting Illinois standards. A water supply well used by the Village of Hanna City was shut down in 1987 by Illinois EPA due to high levels of naturally-occurring radon (TtEC 2008). Drinking water in the area, including the Hanna City Work Camp before it was closed, is provided by the Illinois of America Water Company. It is, therefore, unlikely that residential receptors will use the shallow groundwater underlying the HCAFS.

There are no occasions for contact with subsurface soil unless the soil is exposed via digging or excavation.

It should be noted that the most probable explanations for the presence of metals in the groundwater are the natural occurrence of manganese and iron in the groundwater and the significant turbidity of the SI and SSI samples for other metals. The most probable explanation for arsenic in the subsurface soil is natural occurrence. The most probable explanations for the presence of PAHs in the shallow soil are residual contamination from underground storage tanks, runoff and snow melt from roads, and site operations.

Based on the results of the SI, SSI, and RI the remedial objectives for the HCAFS are:

- Prevent ingestion, inhalation, and direct contact with surface soils containing PAHs above regulated remediation objectives, and
- Reduce migration of contaminants in surface soils and mitigate the possibility of contaminants leaving the site through surface water run-off and erosion of the surface soils.

In the discussions that follow, and in remaining sections of this FS, benzo(a)pyrene is used as the benchmark for comparison with remedial objectives. Because benzo(a)pyrene is the most consistently occurring PAH on the site, and has the lowest remedial objective, the remediation of soil containing benzo(a)pyrene above the identified objective would assure that all other PAHs found above their respective remedial objectives would also be remediated.

Following discussions with the Illinois EPA, two sets of Preliminary Remediation Goals (PRGs) are considered in the FS, as described below:

PRG Set 1 is based on TACO residential criteria (Table 2-11). This set of PRGs reflects a target risk of $1x10^{-6}$, which is more protective than required by the NCP.

PRG Set 2 is based on the minimum of the TACO industrial/commercial and construction worker criteria for ingestion and inhalation, as delineated in TACO Appendix B, Table B. These objectives, presented on Table 2-11, are protective of receptors under current land use and expected future land use. Based on communication with County personnel (personal communication, S. A. Sorrell, July 27, 2011), it is unlikely that the site would be used for County government-sponsored public housing because of the distance of the HCAFS from a population center and from existing or planned public transportation. In addition, there is a deed restriction that was placed on the property by the State of Illinois when the property was transferred to Peoria County. This restriction requires that, if the County does not use the property for public purpose(s), the property will revert to the State. It is, therefore, unlikely that the property will be transferred to private ownership for residential or agricultural development. However, to evaluate this proposed remediation objective under unrestricted land use, the residential risk levels for the preliminary remediation objectives were calculated using the TACO residential criteria in TACO Appendix B, Table A (which reflect a risk level of 10^{-6}). With the exception of naphthalene, the calculated residential risk levels for the proposed remediation objectives are greater than 10^{-6}, but below 10^{-5}, and are well below the upper limit of the NCP target risk range (10^{-4}). For naphthalene, the residential risk level for the PRG is well below 10^{-6}.

As previously discussed, there is uncertainty regarding residential use of the HCAFS in the foreseeable future. Based on this uncertainty factor, a reasonable approach to the remediation of the former HCAFS would be to use the preliminary remediation objectives in Table 2-11, which will be protective of receptors under current land use, and will also be protective of residential users should the property be converted to residential use in the future. Since these remediation objectives are also protective of possible residential users, land use restrictions will not be required.

2.8 EXTENT AND DISTRIBUTION OF CONTAMINANTS

As described in the RI (GEO 2010), the vertical extent of contamination has been well documented as extending from the ground surface to 1 ft. bgs. The lateral extent of contamination is less well defined. The exceedances of the human health screening criteria in surface soil have been shown on Figures 2-3 through 2-7. As seen from these figures, additional data are needed in order to define the lateral boundaries of the contaminated soils

An additional consideration, related to the extent of contamination, is the source of the PAH in surface soils. As previously stated there is the possibility that vehicle emissions and other road related sources contribute to the PAH loading. It should be noted that a CERCLA exclusion exists for PAHs adjacent to roads. A CERCLA exclusion in this instance is defined as "(B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine [42 USC §9601, 22(B)]." The following discussion addresses the issue of PAH contamination adjacent to roads.

Although the HCAFS is located in a generally rural area, the facility use has been similar to an urban or an industrial/commercial site. As noted previously, the facility was used by the USAF as a radar tracking and investigation station from 1952 to 1968. From approximately 1969 to 2002, the site was used by the IDoC for a minimum security prison. Currently, the site is used by Peoria County for law enforcement training. All of these site uses required regular access by a variety of types of motor vehicles with accompanying vehicle emissions and road runoff. According to De La Torre-Roche et al. (2009), the source of PAHs with four or more rings (NOTE: these correspond to the PAHs of concern found in the surface soil at HCAFS) in soil was the result of pyrogenic activity (residential burning, vehicle emissions, or power generation). In order to examine the possibility that such emissions are contributors to the PAHs in the surface soil at HCAFS, it is necessary to discuss the distribution of PAHs across the site, rather than as associated with specific EUs. The following discussion focuses on the occurrence of benzo(a)pyrene because it is the compound that most frequently exceeds standards and has the greatest impact on the risk evaluation.

Figure 2-8 shows the distribution of benzo(a)pyrene across the HCAFS. Inspection of Figure 2-8 shows that the highest proportion of samples with concentrations below the Set 1 PRG (90 μg/kg) occurs at the northern end of the facility, furthest from State Highway 116 (Farmington Road), and at the end of the main road of the facility. The EUs in this area are Coal Area A and the Vehicle Wash Rack. The lowest proportion of the occurrence of these low concentrations is at the Coal Area B EU, which is located approximately 100 ft. from Farmington Road. Since, based on the available information, site activities were similar at the two coal areas, it would be expected that the distribution of benzo(a)pyrene concentrations would be similar. The lack of similarity suggests the possibility of an additional source of benzo(a)pyrene on the southern portion of HCAFS. Inspection of Figure 2-8 shows that the benzo(a)pyrene concentration is below the Set 2 PRG (800 μg/kg) at 44 locations and above the PRG at 15 locations. Note that with three exceptions, all locations at which the Set 1 remediation objective is exceeded are immediately adjacent to the road. At the Coal Area B EU, three samples exceeded the objective and all three are more than 10 ft. from a road. These samples were collected from a low area that appears to be a collection point for runoff. When PAH concentrations near roads are examined, it becomes apparent that surface soils near roads have increased concentrations of PAHs.

The distribution of contaminants described above, examination of the history of site use, and consideration of road use as a source of PAHs in shallow soils have been used to develop the preliminary extent of shallow soil to be remediated in each EU for each of the two PRG sets. It should be noted that sampling will be conducted as part of the remedial design process and prior to soil removal to ensure that actual boundaries of soil remediation will be in conformance with the PRG. It should also be noted that soil remediation will not be conducted so close to any road that the structural integrity of the road will be compromised. The extent of remediation for PRG Set 1 is shown on Figures 2-9 through 2-13 and is described below:

- Coal Area A – shallow soil will be remediated in the area shown on Figure 2-9. This includes all sample locations that exceed the Set 1 PRG for benzo(a)pyrene, with the exception of the CA 02 location. This sample was collected in 1996 and its location is uncertain.
- Coal Area B – shallow soil will be remediated in the area shown on Figure 2-10. This includes all sample locations that exceed the Set 1 PRG for benzo(a)pyrene.
- Coal Area C – shallow soil will be remediated in the area shown on Figure 2-11. This includes all sample locations that exceed the Set 1 PRG for benzo(a)pyrene with two exceptions: sample locations HCMBSS01 and HCCBSS08, due to their distance from the suspected source and their proximity to the road.
- Main Entrance – shallow soil will be remediated in the area shown on Figure 2-12. This includes all sample locations that exceed the Set 1 PRG for benzo(a)pyrene, with the exception of the five sample locations shown on Figure 2-12, due to their distance from the location of the suspected source.
- Vehicle Wash Area – shallow soil will be remediated in the area shown on Figure 2-13, with the exception of the VWSS01 location, which is under a road.

The extent of remediation for PRG Set 2 is shown on Figures 2-14 through 2-18 and is described below:

- Coal Area A – As shown on Figure 2-14, the one location at which the PAH concentration exceeds the remediation goal is sample location HCCASS08. Soil at this location will be remediated and the confirmation sampling will extend toward the general location of CA 02 (the exact location is unknown) in order to bound the remediation area.
- Coal Area B – All sample locations for which the concentrations exceed the remediation goal will be remediated (Figure 2-15).
- Coal Area C – Soil from areas shown on Figure 2-16 will be remediated. There are two isolated occurrences of concentrations above the Set 2 PRG (locations HCMBSS01 and HCCCSS08). These locations are 50 ft. or more away from any likely source of the suspected release and are immediately adjacent to paved roads. On that basis, these locations are considered to be unrelated to DoD site use and will not be remediated.

- Main Entrance – As shown on Figure 2-17, there is one location at which concentrations exceeded the remediation goal and it cannot be established that these concentrations are unrelated to the UST that had been reported in the vicinity. Therefore, soil at this location will be remediated. There is another location at which concentrations exceed the remediation goal. This location (HCMESS02, Figure 2-17) is greater than 100 ft. from the reported tank location, or any other known potential DoD source. On that basis, the PAHs present are attributable to the adjacent paved road and the soil will not be remediated.
- Vehicle Wash Rack – All exceedances of the Set 2 PRG are immediately adjacent to the road (Figure 2-18). These locations are separated from the actual location of the Vehicle Wash Rack by samples that do not exceed the goal. On that basis, the locations near the road are considered to be attributable to road traffic and will not be remediated.

3. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Section 2 described the nature and extent of contamination at the HCAFS. As described, there have been no specific sources identified. However, due to the human health risk posed by the PAHs in surface soil, it is appropriate to consider remediation approaches. The purpose of this section is to present remedial technologies that can potentially be applied to surface soils to meet the remedial objectives. Section 4 discusses the remedial alternatives that have been assembled using these technologies.

Remediation of contaminants can be accomplished using both administrative and engineered controls. Administrative controls could be in the form of fencing and signs identifying the area as a restricted area and deed restrictions placed in property ownership documents that detail the allowed uses for the site and restrictions on site activities (e.g., no-dig, etc.). The existing requirement that the HCAFS be used for public purposes is, although not related to the environmental conditions at the site, a type of administrative control.

The technologies generally applicable to contaminated surface soils include the construction of an engineered barrier over the area of contamination to prohibit contact with the contaminated media, in-situ or ex-situ treatment of the soil, and removal and off-site treatment or disposal of the soil. A brief description of each of these technologies is presented in the subsections that follow and a summary of technologies is presented in Table 3-1.

Regardless of the technology, it will be necessary to determine the aerial extent of contamination above the remedial objective. A preliminary list of additional data requirements for the technologies described are shown in Table 3-2. Final determination of data needs requires detailed discussion with vendors and suppliers.

3.1 ENGINEERED BARRIERS

Various materials and types of caps or engineered barriers can be employed to limit human exposure to the surface soil, as long as the cap is not breached. Capping technologies fall into the category of engineered barriers, as defined by TACO. This regulation requires effective maintenance of engineered barriers be included in an institutional control, which would also address provisions for temporary breaches of the barrier, if intrusive construction work that may temporarily breach the engineered barrier is performed.

Engineered barriers are generally a low cost technology when compared to other technologies. However, these technologies leave the contaminants in place and therefore require on-going maintenance of the site. Because of the requirement for institutional controls, either DoD will have to maintain involvement in the HCAFS or the current owner, Peoria County, will have to agree to enter into a Memorandum of Agreement to take responsibility for maintaining the barrier(s) and comply with the institutional control. Any future land use at the HCAFS would have to take the institutional control into account to preserve the barriers.

Specific engineered barrier technologies include:

Clay Cap. A clay cap consists of natural material placed in compacted layers over the contaminated media. This type of cap is used to prohibit contact with the contaminated media and inhibit the percolation of water through the media and potentially carrying contaminants to groundwater. Since the analytical results for samples collected at the HCAFS to date do not present any evidence that the PAHs in surface soil are either migrating to the subsurface soil or to groundwater, prevention of groundwater infiltration is not a concern at this site. In order to maintain the integrity of a clay cap and to be consistent with the current appearance of the site, a soil/vegetative layer above the cap would be required.

Asphalt Cap. An asphalt cap generally consists of creating a parking lot of the area of concern. This approach prevents contact with the surface soil by creating a barrier. However, asphalt contains PAHs and may, itself, be a source of PAHs to underlying soil. Seal coated parking lots are known to a major source of PAHs to runoff, as well (USGS 2005).

Single Layer Soil Cover. Constructed with local natural soil, this type of cap is designed primarily to prevent contact with the contaminated media and may or may not inhibit percolation of surface water through the cover material. As stated above, transfer of PAHs to subsurface soil is not considered to be a concern at the HCAFS. In order to maintain the integrity of the cover, and to be consistent with the current appearance of the site, a soil/vegetative layer above the cap would be required.

3.2 IN-SITU TREATMENT TECHNOLOGIES

In-situ treatment technologies are those that treat the soil in place, requiring no excavation of the soil. Bench scale and/or pilot studies are necessary to determine the design parameters for in-situ systems. Low permeability soils and soil heterogeneity are both potential limitations to the use of in-situ treatment technologies, as these soil characteristics effect the distribution of the treatment media in the soil. The currently available site data is not sufficient to determine if the soil at the HCAFS is amenable to in-situ technologies. In addition, based on currently available data, multiple systems would be required at HCAFS because of the non-contiguous distribution of the contaminants across the site.

A brief overview of technologies is presented below:

Soil Flushing. In-situ soil treatment for PAHs can be accomplished by in-situ soil flushing. For in-situ soil flushing, volumes of water, at times supplemented with surfactants, cosolvents, or treatment compounds, are applied to the soil. Injected water and treatment agents are recovered together with flushed contaminants. Soil flushing with surfactants or Fenton's reagent has also been shown to be successful. Soil flushing does generate wastewater that must be treated, either by a temporary on-site treatment facility or at an off-site treatment facility.

Chemical Oxidation. Oxidation chemically converts contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Matching the oxidant and in-situ delivery system to the COCs and the site conditions is the key to successful implementation and achieving performance goals. Oxidant delivery systems often employ vertical or horizontal injection wells and sparge points with forced advection to rapidly move the oxidant into the subsurface.

According to the Interstate Technology and Regulatory Council (ITRC 2005) permanganate has been shown to be an effective oxidizing agent for PAHs. Although ITRC states that PAHs are "reluctant" relative to treatment with ozone, others report success using ozone (Dablow et al. 2001). In-situ oxidation has the advantage that use of this technology does not generate large volumes of waste water requiring treatment. However, since the contaminated soil at HCAFS is at and immediately below the surface, injection of even limited quantities water into the system would create saturated conditions at the surface.

Bioremediation. Bioremediation uses processes in which indigenous or inoculated microorganisms metabolize organic contaminants found in soil and/or groundwater. In the presence of sufficient oxygen, microorganisms will ultimately convert many organic contaminants to carbon dioxide, water, and microbial cell mass. In the absence of oxygen, the contaminants will be ultimately metabolized to methane and carbon dioxide. Contaminants may not be completely degraded, but only transformed to intermediate products that may be less, equally, or more hazardous than the original contaminant. In-situ bioremediation of soil typically involves the percolation or injection of water containing dissolved oxygen and nutrients. Bioremediation technologies have been shown to be effective treatments for PAHs in soil. However, the heavy molecular weight PAHs (made up of four or more rings) can be more difficult [Federal Remediation Technologies Roundtable (FRTR) 2007]. Benzo(a)pyrene is made up of five rings and therefore, may require more time to achieve treatment goals.

The effectiveness of in-situ bioremediation can be limited in soils with high concentrations of metals that can be toxic to the bacteria. In addition, injection of biologic treatment agents is difficult in soils that have low permeability and are heterogeneous (as are the soils in question).

Thermal Treatment. In-situ thermal treatment has been shown to be effective for the removal of PAHs for soils and it requires less time than other in-situ technologies. Many different methods and combinations of techniques can be used to apply heat to soil. Heat can be introduced to the subsurface by electrical resistance heating, radio frequency heating, dynamic underground stripping, thermal conduction, or injection of hot water, hot air, or steam. In surface soils, hot air is usually applied in combination with soil mixing or tilling, either in-situ or ex-situ.

In general, in-situ treatment technologies are least successful when the soil permeability is low, as it is at the HCAFS. Because the limited permeability of the soils at the HCAFS, as shown during the soil and groundwater sampling conducted for the RI, and the non-contiguous distribution of contaminants at the HCAFS, in-situ technologies are not considered to be an appropriate class of technologies for use at the HCAFS.

3.3 EX-SITU TREATMENT TECHNOLOGIES

Ex-situ treatment technologies are those that are applied on-site to excavated soils. Ex-situ treatment technologies are similar to those used for in-situ treatment. The primary difference is that, because the soils are either excavated or tilled in place prior to treatment, soil texture and heterogeneity are less limiting. The main advantage of ex-situ treatments is that they generally require shorter time periods than in-situ technologies, and there is more certainty about the uniformity of treatment because of the ability to screen, homogenize, and continuously mix the contaminated media. However, ex-situ processes require excavation of soils, which increases costs and engineering for equipment, permitting, and materials handling. For the purposes of this evaluation, technologies that can be used with in-place tilling of the soil are considered as ex-situ because the soil is disturbed. Specifically, for the soils at the HCAFS, ex-situ technologies would not necessarily have the limitations of in-situ technologies posed by the low permeability of the soil.

A summary of potentially applicable ex-situ technologies follows below:

Soil Washing. Soil washing is similar to soil flushing, as discussed above, but is applied to soil after excavation. Soil washing is a water-based process for scrubbing soils ex-situ to remove contaminants. The process removes contaminants from soils in one of the following two ways:

- By dissolving or suspending them in the wash solution (which can be sustained by chemical manipulation of pH for a period of time); or
- By concentrating them into a smaller volume of soil through particle size separation, gravity separation, and attrition scrubbing.

Soil washing is also used with other techniques, such as chemical oxidation and bioremediation, to achieve remediation objectives (Zheng and Obbard 2002).

Soil washing is considered as having average effectiveness for the treatment of PAHs in soil by the FRTR (2007). Soil washing generates waste water, which requires treatment prior to discharge.

Chemical Oxidation. Ex-situ chemical oxidation differs from in-situ in that the oxidizing agent is mixed with the soil rather than injected into the soil. As stated above, the mixing of soil and agent can mitigate the issue of low permeability soil. Chemical oxidation can be used on-site on excavated soils, off-site on excavated and transported soils, and on-site on soils that are tilled in place.

Bioremediation. Ex-situ bioremediation generally requires shorter time periods than in-situ treatment, and there is more certainty about the uniformity of treatment because of the ability to homogenize, screen, and continuously mix the soil (FRTR 2007). This provides significantly more control over the process than is possible with in-situ technologies. Ex-situ bioremediation typically uses tilling or continuously mixed slurries to apply oxygen and nutrients, and is performed in a prepared bed (liners and aeration) or reactor. Soils are treated aboveground via land-farming, biopiling, or composting. Bioremediation can also be conducted on soils that are tilled in place.

Thermal Treatment. Ex-situ thermal treatment generally involves the destruction or removal of contaminants through exposure to high temperature in treatment cells, combustion chambers, or other means used to contain the contaminated media during the remediation process. There are a number of technologies that are effective for PAHs within the category of ex-situ thermal treatment. These include: thermal desorption, pyrolysis, and incineration (off-site or on-site).

3.4 SOIL REMOVAL

Soil removal and off-site disposal or treatment is also a common method for remediation of PAH contaminated soils. This technology includes removal of soil containing PAHs above a selected limit and transfer of the contaminated soil to an appropriate off-site facility for disposal, treatment, or reuse. In order to maintain the integrity of the site, and to be consistent with the current appearance of the site, the volume of removed soil would need to be replaced with clean soil. Grading and establishment of a vegetative cover would also be required.

Another option for soil removal is on-site encapsulation and stabilization of the removed soil. In this case, rather than removing the soil to an off-site treatment or disposal facility, the soil is allowed to remain on-site in a containment area. This requires excavation and construction of a containment area to hold the soil, excavation and placement of the soil in the containment area, and grading and capping. Additional materials can be added to the contained soil for stabilization. This option is normally incorporated with land use plans for the site, such as placing the encapsulated soil at a location where a building or other structure is planned. Encapsulating the soil on-site would require an institutional control, as described for engineered barriers in Section 3.1.

4. DEVELOPMENT AND SCREENING OF ALTERNATIVES

Based on the established site conditions, contaminant characteristics, and the volume of contaminated soil requiring remediation, three potential remedial actions were evaluated. In-situ and ex-situ treatment technologies were determined to be inappropriate because the soil to be treated is too small to make treatment technologies cost effective. In addition, the non-contiguous distribution of contaminated soil will increase the cost to excavate and move the soil to the treatment location. Examination of the technologies previously presented in Section 3, Table 3-1, shows that the only technology that was retained for consideration is soil removal and off-site disposal. On that basis, the alternatives that have been developed, in addition to the No Action Alternative that is required by the NCP as a baseline for comparison, use soil removal and disposal as the remedial technology. The two alternatives have been developed using Set 1 PRGs and Set 2 PRGs. In considering these alternatives, it should be noted that there is already a restriction on site use. Based on the requirements of the legislation that allowed transfer of the HCAFS to Peoria County (Public Act 95-0982 Illinois General Assembly) the site must be used for public purpose(s).

As previously discussed, the current use of the HCAFS is expected to continue in the future. Preliminary calculations, based on site characterization data previously presented in the RI, indicate that the volume of soil to be remediated to meet the Set 1 PRG (described in Section 2.7.4) would be approximately 2577 cubic yards (yd^3). The largest volume of soil (913 yd^3) occurs in the Coal Area C EU. Preliminary calculations indicate that the amount of soil requiring remediation to meet the Set 2 PRG be approximately 304 yd^3. The largest volume (163 yd^3) to be remediated occurs in the Coal Area C EU; the smallest volume (14 yd^3) in the Coal Area A EU. It should be noted that these are estimates based on current data, final remediation volumes will result from sampling that will be conducted as part of the remedial design.

The alternatives selected for further evaluation are:

- Alternative 1 – No action,
- Alternative 2 – Removal of surface soil that exceeds the Set 1 PRGs, and
- Alternative 3 – Removal of surface soil that exceeds the Set 2 PRGs.

4.1 ALTERNATIVE 1 – NO ACTION

The no action response is identified, as required by the NCP, for the purpose of establishing a baseline against which other alternatives are compared. There would be no preventative or remedial action implemented. As a result of the no action response, the current contamination at the site would remain in place and exposed at the surface. A five year review may be required.

4.2 ALTERNATIVE 2 – REMOVAL OF SURFACE SOIL EXCEEDING THE SET 1 PRG

The removal would be accomplished by excavation of the surface soil (0 – 1 ft. bgs) that has been determined to have PAH concentrations above the Set 1 PRG. Removal of soil containing benzo(a)pyrene above the objective would ensure that all other PAHs found above their respective objectives would also be removed. Implementation of this alternative would result in soil being removed from all five EUs. The exact volume of soil removed will be based on the data collected to date and the data collected during sampling and analysis as part of remedial design, which will be conducted to determine that the soil at the boundary of the removal area(s) does not exceed the Set 1 PRGs. Should the results of the sampling show that this objective has not yet been achieved, soil removal will be extended until the objective has been achieved. The sampling plan for confirmatory sampling and details of removal and disposal implementation will be developed as part of the design documents.

In the areas from which the soil is removed, clean soil will be used to bring the surface up to grade and the area would be seeded to blend in with the surroundings and mulched. Based on the existing data the removed soil is not expected to be considered hazardous waste and therefore can be disposed of without requiring treatment. The removed soil will be disposed of at an approved off-site facility. Off-site disposal leaves no maintenance requirements at the site.

4.3 ALTERNATIVE 3 – REMOVAL OF SURFACE SOIL EXCEEDING THE SET 2 PRG

The removal would be accomplished by excavation of the surface soil (0 – 1 ft. bgs) that has been determined to have PAH concentrations above the Set 2 PRGs. Removal of soil containing benzo(a)pyrene above the objective would assure that all other PAHs found above their respective objectives would also be removed.

Similar to Alternative 2, sampling will be conducted to determine that the soil at the boundary of the removal area(s) does not exceed the Set 2 PRGs. Should the results of the sampling show that this objective has not yet been achieved, soil removal will be extended until the objective has been achieved. A number of the removal locations are close to or bounded by roads; it should be noted that removal will not extend under roads or in such proximity to roads that the integrity of roads is undermined. The sampling plan for confirmatory sampling and details of removal and disposal implementation will be developed as part of the design documents.

In the areas from which the soil is removed, clean soil will be used to bring the surface up to grade and the area will be seeded and mulched. The removed soil would be disposed of or treated at an approved off-site facility. Off-site disposal or treatment leaves no maintenance requirements at the site.

5. DETAILED ANALYSIS OF ALTERNATIVES

Three alternatives were selected for detailed analysis based on the remedial objectives described in Section 2.7.4 and the evaluations presented in Sections 3 and 4. The alternatives selected were:

- Alternative 1 – No Action,
- Alternative 2 – Removal of Surface Soil Exceeding the Set 1 PRG, and
- Alternative 3 – Removal of Surface Soil Exceeding the Set 2 PRG.

Other alternatives and remedial measures not selected may be reconsidered at a later step during the remedial design phase if information that identifies an additional advantage not previously apparent develops.

5.1 EVALUATION OF CRITERIA

The selected alternatives are evaluated against nine criteria. In order to establish priority among the screening criteria, they are separated into three groups. The first two criteria listed are threshold criteria, and must be satisfied by the remedial action alternative being considered. The next five criteria are secondary criteria, used as balancing criteria among those alternatives that satisfy the threshold criteria. The last two criteria are not evaluated during the FS. State and community acceptance is evaluated after receipt of comments from the State and community. Acceptance will be determined during a public comment period, and a responsiveness summary will be incorporated into the decision document.

The seven evaluation criteria that are used are:

Overall Protection of Human Health and the Environment. Each alternative was assessed to determine if risks to site receptors from exposure to soil contamination can be reduced to acceptable levels by eliminating, reducing, or controlling exposures to levels established during development of the remedial goals. Overall protection of human health draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. The SLERA, conducted as part of the RI, concluded that even though zinc and lead were present at levels above ecological screening criteria, further action to address ecological risk was not warranted based on considerations described previously in section 2.5.2.

Compliance with ARARs. The chemical-specific ARARs are those contained in TACO Tier 1 remediation objectives. Other laws and regulations that are applicable solely as a result of the remedial or construction activity will be observed.

Long-Term Effectiveness and Permanence. Each alternative was assessed for the long-term effectiveness and permanence it presents in maintaining protection of human health and the environment after the response objectives have been met.

Reduction of Mobility, Volume, and Toxicity Through Treatment. Each alternative was assessed against this criterion to evaluate the performance of the specific treatment technologies the alternative may employ.

Short-Term Effectiveness. The short-term effectiveness of each alternative was assessed considering the:

- Short-term risks that might be posed to the site workers and the community during implementation of the alternative,
- Potential environmental impacts of the remedial action and the effectiveness and reliability of measures taken to mitigate impacts during implementation, and
- Length of time needed until protection is achieved.

Implementability. The ease or difficulty of implementing each alternative is assessed by considering the following types of factors (as appropriate):

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of a technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.
- Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required obtaining any necessary approvals and permits from other agencies.
- Availability of services and materials, including the availability of necessary equipment, specialists, and services and materials.

Cost. Capital costs were assessed. These costs include direct and indirect costs, and net present worth of capital and operation and maintenance (O&M) costs. The present worth of each alternative provides the basis for the cost comparison.

State Acceptance. The assessment of the concerns of the State of Illinois (i.e., Illinois EPA) will not be completed until comments on the FS report is received, but may be discussed, to the extent possible, in the proposed plan issued for public comment. Concerns that will be assessed include:

- The State's position and key concerns related to the preferred alternative and other alternatives and
- Comments from the State on ARARs.

Community Acceptance. This assessment includes determining which components of the community support, has reservations about, or categorically reject. This assessment will not be completed until comments are received.

5.2 ANALYSIS OF ALTERNATIVES

The objective of this section is to evaluate each of the alternatives for site remediation, individually on the basis of the threshold, and balancing criteria. A comparative analysis of how the alternatives satisfy the threshold and balancing criteria is presented in Section 6.

5.2.1 Alternative 1 – No Action

No further remedial actions would be taken under this alternative and the site would be allowed to remain "as is." However, since contaminated soil would be left in place on-site above levels that would allow for unlimited used and unrestricted exposure, a five year review may be required.

5.2.1.1 Overall Protection of Human Health and the Environment

Because remedial actions would not be initiated as part of this alternative, it would not provide any increased protection to human health or the environment. If no action is taken, any risk of a release and possible exposure to on-site contaminants would remain. It should be noted that, as described in the RI report (GEO 2010) and summarized in Section 2.5.2 of this FS, the current level of contamination at the HCAFS does not pose an unacceptable ecological risk. The human health risk to site users has been shown to exceed acceptable levels. Therefore this alternative is not protective of human health.

5.2.1.2 Compliance with ARARs

This alternative does not achieve the RAOs and does not comply with chemical-specific ARARs for the site contaminants, as contained in TACO.

5.2.1.3 Long-Term Effectiveness and Permanence

This alternative would not be effective in mitigating the potential exposure of receptors to the contaminants at the site. The contaminated soil would remain and would be available for transport by wind and water erosion.

5.2.1.4 Reduction of Mobility, Volume, or Toxicity through Treatment

No reductions in contaminant mobility, volume, or toxicity would occur under this alternative.

5.2.1.5 Short-Term Effectiveness

Since no further remedial actions would be implemented at the site, this alternative poses no short-term risks to on-site remedial workers or the surrounding community. Because the site is periodically used by the Peoria Sheriff's Department for law enforcement training, a limited, short duration exposure risk to trainees and other users would remain. It should be pointed out that risk to correctional workers, presented in the RI (GEO 2010), is $2.5x10^{-5}$; this risk includes arsenic in the subsurface soils. Although arsenic in subsurface soils contributed less than 10% of the total risk at the Coal Areas, the chemical-specific risk from this metal alone exceeded 10^{-6} for all the site receptors. The Exposure Point Concentrations used to calculate the risks ranged from 10.5 to 12.6 mg/kg, all of which are already below the TACO background level for arsenic in metropolitan areas. This suggests that the risks from arsenic in soil at HCAFS are comparable to background conditions. In addition, the risk calculation also assumes that correctional facility workers would be full time workers, not occasional users.

5.2.1.6 Implementability

This alternative could be implemented immediately.

5.2.1.7 Cost

It is assumed that a five-year review of the site would be required. This would entail an SI and generation of a five year review report. The costs associated with conducting the five year inspection and review are $20,000. If a five year review is not required, then this is a no-cost alternative.

5.2.2 Alternative 2 – Removal of Surface Soil Exceeding the Set 1 PRG

This alternative includes excavation of the soil with concentrations of benzo(a)pyrene above the Set 1 PRG. The excavated soil would be removed to an off-site location for either disposal or treatment. Disposal and treatment would be accomplished according to ARARs. As stated previously, final design of this alternative would require confirmation soil sampling to determine the lateral limits of the soil to be excavated and to determine disposal or treatment options. Based on currently available data, the soil could be disposed of by non-hazardous direct disposal.

Following the removal of the soil and confirmation sampling to determine that the remediation objectives were met, the excavated areas would be regraded, reseeded, and mulched.

5.2.2.1 Overall Protection of Human Health and the Environment

As stated previously in Section 2.5.2 and discussed in detail in the RI (GEO 2010), the current levels of contamination at HCAFS do not present an unacceptable ecological risk. As shown in Section 2.7.4, risk to site users would be reduced to acceptable levels. Therefore, this alternative is protective of human health.

5.2.2.2 Compliance with ARARs

This alternative achieves the RAOs and complies with chemical-specific ARARs for the site contaminants, as contained in TACO. Off-site activities specific to the remedial work at HCAFS will comply with Federal and Illinois laws governing off-site transportation, handling, and disposal of excavated soil.

5.2.2.3 Long-Term Effectiveness and Permanence

Removal and disposal of off-site treatment of the contaminated soils permanently eliminates the long-term health risks at the site by effectively removing the contaminants from the HCAFS. Risks associated with direct contact would be eliminated. Alternative 2, therefore, provides long-term effectiveness and permanence at the HCAFS.

5.2.2.4 Reduction of Mobility, Volume, or Toxicity through Treatment

This alternative removes the contaminants from the HCAFS. Disposal of the soil does not reduce the mobility, volume, or toxicity of the contaminants. It does remove the contaminants to an approved facility where the potential for mobilization is controlled.

5.2.2.5 Short-Term Effectiveness

Alternative 2 would be effective at achieving remediation objectives in the short-term. Short-term monitoring would be required under this alternative, since excavation activities could result in the release of fugitive dust. Also, operation of heavy equipment during excavation would produce some noise nuisance. Air monitoring during excavation would be necessary to ensure that a safe working environment is maintained and that no threat to human health or the environment is created by air emissions from any area during construction. Activities resulting in increases in ambient noise levels, windblown dust, and soil erosion would be mitigated by limiting hours of operation, soil moisture control, erosion, and surface runoff control measures.

5.2.2.6 Implementability

Soil removal with disposal or treatment is a widely used, established method for site remediation. Conditions external to the site, such as equipment availability, materials, and services present no problem at this time.

5.2.2.7 Cost

The following assumptions were used in developing the cost estimate for Alternative 2:

- Development of Project Plans, including: a Work Plan, a Health & Safety Plan, a Quality Control Plan, and an Environmental Protection Plan;
- Sampling to confirm that objectives will be reached;
- Site preparation, including: mobilization, set up of a staging area, installation of erosion control measures, and haul rod construction;
- Removal activities;
- Waste disposal, including: loading and transportation of soil, sample analysis, and landfill disposal;
- Site restoration, including: backfill material, vegetative cover, and road repair or removal;
- Demobilization; and
- Documentation.

To meet the Set 1 PRG, the total present worth for this alternative is approximately $502,398.

A detailed cost estimation table is presented in Appendix C.

5.2.3 Alternative 3 – Removal of Surface Soil Exceeding the Set 2 PRG

This alternative includes excavation of the soil with concentrations of benzo(a)pyrene above the Set 2 PRG. The excavated soil would be removed to an off-site location for either disposal or treatment. Disposal and treatment would be accomplished according to ARARs. As stated previously, final design of this alternative would require confirmation soil sampling to determine the lateral limits of the soil to be excavated and to determine disposal or treatment options. Based on currently available data, the soil could be disposed of by non-hazardous direct disposal; this must be confirmed by additional analysis.

Following the removal of the soil and confirmation sampling to determine that the remediation objectives had been met, the excavated areas would be regraded, reseeded, and mulched.

5.2.3.1 Overall Protection of Human Health and the Environment

As stated previously in Section 2.5.2 and discussed in detail in the RI (GEO 2010), the current levels of contamination at HCAFS do not present an unacceptable ecological risk. In the soil removal alternative to address risk to human health, soils with PAH levels that exceed the remediation objective will be excavated and transported to an off-site disposal facility. Removal of the soil that exceeds the remediation objectives eliminates possible exposure to risk by site users. The risk to site users is reduced to levels that are within the acceptable range, as defined by the NCP. Transport of the soil to an approved disposal site transfers the contaminated soil to a controlled location, but does not eliminate the contaminants (see Section 5.2.3.4 below). However, it is not anticipated that soil treatment prior to disposal will be required because the soils are unlikely to be hazardous waste based on currently available data.

5.2.3.2 Compliance with ARARs

This alternative would achieve the remedial objectives. Off-site activities specific to the remedial work at HCAFS will comply with Federal and Illinois laws governing off-site transportation, handling, and disposal of excavated soil.

5.2.3.3 Long-Term Effectiveness and Permanence

Removal and disposal of off-site treatment of the contaminated soils permanently eliminates the long-term health risks at the site by effectively removing the contaminants from the HCAFS. Risks associated with direct contact would be eliminated. Alternative 3, therefore, provides long-term effectiveness and permanence at the HCAFS.

5.2.3.4 Reduction of Mobility, Volume, or Toxicity through Treatment

This alternative removes the contaminants from the HCAFS. Disposal of the soil does not reduce the mobility, volume, or toxicity of the contaminants. It does remove the contaminants to an approved facility where the potential for mobilization is controlled. Removal and treatment reduces the mobility, volume, and toxicity of the contaminants through the treatment process.

5.2.3.5 Short-Term Effectiveness

Alternative 3 would be effective at achieving remediation objectives in the short-term. Short-term monitoring would be required under this alternative, since excavation activities could result in the release of fugitive dust. Also, operation of heavy equipment during excavation would produce some noise nuisance. Air monitoring during excavation would be necessary to ensure that a safe working environment is maintained and that no threat to human health or the environment is created by air emissions from any area during construction. Activities resulting in increases in ambient noise levels, windblown dust, and soil erosion would be mitigated by limiting hours of operation, soil moisture control, erosion, and surface runoff control measures.

5.2.3.6 Implementability

Soil removal with disposal or treatment is a widely used, established method for site remediation. Conditions external to the site, such as equipment availability, materials, and services present no problem at this time.

Additional testing to determine the extent of contamination and the preparation of design documents are estimated to require approximately six months. The completion of the removal and disposal or treatment and preparation of final documents are expected to take approximately six months. It should be noted that remediation to the industrial/commercial objective will require an institutional control to prevent the HCAFS from being developed for long-term/permanent residences.

5.2.3.7 Cost

The following assumptions were used in developing the cost estimate for Alternative 3:

- Collection of additional samples of surface soil for PAH analysis to determine the extent of contamination;
- Development of Project Plans, including: a Work Plan, a Health & Safety Plan, a Quality Control Plan, and an Environmental Protection Plan;

- Site preparation including: mobilization, set up of staging area, installation of erosion control measures, and haul rod construction;
- Removal activities;
- Waste disposal including: loading and transportation of soil, sample analysis, and landfill disposal;
- Site restoration including: backfill material, vegetative cover, and road repair or removal;
- Demobilization; and
- Documentation.

To meet the remediation objective, the total present worth for this alternative is approximately $134,980. These costs assume final disposition without treatment at an approved facility. Potential vendors have indicated in conversations that, based on the RI sample results, treatment would not necessarily be required. It should be noted, however, that this was a preliminary assessment by the vendors. Final decisions would be based on analysis of the specific soil to be disposed and on different analytical methods.

A detailed cost estimation table is presented in Appendix C.

6. COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis of the alternatives identified for the surface soil contamination at the HCAFS based on the threshold and balancing evaluation criteria. The objective of this section is to compare and contrast the alternatives so that decision makers may select a preferred alternative.

Based on the site data presented in the RI (GEO 2010) three alternatives are presented to give decision makers a range of potential actions that could be taken to remediate this site. The alternatives are:

- Alternative 1 – No Further Action,
- Alternative 2 – Removal of Surface Soil Exceeding the Set 1 PRG , and
- Alternative 3 – Removal of Surface Soil Exceeding the Set 2 PRG

Table 6-1 presents a summary of each remedial alternative with an evaluation of the compliance with each evaluation criterion. This evaluation, and the present worth costs, provides the basis for comparison among alternatives.

6.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 does not meet the threshold criteria of protecting human health and the environment. Both Alternatives 2 and 3 meet the criteria.

6.2 COMPLIANCE WITH ARARS

Off-site activities specific to the remedial work at HCAFS will comply with Federal and Illinois laws governing off-site transportation, handling, and disposal of excavated soil.

Alternative 1 does not comply with the TACO standards. As noted in Table 2-10, TACO is not an ARAR. However, TACO chemical-specific standards are to-be-considered (TBC) guidelines and the TACO procedures were considered when establishing the site PRGs in Table 2-11 and the soil removal areas for Alternatives 1 and 2. . Alternatives 2 and 3 involve the use of machinery that will generate noise however, as noted in Table 2-10, these noises are from construction-related activity such that noise pollution standards are not ARARs.

6.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 would leave the contaminated surface soil in place with neither treatment nor containment. Since the surface soil presents a risk to short-term and long-term site users, this alternative is considered the least preferable of the three.

Alternative 2 and Alternative 3 will remove the soil above the remediation objective from the site. The soil will be transported to an approved site for disposal or treatment and will be effectively and permanently removed from the HCAFS.

6.4 REDUCTION OF MOBILITY, TOXICITY, OR VOLUME THROUGH TREATMENT

Since Alternative 1 does not include any action, it has no effect on the mobility, toxicity, or volume of the contaminated soil. Alternative 2 and Alternative 3 will reduce the mobility, toxicity, and volume if the final disposition of the soil is through treatment at an off-site facility. Regardless of the final disposition of the soil, the mobility, toxicity, and volume of contaminants at HCAFS will be reduced.

6.5 SHORT-TERM EFFECTIVENESS

Alternative 1 would not increase the risk to the surrounding community or site workers, but the risk to site users would remain. Alternatives 2 and 3 would result in a temporary increase in nuisance noise, dust, and exposure to remediation workers during soil excavation. Alternatives 2 and 3 would require site workers to have precautionary protection against dermal contact and inhalation of contaminated dust during soil excavation and handling. Both Alternatives 2 and 3 will require approximately six months to complete final design and required plans. The implementation of both Alternatives 2 and 3 can be expected to be completed in an additional six months. Based on these assumptions, the period of performance for Alternative 2 and Alternative 3 is one year.

6.6 IMPLEMENTABILITY

The ease or difficulty of implementing each alternative was assessed by considering the following types of factors (as appropriate):

- Technical feasibility – including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of a technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.
- Administrative feasibility – including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies.
- Availability of services and materials – including the availability of necessary equipment and specialists, and the availability of services and materials.

Alternative 1 could be implemented immediately. Alternatives 2 and 3 use established methods that have been successfully demonstrated in applications for heavy molecular weight PAHs. Conditions external to the site (e.g., equipment availability, materials, and services) present no problem at this time for Alternatives 2 or 3.

6.7 COST

The type of costs that were assessed included: capital costs, including both direct and indirect costs; annual O&M; and net present worth of capital and O&M costs. The present worth of each alternative provides the basis for the cost comparison.

Alternative 1 – The costs associated with conducting the five year inspection are $20,000, if a five year review is required. If a five year review is not required, then there is no cost associated with this alternative.

Alternative 2 – The total present worth for this alternative is approximately $502,398 to achieve the remediation objective. Costs assume that the ultimate disposition of the soil will be disposed at an approved location. Regardless of the ultimate disposition and remedial objective that is selected, the initial activity will be to collect additional surface soil samples to better define the volume of soil that will be removed. To achieve the remediation objective, development of costs assumed that the volume of soil to be removed and disposed is 2577 yd^3. This volume is approximate and based on existing data. Site preparation includes equipment and personnel mobilization, and setting up a staging area and erosion control measures. These costs are generally independent of soil volume. Following site preparation, the soil will be excavated, sampled for disposal parameters, and loaded and transported for disposal. These costs are dependent on soil volume. At completion of excavation and removal of the soil, the site will be restored. Site restoration includes backfilling the excavated areas with new soil; grading, seeding, and mulching the excavated areas; and removing or repairing the haul road. These costs are also dependent on soil volume.

Alternative 3 – To meet the remediation objective, the total present worth for this alternative is approximately $134,980. Costs assume that the ultimate disposition of the soil will be disposal at an approved location. Regardless of the ultimate disposition and remedial objective that is selected, the initial activity will be to collect additional surface soil samples to better define the volume of soil that will be removed. To achieve the remediation objective, development of costs assumed that the volume of soil to be removed and disposed is 304 yd^3. This volume is approximate, and based on existing data. Site preparation includes equipment and personnel mobilization and setting up a staging area and erosion control measures. These costs are generally independent of soil volume. Following site preparation, the soil will be excavated, sampled for disposal parameters, and loaded and transported for disposal. These costs are dependent on soil volume. At completion of excavation and removal of the soil, the site will be restored. Site restoration includes backfilling the excavated areas with new soil; grading, seeding, and mulching the excavated areas; and removing or repairing the haul road. These costs are also dependent upon soil volume.

6.8 STATE ACCEPTANCE

Based on the State of Illinois' (i.e., Illinois EPA) review of the Draft FS and the response to the comments received, it is expected that the State will accept either Alternative 2 or Alternative 3. Both Alternatives 2 and 3 are in accordance with the respective PRGs that have been reviewed by the State.

6.9 COMMUNITY ACCEPTANCE

This assessment includes determining which components of the alternatives interested persons in the community support, have reservations about, or categorically reject. This assessment will not be completed until comments on the proposed plan are received.

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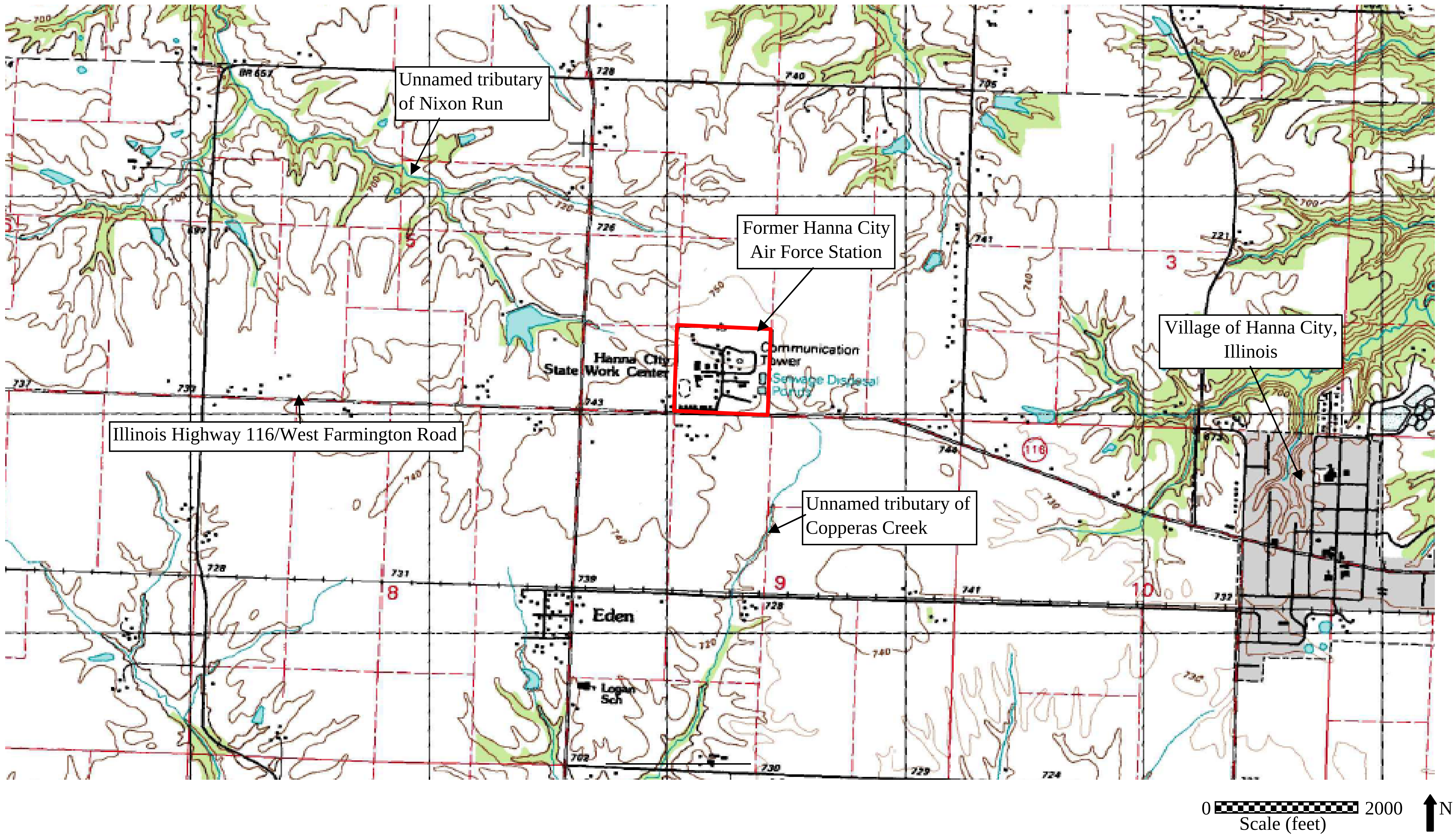
APPENDICES

APPENDIX A

FIGURES



Topographic map courtesy of U.S. Geological Survey, Hanna City quadrangle 1996.

Figure 1-1. Site vicinity map for the HCAFS

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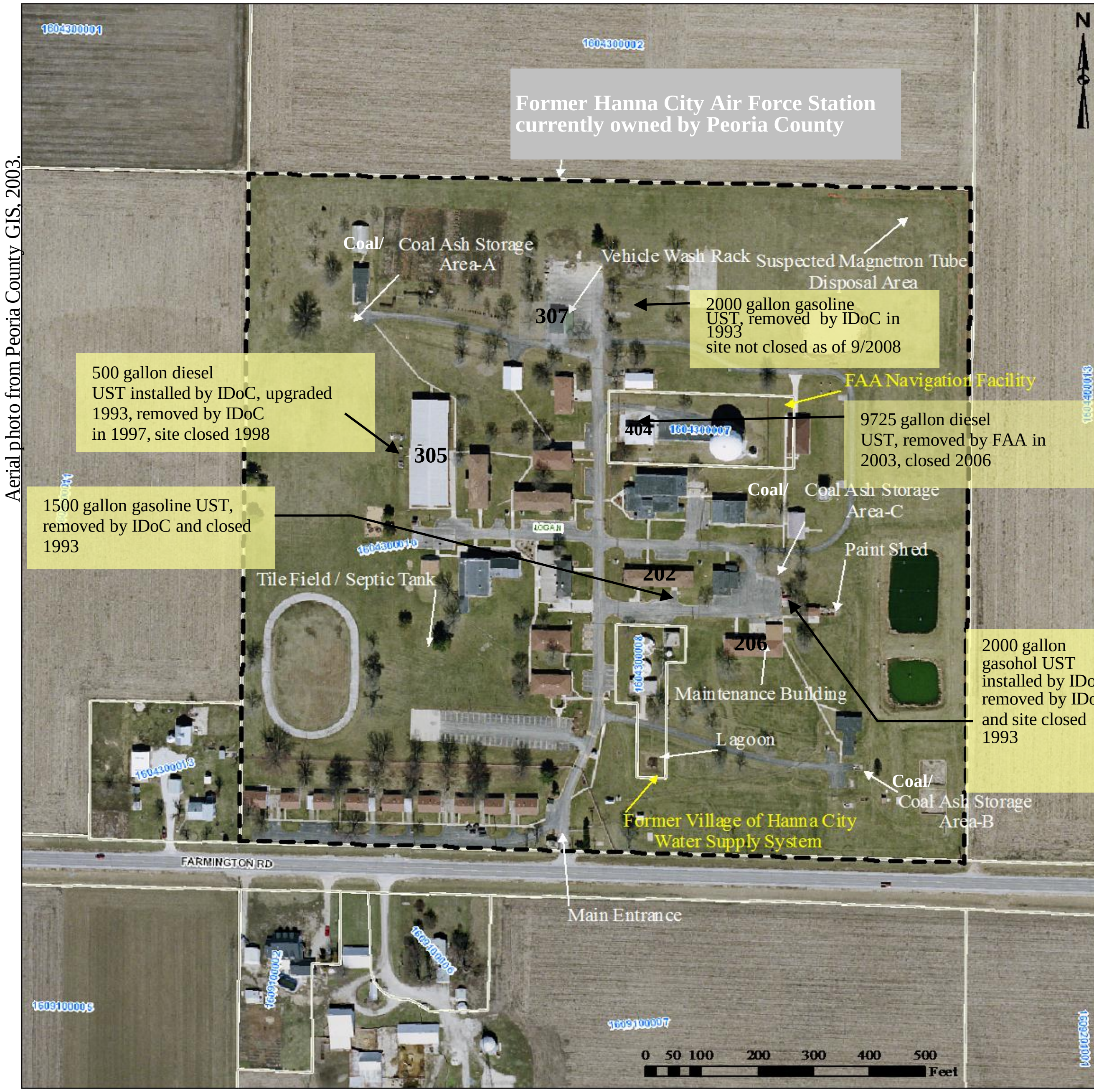
Hanna City, Illinois

Aerial photo from Peoria County GIS, 2003.

Areas (white text), building numbers (black text) are based on the Hanna City Air Force Station (HCAFS) site layout drawing from TtEC (2008).
Areas of Potential Concern are the Coal Ash Storage Areas A,B, and C; Main Entrance; Vehicle Wash Rack; Maintenance Building; and Paint Shed. These areas are marked by bright green circles.

Peoria County parcel identification number

Former Hanna City Air Force Station **Hanna City, Illinois**	**Figure 1-2. Historical and current site layout for the HCAFS**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky



Former UST locations based on documents from IEPA L.U.S.T. program for LPC#1430405005.

IDoC: Illinois Department of Corrections
FAA: Federal Aviation Administration

Peoria County parcel identification number

Former Hanna City Air Force Station Hanna City, Illinois	Figure 2-1. Former UST locations
U.S. Army Corps of Engineers Louisville District	GEO Consultants, LLC *A Geological Engineering and Environmental Services Company* Kevil, Kentucky

Source for base photo map: Peoria County GIS, 2003

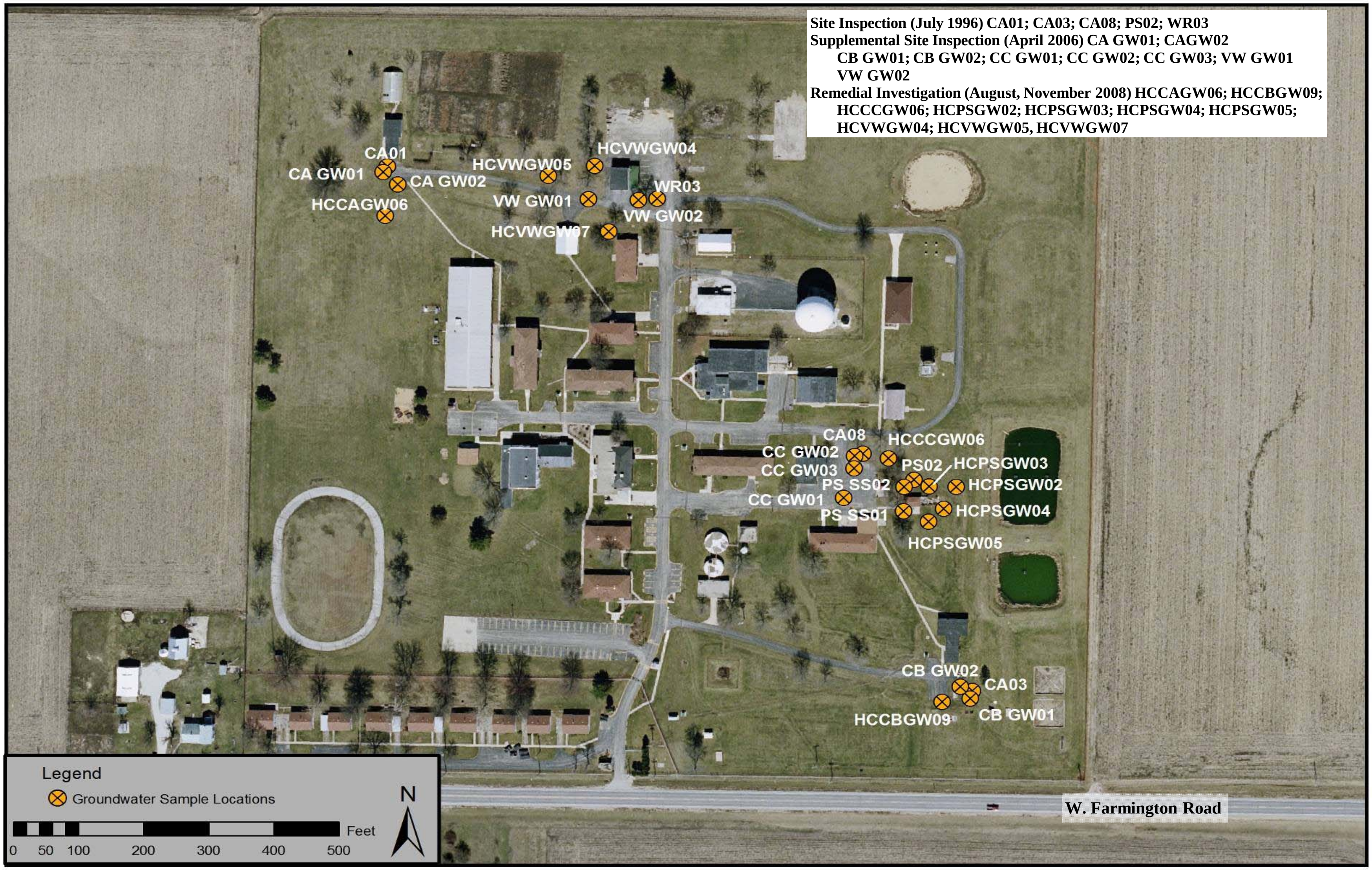


Figure 2-2. Groundwater sampling locations at HCAFS

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Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

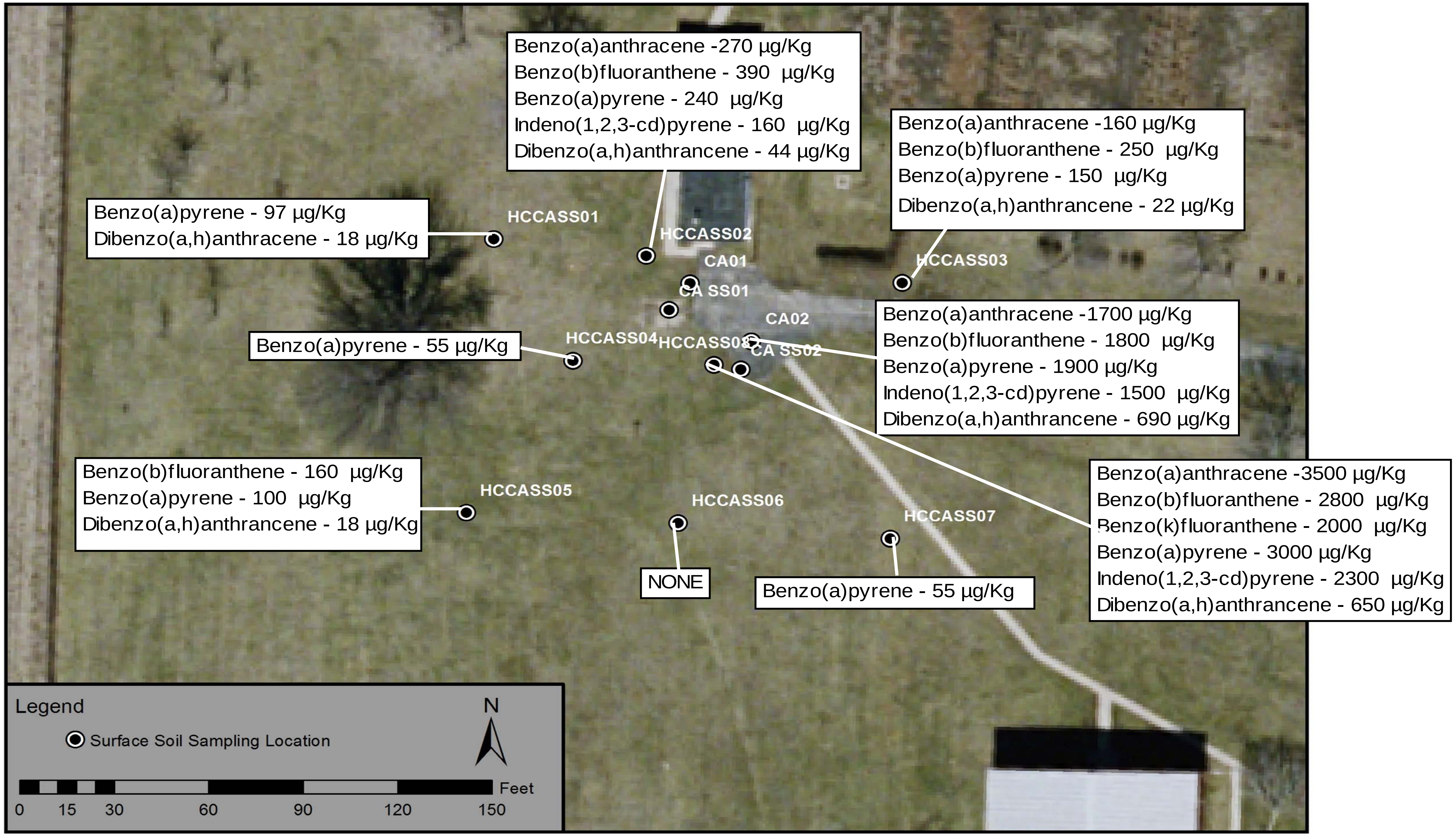

Figure 2-3. PAH exceedances of human health screening criteria in surface soils at Coal Area A

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Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

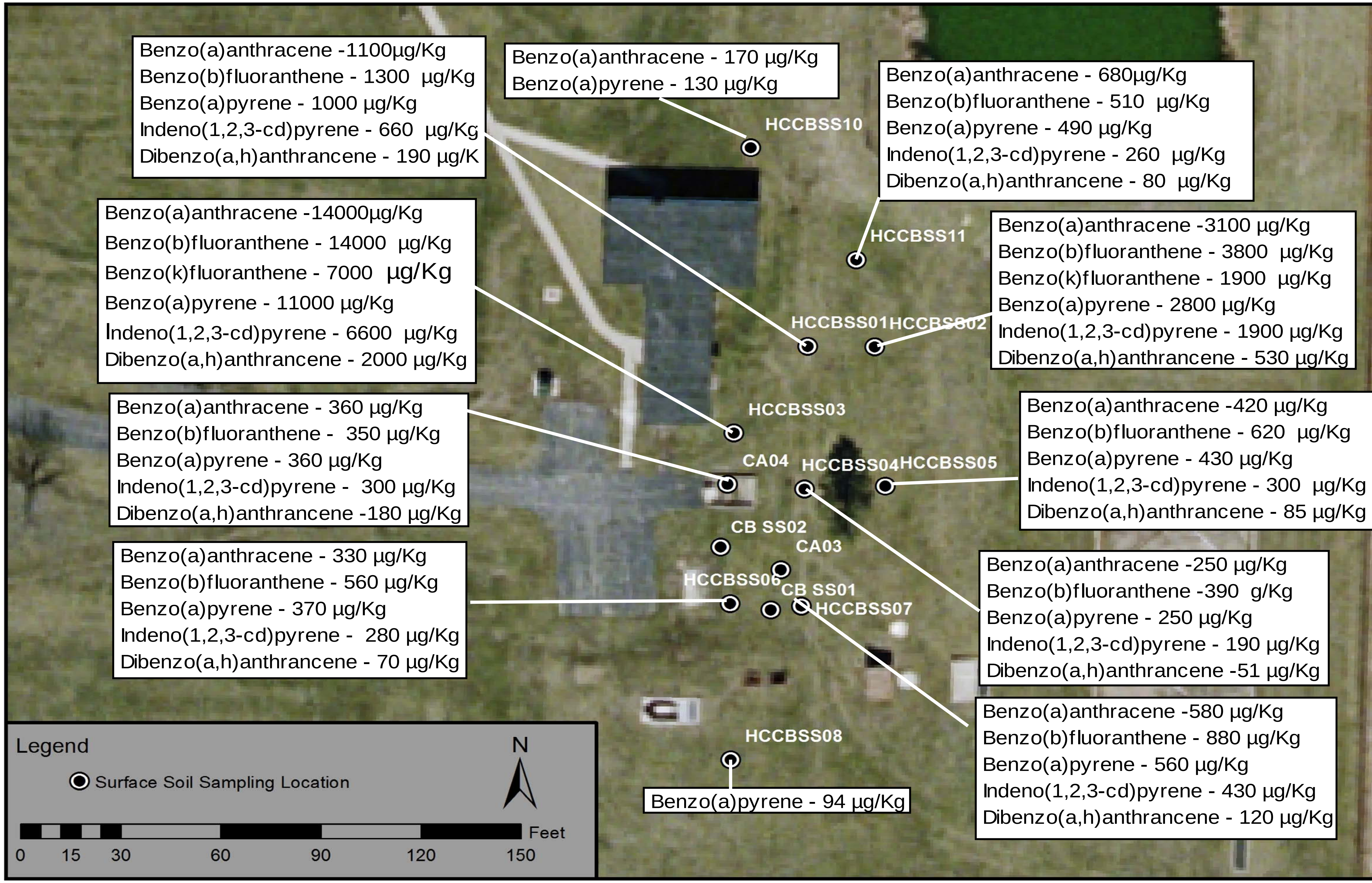

Figure 2-4. PAH exceedances of human health screening criteria in surface soils at Coal Area B

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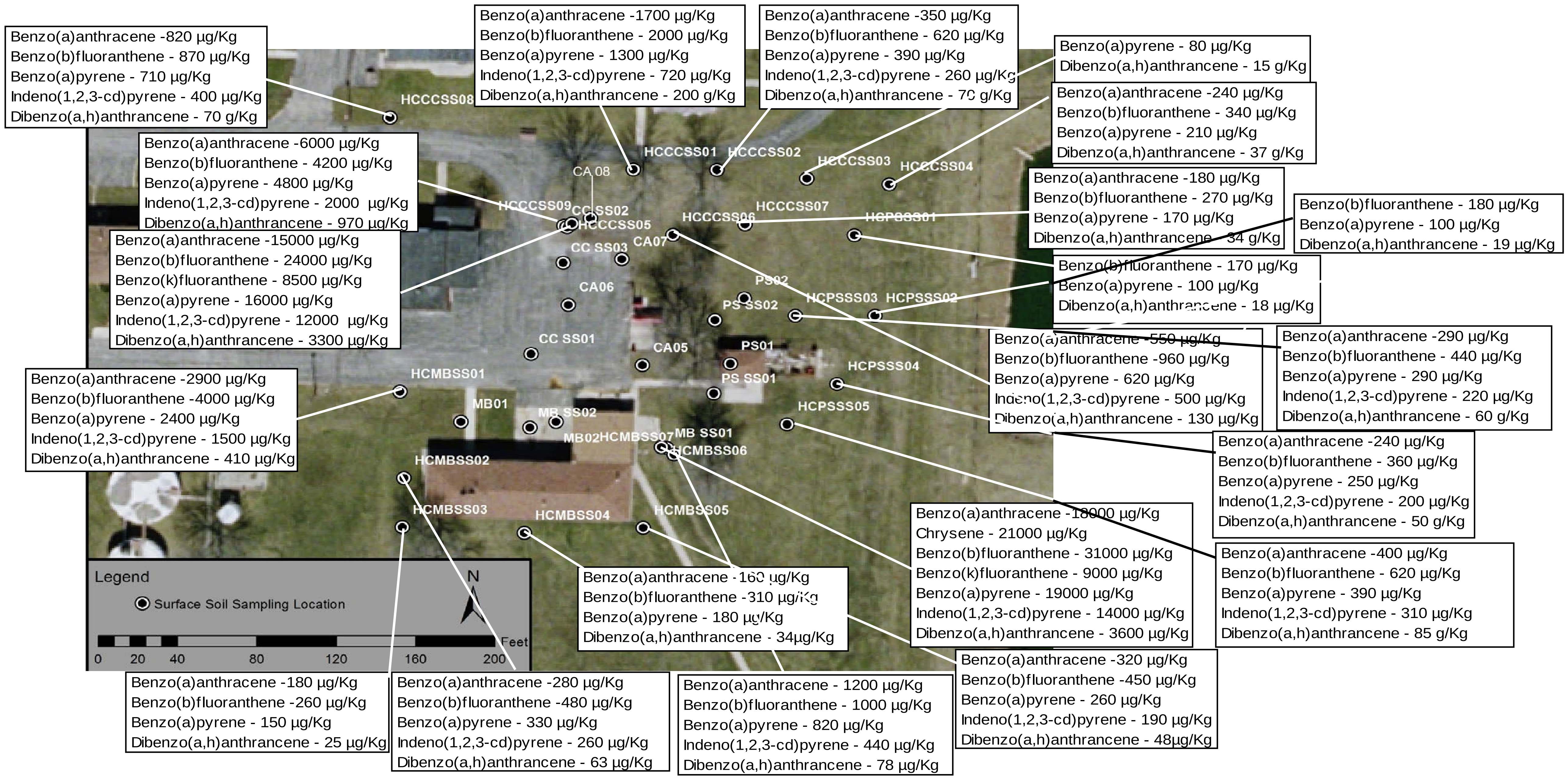

Source for base photo map: Peoria County GIS, 2003

Figure 2-5. PAH exceedances of human health screening criteria in surface soils at Coal Area C

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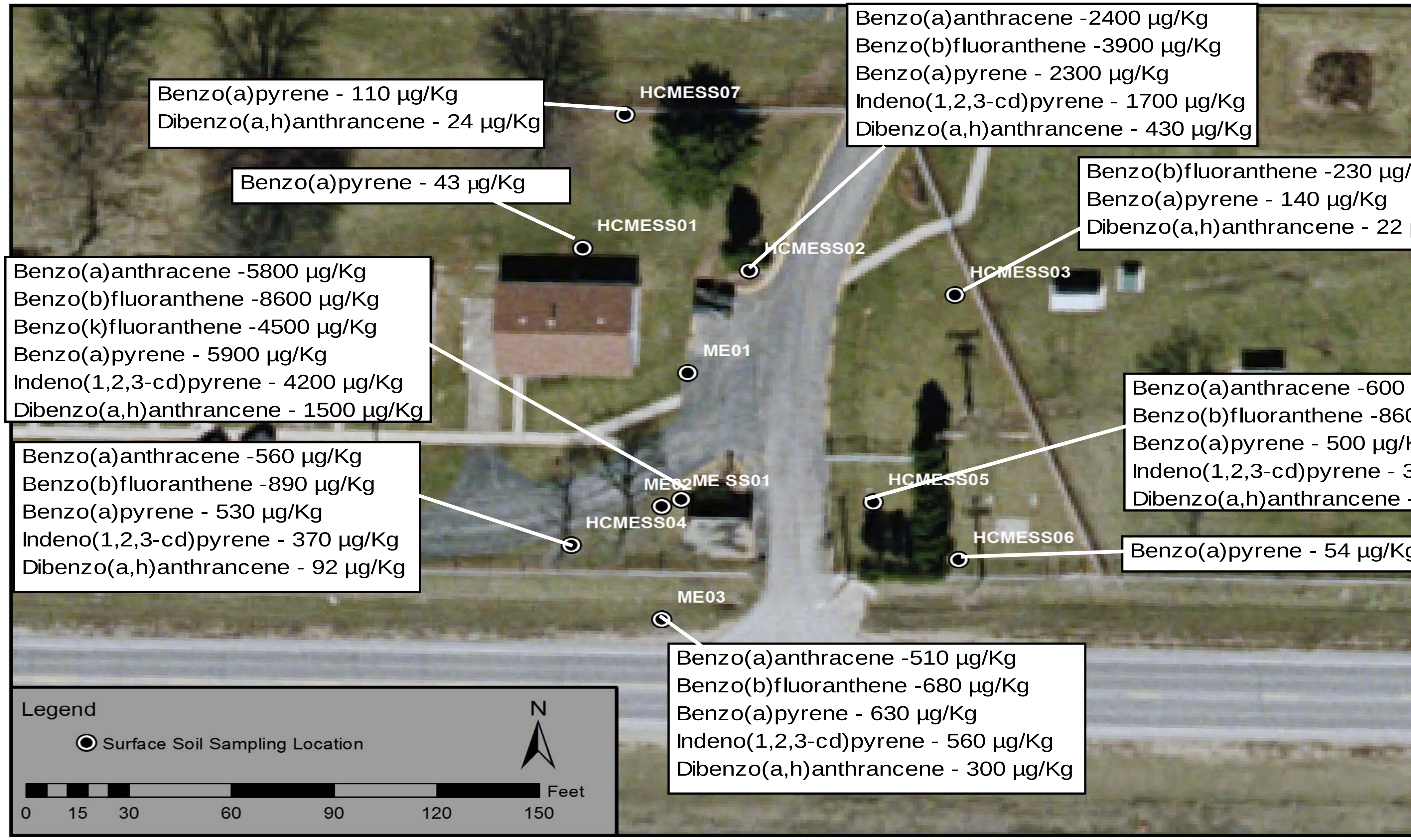

Source for base photo map: Peoria County GIS, 2003

Figure 2-6. PAH exceedances of human health screening criteria in surface soils at the Main Entrance

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Source for base photo map: Peoria County GIS, 2003

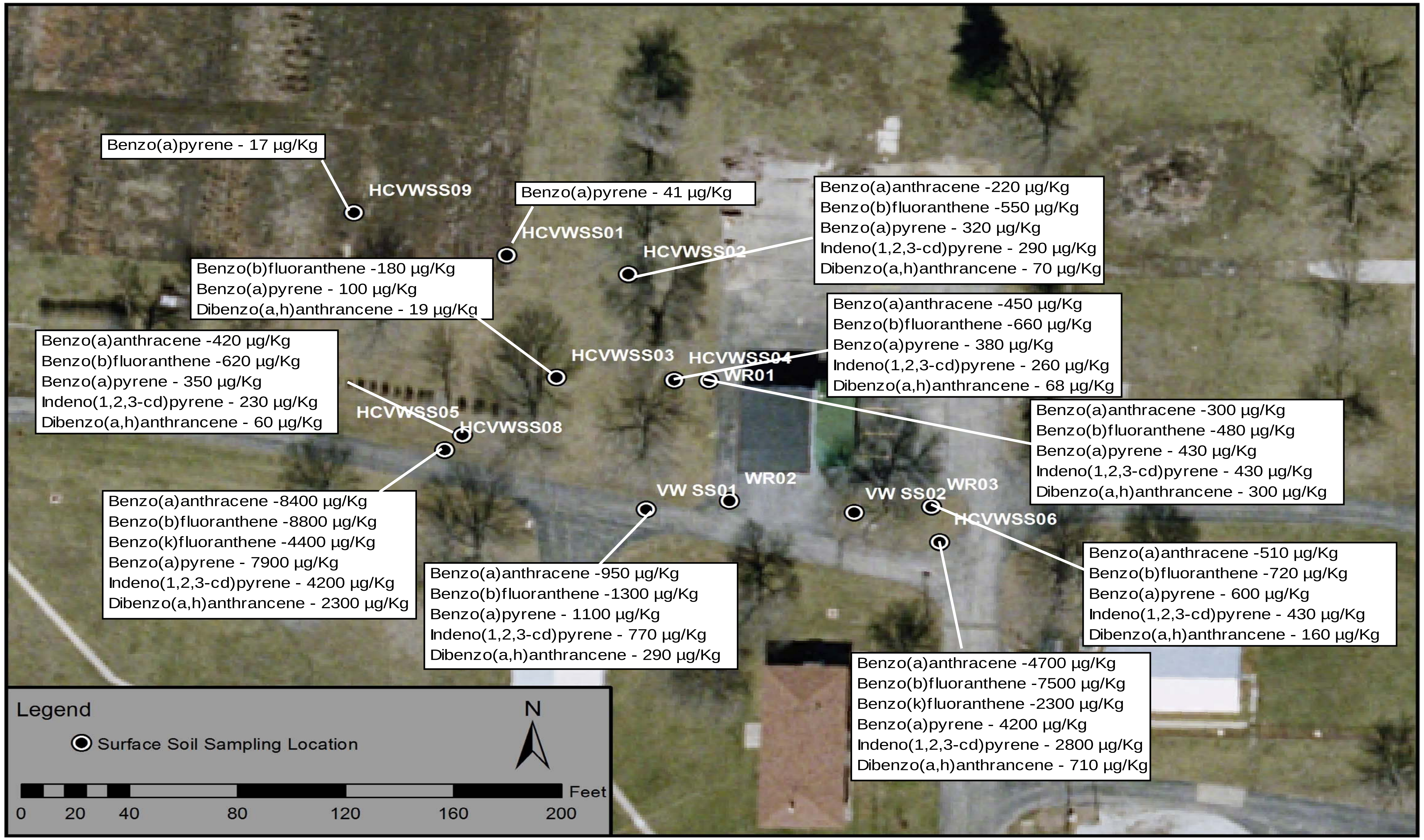

Figure 2-7. PAH exceedances of human health screening criteria in surface soils at the Vehicle Wash Rack

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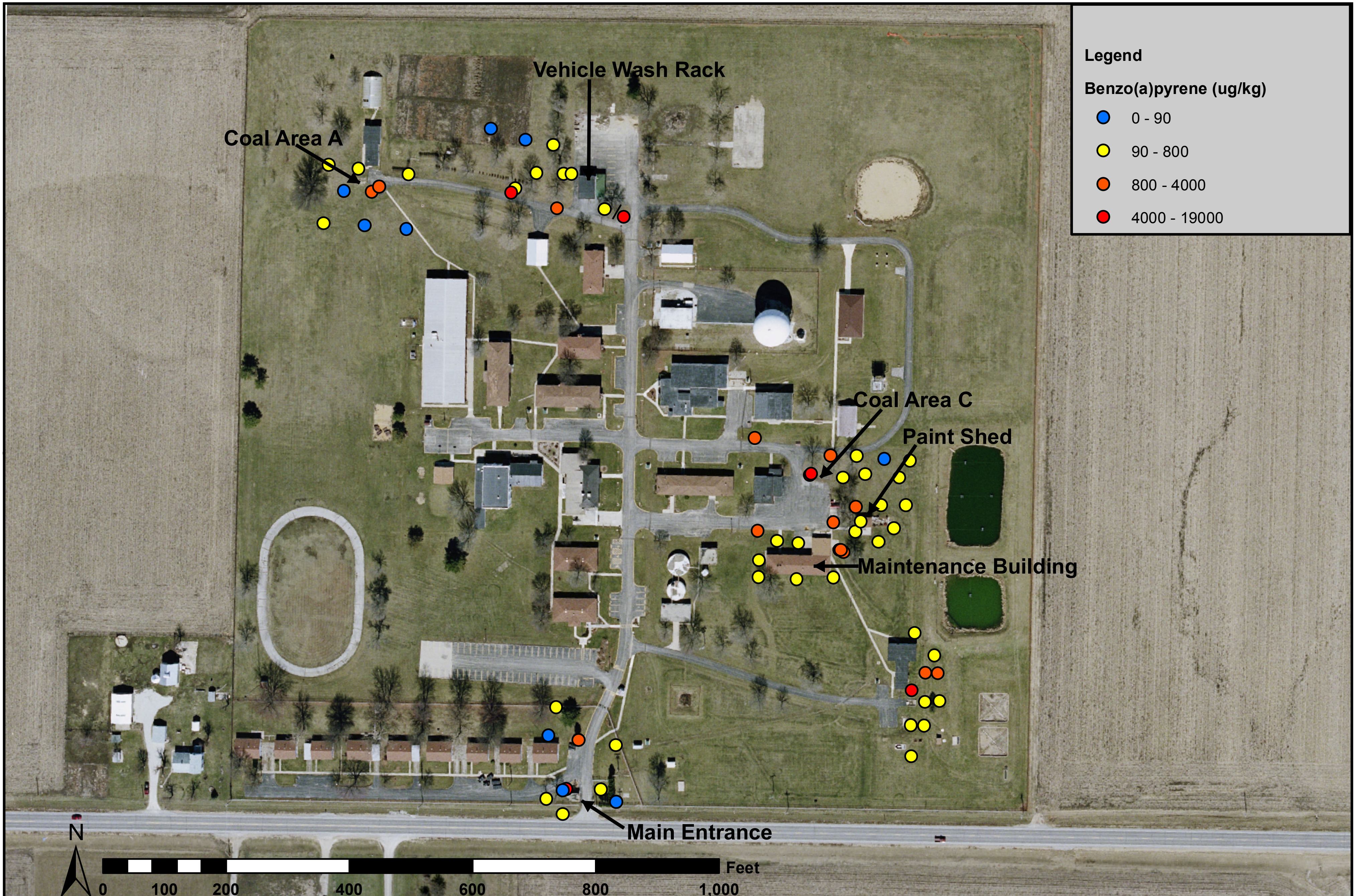

Figure 2-8. Benzo(a)pyrene concentrations in surface soil at HCAFS

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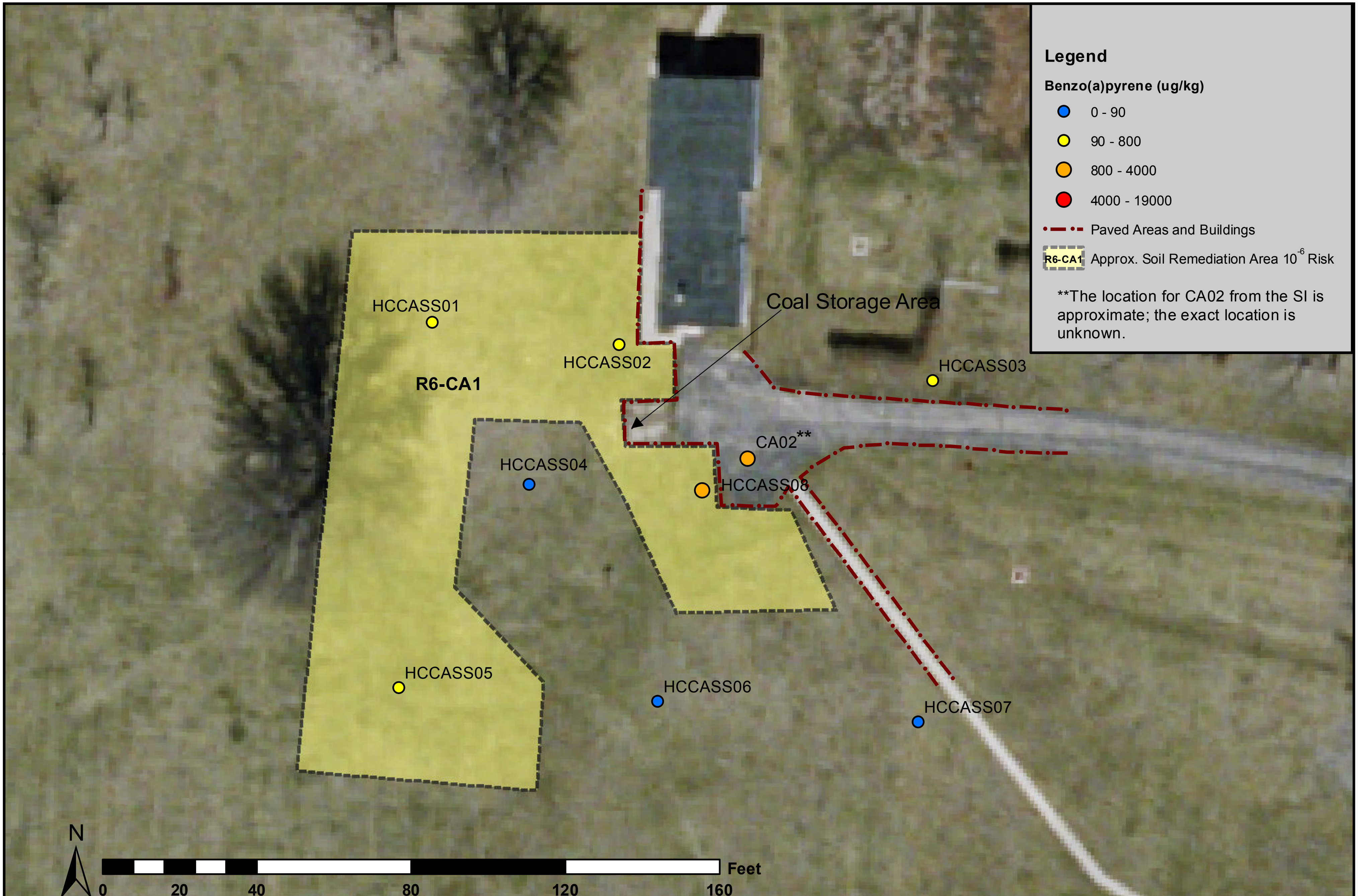

Figure 2-9. Areas requiring surface soil remediation based on Set 1 Preliminary Remediation Goals (Table 2-11), Coal Area A

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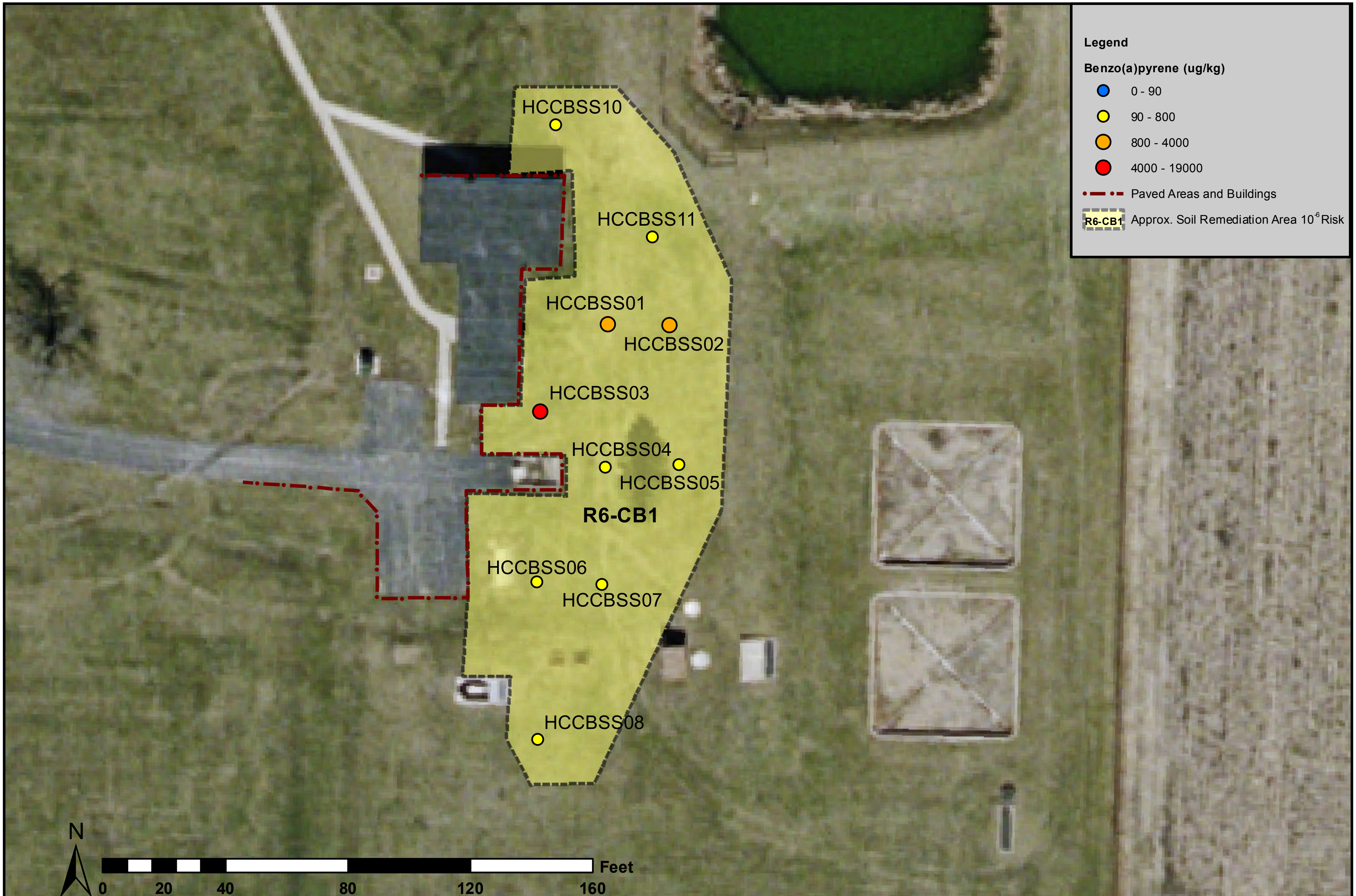

Figure 2-10. Areas requiring surface soil remediation based on Set 1 Preliminary Remediation Goals (Table 2-11), Coal Area B

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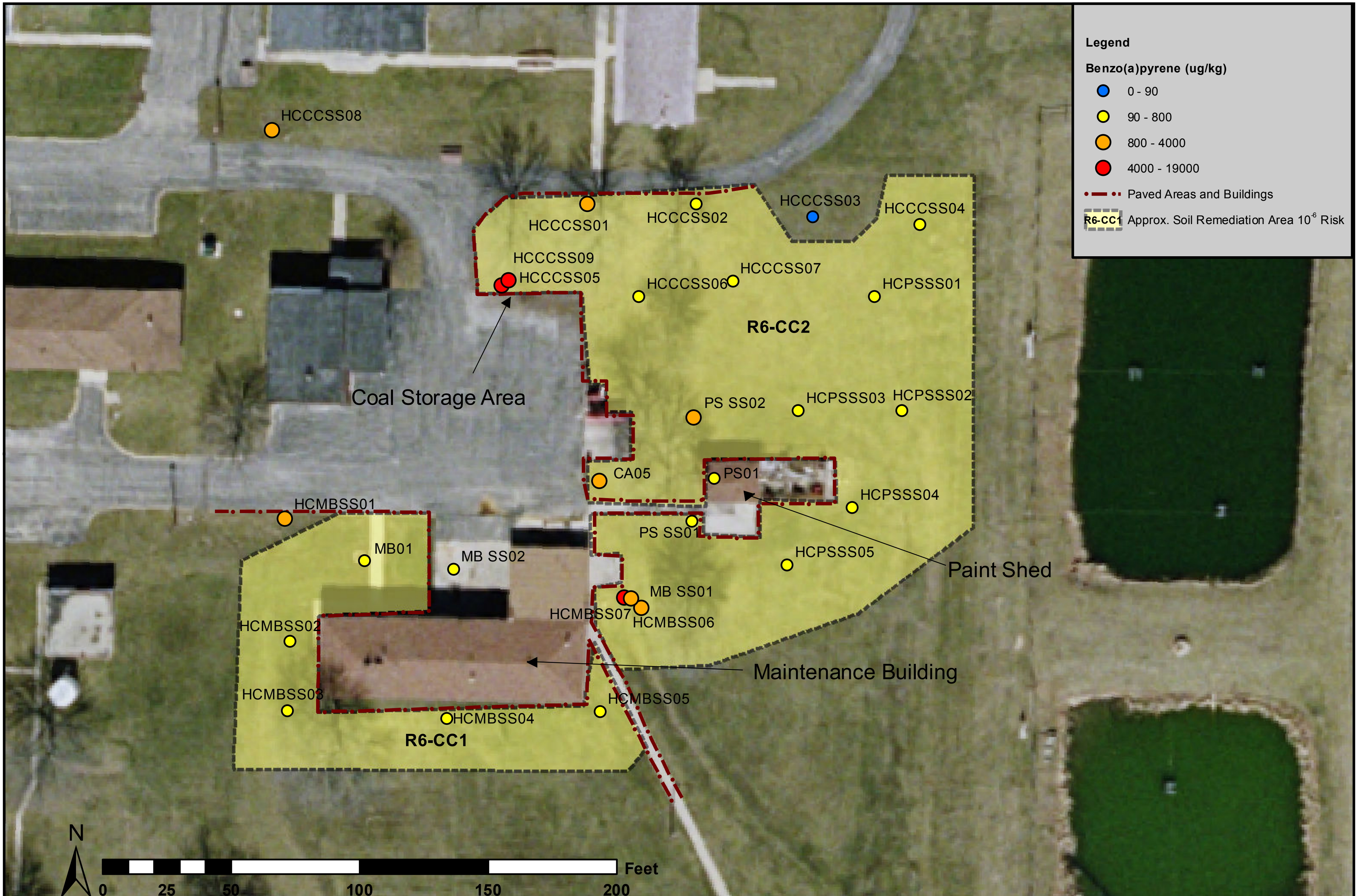

Figure 2-11. Areas requiring surface soil remediation based on Set 1 Preliminary Remediation Goals (Table 2-11), Coal Area C/Maintenance Building/Paint Shed

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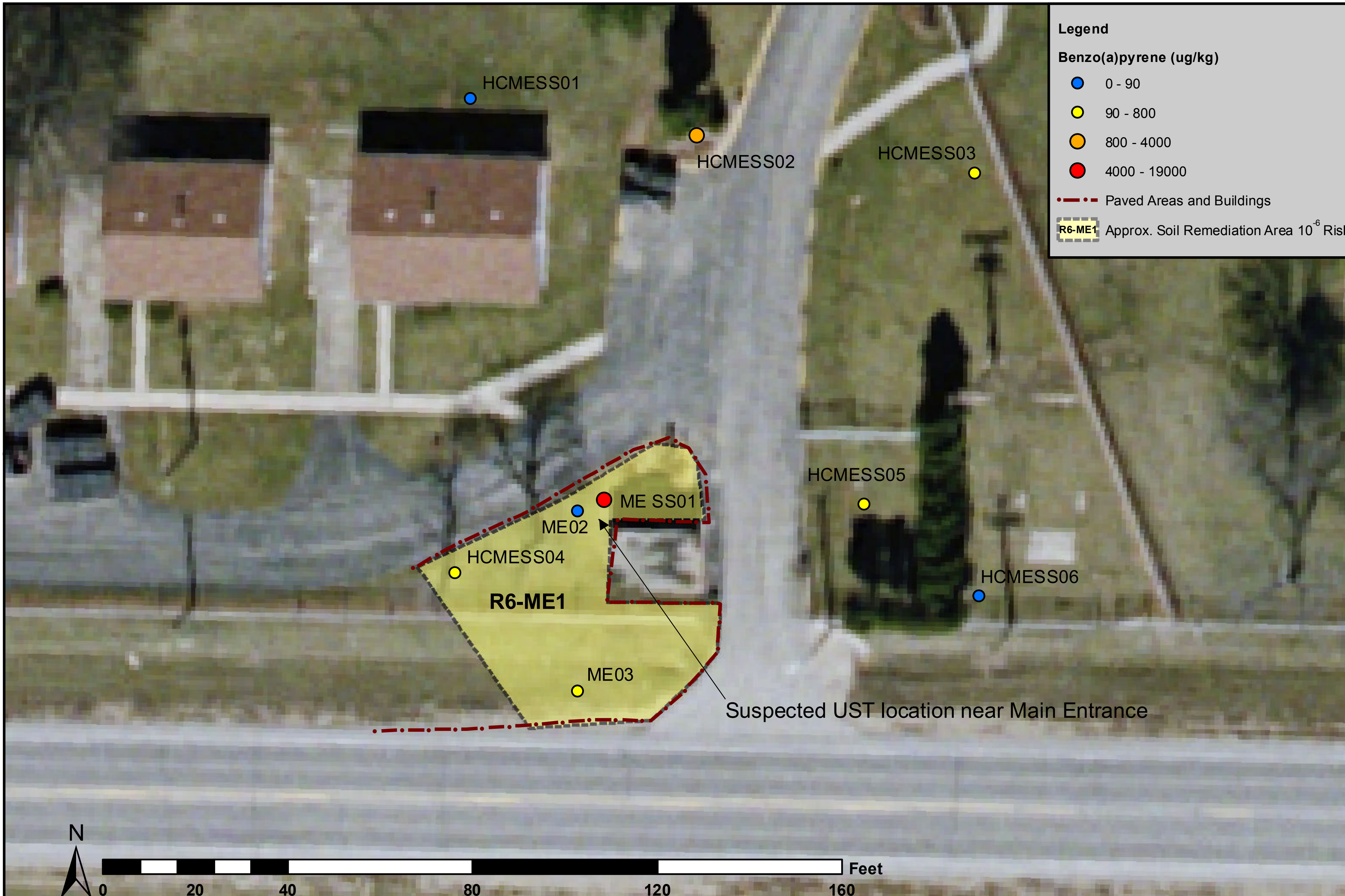

Figure 2-12. Areas requiring surface soil remediation based on Set 1 Preliminary Remediation Goals (Table 2-11), Main Entrance

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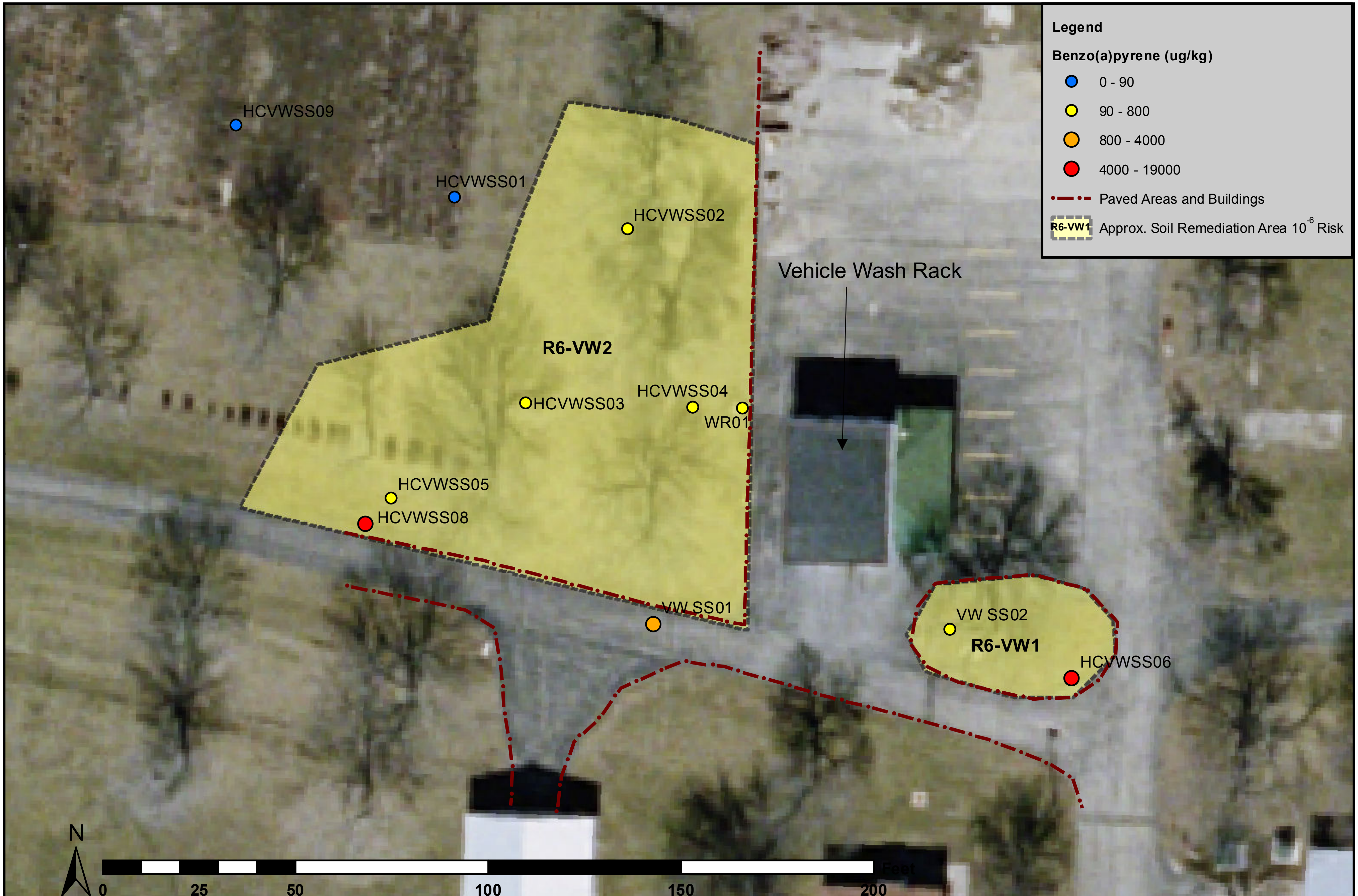

Figure 2-13. Areas requiring surface soil remedation based on Set 1 Preliminary Remediation Goals (Table 2-11), Vehicle Wash Rack

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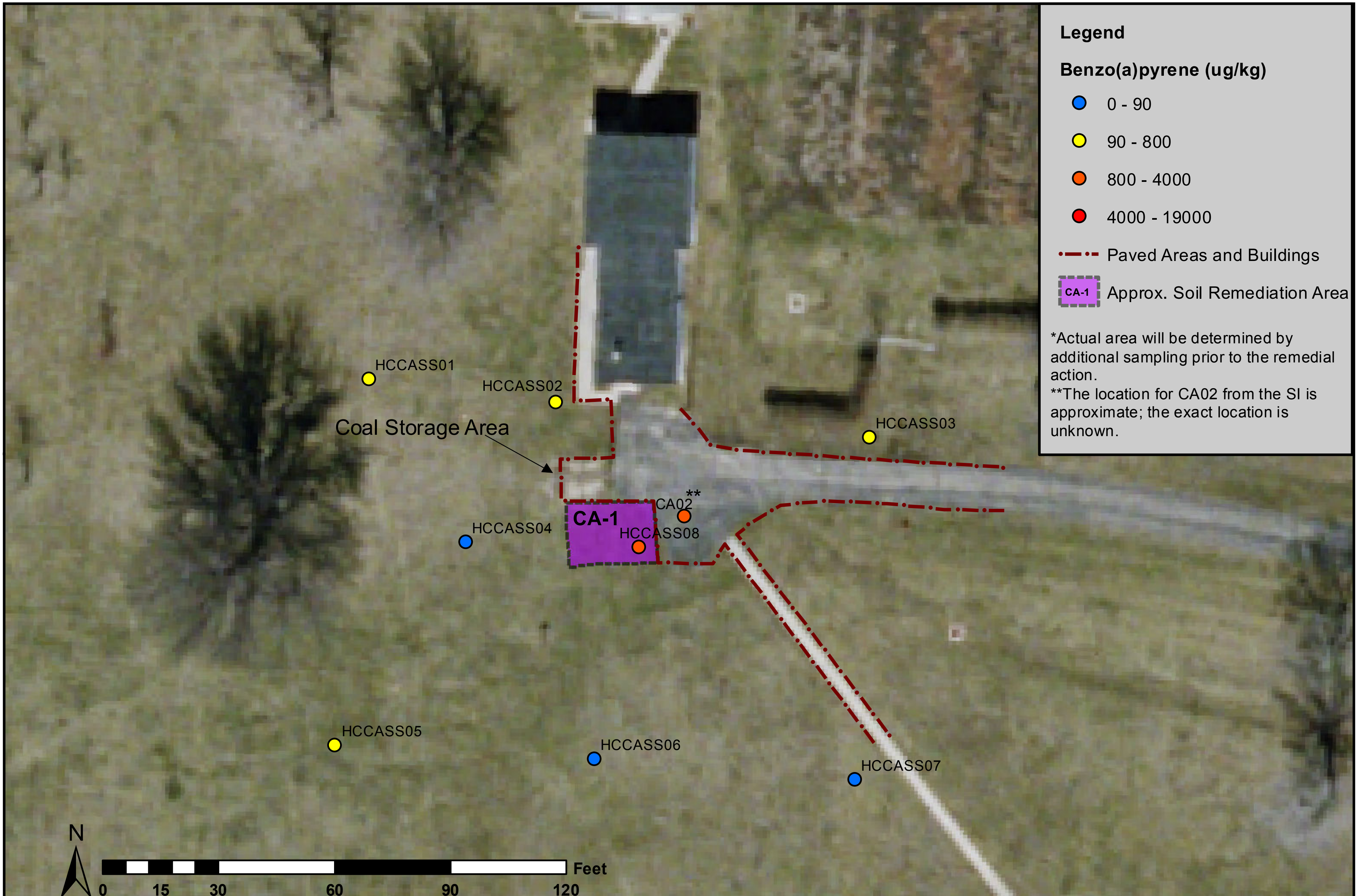

Figure 2-14. Areas requiring surface soil remediation based on Set 2 Preliminary Remediation Goals (Table 2-11), Coal Area A

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Hanna City, Illinois

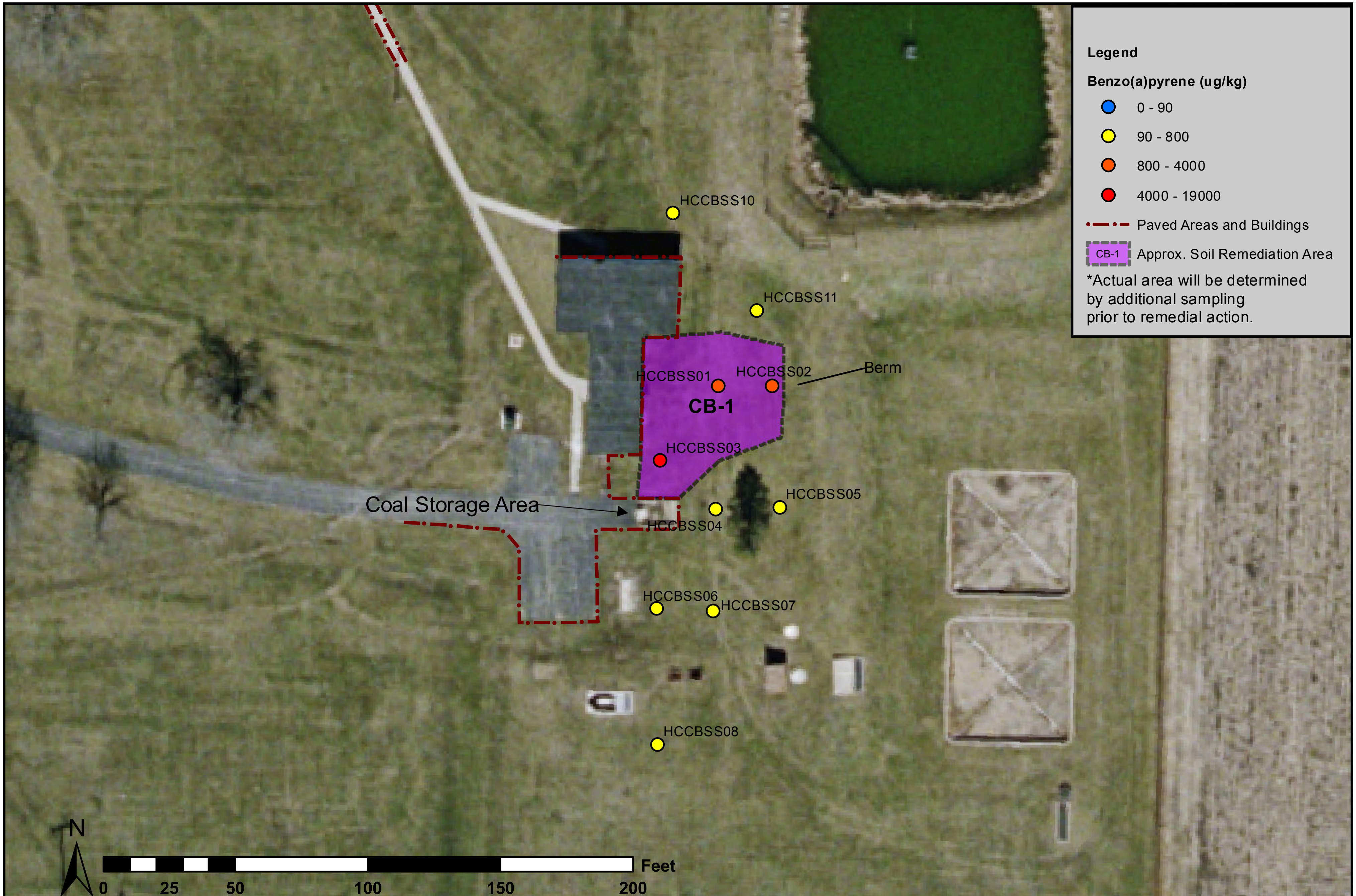

Figure 2-15. Areas requiring surface soil remediation based on Set 2 Preliminary Remediation Goals (Table 2-11), Coal Area B

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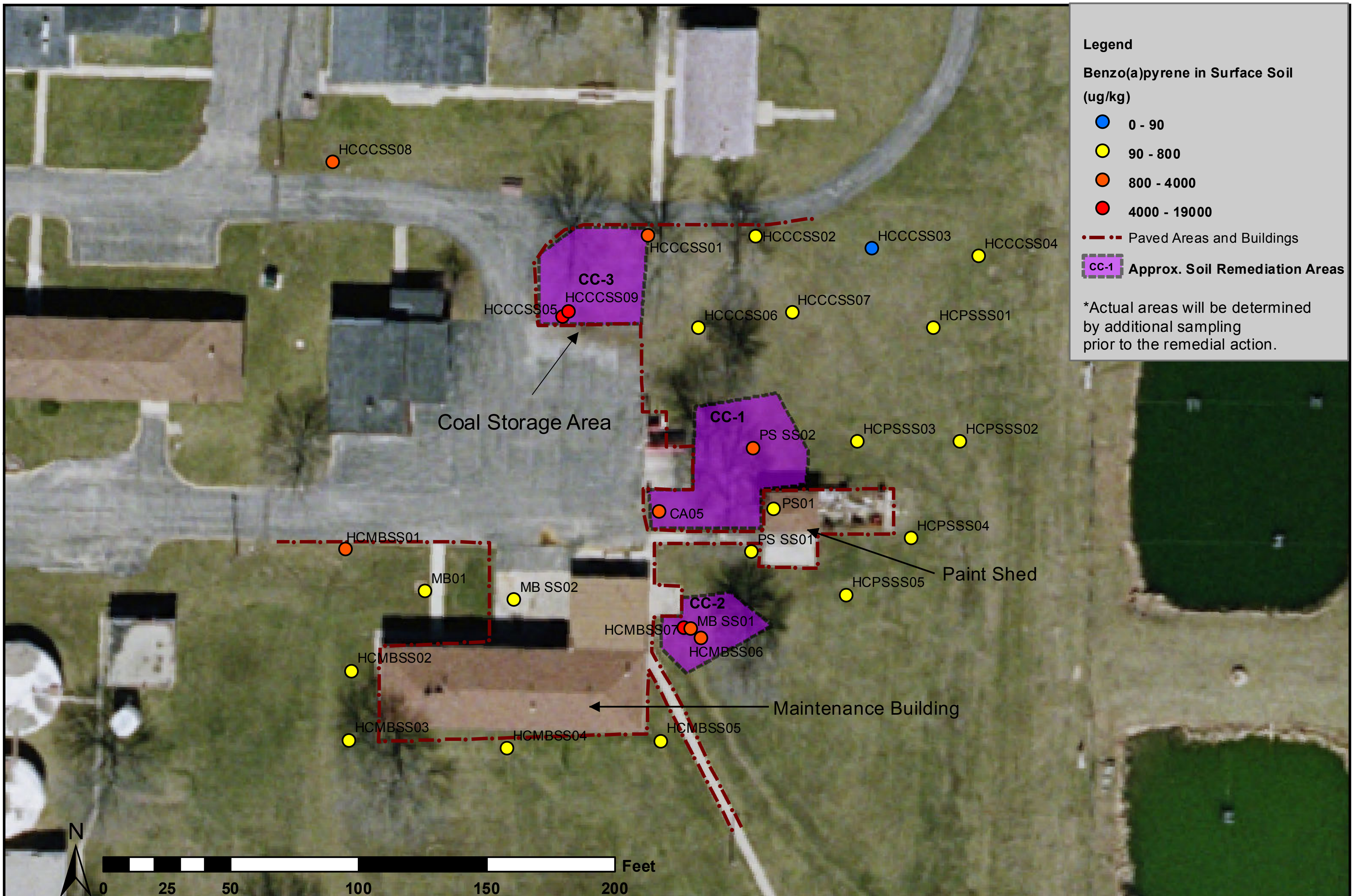

Figure 2-16. Areas requiring surface soil remediation based on Set 2 Preliminary Remediation Goals (Table 2-11), Coal Area C/Maintenance Building/Paint Shed

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Hanna City, Illinois

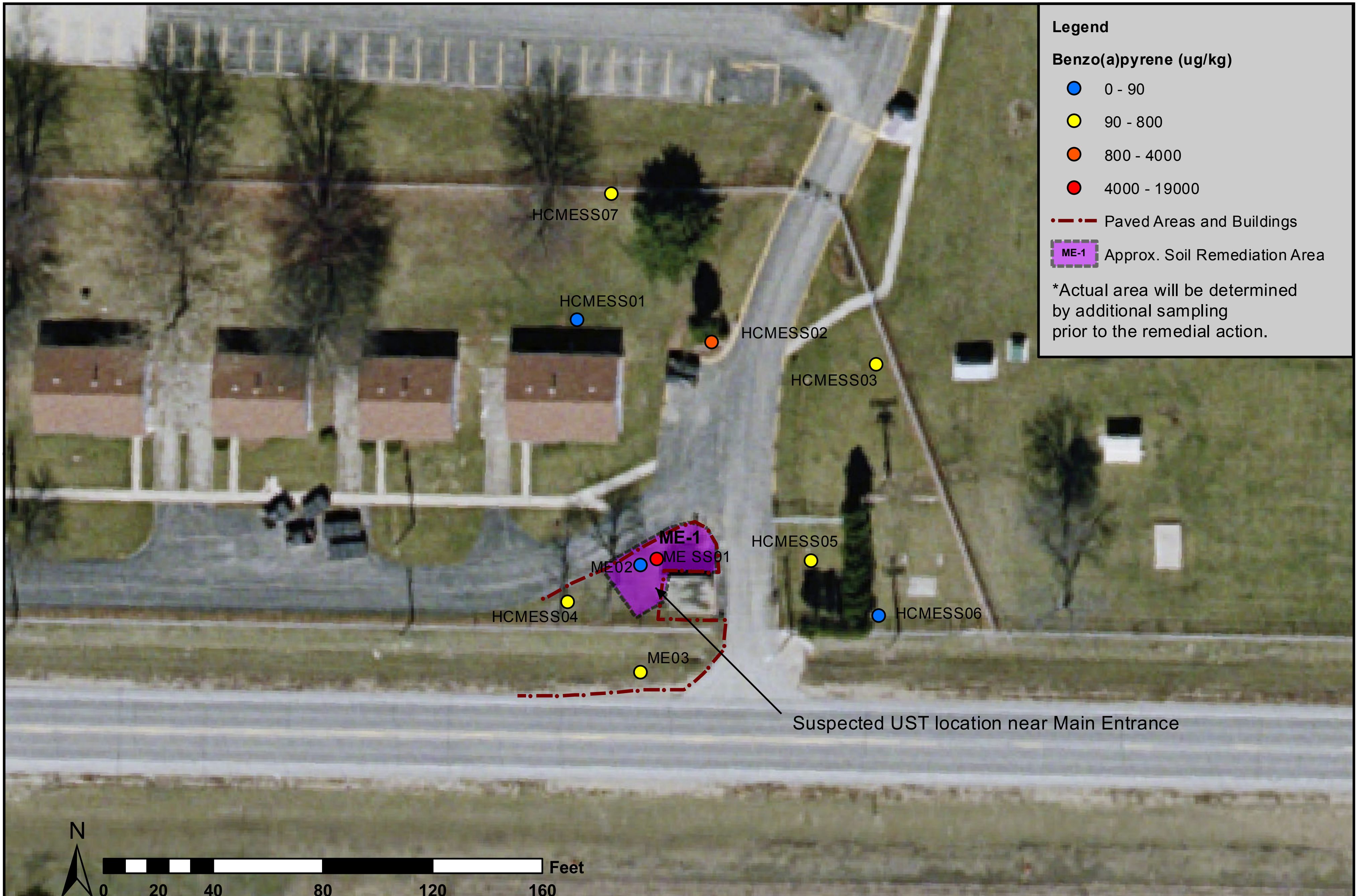

Figure 2-17. Areas requiring surface soil remediation based on Set 2 Preliminary Remediation Goals (Table 2-11), Main Entrance

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Figure 2-18. Exceedances of Set 2 Preliminary Remediation Goals (Table 2-11) at Vehicle Wash Rack; all next to paved areas

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APPENDIX B

TABLES

Table 2-1. Analysis results, metals in groundwater samples

Groundwater Screening Criteria [a]			3500	6	10 [b]	2000	4	5	1200000[c]	1000	1000	650	5000	7.5	1200000[c]	150	2	100	1200000[c]	50	50	1200000[c]	2	49	5000	
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Sample Numbers	**Sampling Date**		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Total Suspended Solids
HCVWGW0401	Nov-08	Result	**10600**	**15**	3	158	**5**	**5**	96000	12.5	15	6.3	**10000**	3.7	48600	**409**	0.2	9.9	1870	5	10	9770	**10**	19.4	24.8	
		Lab Qualifier	N	U	J		U	U	E		U	J					U	J	J	U	U		U	J		
HCVWGW0401F	Nov-08	Result	222	**15**	5	86.9	**5**	**5**	94400	10	15	10	177	3	47100	**246**	0.2	10	5000	5	10	9570	**10**	50	20	
		Lab Qualifier	N	U	U		U	U	E	U	U	U		U			U	U	U	U	U		U	U	U	
HCVWGW0402	Nov-08	Result	2530	**15**	5	133	**5**	**5**	96000	2.2	15	10	1990	3	48000	**209**	0.2	10	5000	5	10	9390	**10**	5.4	7.3	
		Lab Qualifier	N	U	U		U	U	E	J	U	U		U			U	U	U	U	U		U	J	J	
HCVWGW0402F	Nov-08	Result	200	**15**	5	78.7	**5**	**5**	89600	10	5.8	10	100	3	44500	143	0.2	10	5000	5	10	8780	**10**	50	20	
		Lab Qualifier	UN	U	U		U	U	E	U	J	U	U	U			U	U	U	U	U		U	U	U	
HCVWGW0501	Nov-08	Result	106	**15**	5	81	**5**	**5**	77100	3.9	15	10	467	3	34400	**299**	0.2	10	1550	5	10	15200	**10**	50	19.6	
		Lab Qualifier	JN	U	U		U	U	E	J	U	U		U			U	U	J	U	U		U	U	J	
HCVWGW0501F	Nov-08	Result	200	**15**	5	79.2	**5**	**5**	77900	10	15	10	48.1	3	35100	**299**	0.11	10	1470	5	10	15300	**10**	50	16	
		Lab Qualifier	UN	U	U		U	U	E	U	U	U	J	U			B	U	J	U	U		U	U	J	
HCVWGW0701	Nov-08	Result	292	**15**	5	177	**5**	**5**	100000	10	15	10	370	3	49400	**540**	0.2	10	3640	5	10	90100	**10**	50	8.5	
		Lab Qualifier	N	U	U		U	U	E	U	U	U		U			U	U	J	U	U		U	U	J	
HCVWGW0701 F	Nov-08	Result	200	**15**	5	170	**5**	**5**	99200	10	6.5	10	100	3	48500	**490**	0.2	10	3730	5	10	89900	**10**	50	7.1	
		Lab Qualifier	UN	U	U		U	U	E	U	J	U	U	U			U	U	J	U	U		U	U	J	
VW GW01	Apr-06	Result	**18000**	<6	6	200	0.78	2	97000	26	8.4	1.8	**20000**	**12**	52000	**3200**	<0.5	24	2900	<15	<5	96000	2	**50**	43	
		Lab Qualifier			B		B																			
VW GW02	Apr-06	Result	**52000**	<6	**18**	610	2.1	<2	200000	74	15	56	**64000**	**25**	120000	**660**	0.5	48	5700	15	5	47000	2	**140**	120	
		Lab Qualifier					B																			
VW GW03	Apr-06	Result	**34000**	2	**14**	450	1.5	<2	170000	50	9.9	35	**41000**	**14**	100000	**420**	<0.5	32	4600	<15	<5	44000	<2	**96**	78	
		Lab Qualifier		B			B																			
Wash Rack	Jul-96	Result	**36400**	<2.6	**11.7**	814	<1.2	0.34	131000	59.2	<12.3	36.8	**47100**	**13.9**	74400	**646**	<0.16	29.5	2910	<1.6	<3.1	14900	<2	**91.2**	115	
		Lab Qualifier																								
HCCAGW0601	Nov-08	Result	762	**15**	5	46.6	**5**	**5**	62500	2.1	15	10	752	3	32200	**213**	0.2	10	5000	5	10	10900	**10**	50	20	
		Lab Qualifier	N	U	U		U	U	E	J	U	U		U			U	U	U	U	U		U	U	U	
HCCAGW0601F	Nov-08	Result	200	**15**	5	41.7	**5**	**5**	60700	10	15	10	100	3	31300	**216**	0.2	10	5000	3.3	10	10500	**10**	50	20	
		Lab Qualifier	UN	U	U		U	U	E	U	U	U	U	U			U	U	U	J	U		U	U	U	
CA GW01	Apr-06	Result	**6200**	<6	3.4	110	0.29	<2	5400	9.5	2.3	5.8	**7500**	<5	27000	110	<0.5	7.4	1300	12	<5	10000	<2	16	19	
		Lab Qualifier			B		B			B	B	B						B		B					B	
CA GW02	Apr-06	Result	**14000**	<6	<10	150	0.43	<2	64000	19	3.1	8.8	**13000**	6.2	34000	120	<.5	11	2300	4.3	<5	6800	<2	27	30	
		Lab Qualifier					B				B	B								B					B	
Coal Area A	Jul-96	Result	**297000**	<2.6	**10.4**	267	<1.2	<.28	93400	52.8	<13.7	37.2	**39700**	**96.9**	47900	**441**	<.13	39.1	2280	<1.8	<3.1	12900	<1.5	**67.3**	241	
		Lab Qualifier																								
HCCBGW0901	Nov-08	Result	3030	**15**	5.4	170	**5**	**5**	61600	4.1	15	10	3510	3	30700	146	0.2	10	5000	5	10	75200	**10**	6	11.1	
		Lab Qualifier	N	U			U	U	E	J	U	U		U			U	U	U	U	U		U	J	J	
HCCBGW0901 F	Nov-08	Result	200	**15**	5	158	**5**	**5**	62500	10	15	10	1220	3	31100	142	0.2	10	5000	5	10	76200	**10**	50	20	
		Lab Qualifier	UN	U	U		U	U	E	U	U	U		U			U	U	U	U	U		U	U	U	
CB GW01	Apr-06	Result	**4900**	<6	2.3	140	0.22	<2	73000	7.5	1.7	14	**5400**	2.6	37000	100	<0.5	6.5	1200	5.2	<5	34000	<2	13	25	
		Lab Qualifier			B		B			B	B			B						B					B	
CB GW02	Apr-06	Result	**13000**	<6	6.1	270	0.54	<2	65000	20	5.9	16	**13000**	**7.9**	34000	**480**	<0.5	17	2100	6.3	<5	27000	<2	33	39	
		Lab Qualifier			B		B													B				B		
Coal Area B	Jul-96	Result	**16500**	<2.6	**11.6**	1250	<1.5	2	101000	31	<7.8	38.2	**43600**	**43.4**	56000	**359**	<0.1	23.2	2170	<1.5	<3.1	44800	<2	**58.6**	91.8	
		Lab Qualifier																								

***Continued next page ***

Table 2-1. Analysis results, metals in groundwater samples (continued)

Groundwater Screening Criteria [a]			3500	6	10 [b]	2000	4	5	1200000[c]	1000	1000	650	5000	7.5	1200000[c]	150	2	100	1200000[c]	50	50	1200000[c]	2	49	5000	
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Sample Numbers	**Sampling Date**		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Total Suspended Solids
HCPSGW0201	Nov-08	Result												3												8.4
		Lab Qualifier												U												
HCPSGW0201F	Nov-08	Result												3												
		Lab Qualifier												U												
HCPSGW0301	Nov-08	Result												3												160
		Lab Qualifier												U												
HCPSGW0401	Nov-08	Result												3												
		Lab Qualifier												U												40.5
HCPSGW0401F	Nov-08	Result												3												
		Lab Qualifier												U												
HCPSGW0402	Nov-08	Result												3												
		Lab Qualifier												U												
HCPSGW0501	Nov-08	Result												3												
		Lab Qualifier												U												
PS GW01	Apr-06	Result												**7.7**												
		Lab Qualifier																								
PS GW03	Apr-06	Result												6.2												
		Lab Qualifier																								
PS GW02	Apr-06	Result												3.6												
		Lab Qualifier																								
Paint Shed	7/1006	Result												**48.1**												
		Lab Qualifier																								
HCCCGW0601	Nov-08	Result	**6280**	**15**	4.2	108	5	5	68300	8.5	15	10	4970	3	38000	**198**	0.2	5.1	5000	5	10	31700	10	11.1	12.9	
		Lab Qualifier		U	J		U	U		J	U	U		U				J	U	U	U		U	J	J	
HCCCGW0601F	Nov-08	Result	200	**15**	5	64.3	5	5	66400	2.8	6.8	10	100	3	36400	149		10	5000	5	10	30200	10	50	20	
		Lab Qualifier	U	U	U		U	U		J	J	U	U	U				U	U	U	U		U	U	U	
CC GW01	Apr-06	Result	**59000**	3.9	18	580	2.4	<2	210000	92	19	56	**64000**	36	130000	**1100**	0.12	56	7000	<15	5	36000	<2	**140**	160	
		Lab Qualifier		B			B										B									
CC GW02	Apr-06	Result	**43000**	<6	21	610	2.1	<2	210000	68	13	53	**58000**	21	120000	**650**	<0.5	42	5900	<15	1.1	33000	<2	**120**	120	
		Lab Qualifier					B														B					
CC GW03	Apr-06	Result	2200	<6	<10	74	<4	<2	70000	3.1	<5	<10	1700	<5	38000	13	<0.5	2.6	700	<15	<5	26000	<2	5.5	<100	
		Lab Qualifier								B								B								

[a] Groundwater screening criteria consists of the lower value between TACO Class I groundwater and Maximum Contaminant Levels (MCLs).
[b] The TACO Class I standard for arsenic is 50 ug/L.
[c]This chemical is included in the Total Dissolved Solids (TDS) Groundwater Quality Standard of 1,200 mg/l pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.
J - Result is an estimated value below the reporting limit.
JD - Result is an estimated value due to high RPD.
a - Concentration is below the method reporting limit.
M - Manually integrated compound.
H - Alternate peak selection upon analytical review.
Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.
X - Indicates a positive bias.
Y - Indicates a negative bias.
B - this compound was also detected in the method blank and the correct sample result may be less than the reported result.

Table 2-2. Analysis results, PAHs in surface soils from Coal Area A

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria*		**3900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCASS01 01 (0-1.0')	Aug-08	5.4	J	7.4	U	5.9	J	5	J	94		14		190		150		120	
HCCASS02 01 (0-1.0')	Aug-08	6.9		7.4		26		21		310		61		610		480		**270**	
HCCASS03 01 (0-1.0')	Aug-08	5.2	U	1.7	J	6.6		5.5	J	140		17		350		270		**160**	
HCCASS04 01 (0-1.0')	Aug-08	7.8		7.1	U	3.1	J	2.3	J	63		7.5	J	140		110		53	
HCCASS04 02 (0-1.0')	Aug-08	6.4	J	7.1	U	4.9	J	3.3	J	75		8.9		150		110		64	
HCCASS05 01 (0-1.0')	Aug-08	4.9	J	2.4	J	12		8.5		120		16		230		170		120	
HCCASS06 01 (0-1.0')	Aug-08	5.2	U	5.6	U	5.6	U	6.4	U	12		1.5	J	30		23		14	
HCCASS07 01 (0-1.0')	Aug-08	6.1		5.7	U	2.1	J	1.8	J	20		2.7	J	49		37		29	
HCCASS08 01 (0-1.0')	Nov-08	38		42		130		120		2400	D	790		6300	D	5300	D	**3500**	DX
CA02 (0-0.5')	Jul-96	4100		400		4200		390		3,400		770		5,400		3,300		**1,700**	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-2. Analysis results, PAHs in surface soils from Coal Area A (continued)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCASS01 01 (0-1.0')	Aug-08	120		150		56		**97**		65		**18**		6.3	J	79	
HCCASS02 01 (0-1.0')	Aug-08	270		**390**		180		**240**		**160**		**44**		10		180	
HCCASS03 01 (0-1.0')	Aug-08	190		**250**		86		**150**		86		**22**		5.5	U	100	
HCCASS04 01 (0-1.0')	Aug-08	56		89		28		**55**		42		11		4.9	J	51	
HCCASS04 02 (0-1.0')	Aug-08	68		110		30		**63**		48		13		12		60	
HCCASS05 01 (0-1.0')	Aug-08	120		**160**		53		**100**		70		**18**		4.3	J	84	
HCCASS06 01 (0-1.0')	Aug-08	17		25		7.4		13		12		2.6	J	5.5	U	5.6	U
HCCASS07 01 (0-1.0')	Aug-08	31		41		12		**20**		16		3.7	J	3.6	J	21	
HCCASS08 01 (0-1.0')	Nov-08	3300	D	**2800**	DY	**2000**		**3000**	D	**2300**		**650**		24		2300	
CA02 (0-0.5')	Jul-96	2,200		**1,800**		930		**1,900**		**1,500**		**690**		NA		870	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-3. Analysis results, PAHs in surface soils from Coal Area B

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria*		**3900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCBSS01 01 (0-1.0')	Aug-08	32		28		210		170		1900		440		2800		2100		**1100**	
HCCBSS02 01 (0-1.0')	Aug-08	330	D	860	D	71	UD	740	D	9400	D	870	D	10000	D	7300	D	**3100**	**D**
HCCBSS02 02 (0-1.0')	Aug-08	6.3		3	J	15		11		160		35		400		310		**220**	
HCCBSS03 01 (0-1.0')	Aug-08	710	D	310	UD	3300	D	2400	D	26000	D	6100	D	35000	D	27000	D	**14000**	D
HCCBSS04 01 (0-1.0')	Aug-08	8.7		3.6	J	20		16		250		51		560		450		**250**	
HCCBSS05 01 (0-1.0')	Aug-08	14	D	13	UD	79	D	56	D	650	D	150	D	1100	D	840	D	**420**	D
HCCBSS06 01 (0-1.0')	Aug-08	7.5		7.1		15		12		290		52		860		670		**330**	
HCCBSS07 01 (0-1.0')	Aug-08	28	JD	32	UD	140	D	120	D	1200	D	220	D	1600	D	1200	D	**580**	D
HCCBSS08 01 (0-1.0')	Nov-08	5.7	U	6.1	U	3.4	J	3.1	J	72		7	U	200		140		120	
HCCBSS10 01 (0-1.0')	Nov-08	13		6	U	24		21		250		60		280		220		**170**	
HCCBSS11 01 (0-1.0')	Nov-08	10		5.8	J	70		61		690		160		830	D	780		**680**	
CA04 (0-0.5')	Jul-96	86	U	86	U	2300		120		620		90		870		640		**360**	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-3. Analysis results, PAHs in surface soils from Coal Area B (continued)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCBSS01 01 (0-1.0')	Aug-08	1100		**1300**		520		**1000**		**660**		**190**		74		730	
HCCBSS02 01 (0-1.0')	Aug-08	3500	D	**3800**	D	**1900**	D	**2800**	D	**1900**	D	**530**	D	150	D	2000	D
HCCBSS02 02 (0-1.0')	Aug-08	210		**290**		110		**200**		150		**39**		4.9	J	170	
HCCBSS03 01 (0-1.0')	Aug-08	14000	D	**14000**	D	**7000**	D	**11000**	D	**6600**	D	**2000**	D	660	D	7000	D
HCCBSS04 01 (0-1.0')	Aug-08	240		**390**		130		**250**		**190**		**51**		13		230	
HCCBSS05 01 (0-1.0')	Aug-08	400	D	**620**	D	220	D	**430**	D	**300**	D	**85**	D	10	JD	340	D
HCCBSS06 01 (0-1.0')	Aug-08	340		**560**		180		**370**		**280**		**70**		5.4	J	330	
HCCBSS07 01 (0-1.0')	Aug-08	560	D	**880**	D	260	D	**560**	D	**430**	D	**120**	D	26	JD	490	D
HCCBSS08 01 (0-1.0')	Nov-08	130	X	96	Y	36		**94**		53		8.6		6	U	57	
HCCBSS10 01 (0-1.0')	Nov-08	190	X	130	Y	77		**130**		65		12		25		66	
HCCBSS11 01 (0-1.0')	Nov-08	710	X	**510**	Y	290		**490**		**260**		**80**		8.6		250	
CA04 (0-0.5')	Jul-96	390		**350**		160		**360**		**300**		**180**		NA		120	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-4. Analysis results, PAHs in surface soils from Coal Area C

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria*		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCCSS01 01 (0-1.0')	Aug-08	32	D	28	D	110	D	150	D	2400	D	970	D	4000	DE	3000	D	**1700**	D
HCCCSS02 01 (0-1.0')	Aug-08	14	D	15	D	32	D	25	D	490	D	74	D	1000		780	D	**350**	
HCCCSS03 01 (0-1.0')	Aug-08	4.2	J	1.7	J	6.3		4.7	J	100		12		190		140		92	
HCCCSS04 01 (0-1.0')	Aug-08	4.4	J	5	J	9.8		7.4	J	160		32		480		360		**240**	
HCCCSS05 01 (0-1.0')	Aug-08	510	UD	550	UD	1500		1200	D	21000	D	3500	D	42000	DE	32000	D	**15000**	D
HCCCSS05 02 (0-1.0')	Aug-08	260	UD	370	UD	1700		1300	D	21000	D	5100	D	41000	D	31000	D	**14000**	D
HCCCSS06 01 (0-1.0')	Aug-08	31	D	26	D	45		40		1100	D	120	D	1700	D	1300	D	**550**	D
HCCCSS07 01 (0-1.0')	Aug-08	7.4		6.4	U	20		13		240		37		440		340		**180**	
HCCCSS08 01 (0-1.0')	Nov-08	5.7		5.8	U	43		33		640		140		1200	D	1000	D	**820**	
HCCCSS08 02 (0-1.0')	Nov-08	13		5.7	U	100		100		2400		360		3900	D	3100	D	**1700**	D
HCCCSS09 01 (0-1.0')	Nov-08	130		5.9		700		540		7400	D	340	UD	13000	D	11000	D	**6000**	DX
CA05 (0-0.5')	Jul-96	**10,000**		1,200		6,900		5,600		5,400		1,100		7,800		5,400		**2,700**	
HCMBSS01 01 (0-1.0')	Aug-08	64	D	40	D	120	D	110	D	2600	D	380	D	5700	D	4200	D	**2900**	D
HCMBSS02 01 (0-1.0')	Aug-08	8.2		22		12		9.9		240		33		710		560		**280**	
HCMBSS03 01 (0-1.0')	Aug-08	5.5		6.2		11		8.7		160		24		370		280		**180**	
HCMBSS04 01 (0-1.0')	Aug-08	5	J	9		8.9		6.7	J	140		22		400		310		**160**	
HCMBSS05 01 (0-1.0')	Aug-08	12		19		13		9.2		250		35		600		450		**320**	
HCMBSS06 01 (0-1.0')	Aug-08	560	UD	610	UD	1100	D	1300	D	27000	D	4900	D	52000	D	39000	D	**18000**	D
HCMBSS07 01 (0-1.0')	Nov-08	78		6.4	U	120		58		1500		210		1800	D	1500	D	**1200**	
MB SS01 (0-0.5')	Apr-06	38	Ja JD	180		26	Ja	29	Ja	500		110		960		750		**530**	
MB SS02 (0-0.5')	Apr-06	16	Ja	40	U	8.3	Ja	11	Ja	250		30	Ja	610		420		**190**	
MB SS03 (0-0.5')	Apr-06	130		120		48		37	Ja	920		130		1200		1100		**600**	
MB01 (0-0.5')	Jul-96	2100		92	U	1500		110		1200		160		1800		1300		**730**	
HCPSSS01 01 (0-1.0')	Aug-08	7.8		2.4	J	7.6		6.6	J	6.6	J	20		240		180		120	
HCPSSS02 01 (0-1.0')	Aug-08	6.1		2.6	J	8.2		4.8	J	100		13		200		150		110	
HCPSSS03 01 (0-1.0')	Aug-08	19		6.5	U	28		20		350		57		660		520		**290**	
HCPSSS04 01 (0-1.0')	Aug-08	15		5.9	U	50		32		350		57		680		550		**240**	
HCPSSS05 01 (0-1.0')	Aug-08	21	D	12	UD	87		51	D	600	D	110	D	990	D	790	D	**400**	D
PS SS01(0-0.5')	Apr-06	32	Ja JD	44		24	Ja JD	28	Ja JD	550	JD	70	JD	890	JD	710	JD	**420**	JD
PS SS02 (0-0.5')	Apr-06	54		41	U	11	Ja	11	Ja	240		27	Ja	350		270		140	
PS SS03 (0-0.5')	Apr-06	540		53		2400		1700		15000		2400		16000		14000		**8000**	
PS01 (0-0.5')	Jul-96	320		94	U	550		23	U	110		16		480		440		**260**	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

H - Alternate peak selection upon analytical review.

Table 2-4. Analysis results, PAHs in surface soils from Coal Area C (continued)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCCSS01 01 (0-1.0')	Aug-08	1700	D	**2000**	D	760	D	**1300**	D	**720**	D	**200**	D	98		840	D
HCCCSS02 01 (0-1.0')	Aug-08	430	D	**620**	D	220	D	**390**	D	**260**	D	**70**	D	13	D	320	D
HCCCSS03 01 (0-1.0')	Aug-08	110		140		41		**80**		56		**15**		10		69	
HCCCSS04 01 (0-1.0')	Aug-08	260		**340**		110		**210**		140		**37**		5.9	J	170	
HCCCSS05 01 (0-1.0')	Aug-08	13000	D	**24000**	D	**8500**	D	**16000**	D	**12000**	D	**3300**	D	340	JD	14000	D
HCCCSS05 02 (0-1.0')	Aug-08	**18000**	D	**20000**	D	**11000**	D	**15000**	D	**12000**	D	**3300**	D	320	JD	15000	D
HCCCSS06 01 (0-1.0')	Aug-08	730	D	**960**	D	320	D	**620**	D	**500**	D	**130**	D	140	D	590	D
HCCCSS07 01 (0-1.0')	Aug-08	220		**270**		97		**170**		130		**34**		20		170	
HCCCSS08 01 (0-1.0')	Nov-08	1100	X	**870**	Y	400		**710**		**400**		**70**		6.8		400	
HCCCSS08 02 (0-1.0')	Nov-08	1900	D	**1600**	D	1400		**2300**		**1300**		**360**		13		1300	
HCCCSS09 01 (0-1.0')	Nov-08	4700	D	**4200**	DY	2900	D	**4800**	D	**2000**	D	**970**		180		2600	D
CA05 (0-0.5')	Jul-96	3,800		**3,100**		1,400		**2,700**		**2,300**		**1,400**		NA		1,600	
HCMBSS01 01 (0-1.0')	Aug-08	3400	D	**4000**	D	1400	D	**2400**	D	**1500**	D	**410**	D	41	D	1800	D
HCMBSS02 01 (0-1.0')	Aug-08	310		**480**		180		**330**		**260**		**63**		14		300	
HCMBSS03 01 (0-1.0')	Aug-08	210		**260**		84		**150**		100		**25**		7.9		120	
HCMBSS04 01 (0-1.0')	Aug-08	200		**310**		87		**180**		130		**34**		5.8	J	160	
HCMBSS05 01 (0-1.0')	Aug-08	350		**450**		140		**260**		**190**		**48**		24		220	
HCMBSS06 01 (0-1.0')	Aug-08	**21000**	D	**31000**	D	**9000**	D	**19000**	D	**14000**	D	**3600**	D	740	D	740	D
HCMBSS07 01 (0-1.0')	Nov-08	1500	X	**1000**	Y	420		**820**		**440**		**78**		280		470	
MB SS01 (0-0.5')	Apr-06	640	H	**940**	M	700	M	**850**		**750**		**300**		NA		900	
MB SS02 (0-0.5')	Apr-06	290	H	**360**	H	230	M	**260**		**220**		**87**		NA		270	
MB SS03 (0-0.5')	Apr-06	710	H	**810**	M	690	M	**770**		**720**	H	**310**		NA		880	
MB01 (0-0.5')	Jul-96	830		**800**		360		**800**		**680**		**320**		NA		320	
HCPSSS01 01 (0-1.0')	Aug-08	140		**170**		60		**100**		74		**18**		14		91	
HCPSSS02 01 (0-1.0')	Aug-08	120		**180**		48		**100**		72		**19**		13		90	
HCPSSS03 01 (0-1.0')	Aug-08	290		**440**		160		**290**		**220**		**60**		44		260	
HCPSSS04 01 (0-1.0')	Aug-08	250		**360**		120		**250**		**200**		**50**		42		250	
HCPSSS05 01 (0-1.0')	Aug-08	490	D	**620**	D	210	D	**390**	D	**310**	D	**85**	D	30	D	360	D
PS SS01(0-0.5')	Apr-06	550	JD	**590**	M JD	390	M JD	**500**	JD	**320**	JD	**140**	JD	NA		410	JD
PS SS02 (0-0.5')	Apr-06	210		**220**	M	170	M	**200**		140		**53**		NA		200	
PS SS03 (0-0.5')	Apr-06	8700		**6500**	M	**7000**	M	**7100**		**4000**		**1800**		NA		4300	
PS01 (0-0.5')	Jul-96	280		**330**		160		**440**		**340**		**240**		NA		210	

Units: ug/kg

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

H - Alternate peak selection upon analytical review.

Table 2-5. Analysis results, PAHs in surface soils from Main Entrance

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria*		**3900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCMESS01 01 (0-1.0')	Aug-08	6.5	U	7	U	2.1	J	1.8	J	33		4.4	J	99		78		34	
HCMESS02 01 (0-1.0')	Aug-08	53	UD	16	JD	94	D	93	D	2600	D	390	D	6000	D	4500	D	**2400**	**D**
HCMESS03 01 (0-1.0')	Aug-08	3.6	J	2.1	J	6.2		5.6	J	130		15		330		250		140	
HCMESS04 01 (0-1.0')	Aug-08	9.4		4.7	J	25		20		510		64		990	D	760	D	**560**	
HCMESS05 01 (0-1.0')	Aug-08	11	D	5	JD	56	D	34	D	670	D	73	D	1200	D	910		**600**	**D**
HCMESS06 01 (0-1.0')	Aug-08	4.6	J	5	U	6.6		4.6	J	74		8.2		130		100		52	
HCMESS07 01 (0-1.0')	Nov-08	5.7	U	1.7	J	4.6	J	3.9	J	79		7	U	200		150		120	
ME SS01 (0-0.5')	Apr-06	120		21	Ja	850		690		9300		1400		14000		11000		**5800**	
ME03 (0-0.5')	Jul-96	91	U	91	U	970		56		620		69		1400		1100		**510**	
ME02 (15-18')	Jul-96	98	U	98	U	20	U	2.4	U	9.8	U	0.49	U	4.9		9.8	U	2	U

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-5. Analysis results, PAHs in surface soils from Main Entrance (continued)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCMESS01 01 (0-1.0')	Aug-08	42		70		22		**43**		34		8.8		6.9		43	
HCMESS02 01 (0-1.0')	Aug-08	2900	D	**3900**	D	1200	D	**2300**	D	**1700**	D	**430**	D	56		2000	D
HCMESS03 01 (0-1.0')	Aug-08	180		**230**		80		**140**		86		**22**		3.7		110	
HCMESS04 01 (0-1.0')	Aug-08	730		**890**		310		**530**		**370**		**92**		11		450	
HCMESS05 01 (0-1.0')	Aug-08	700	D	**860**	D	280	D	**500**	D	**330**	D	**94**	D	9.4		390	D
HCMESS06 01 (0-1.0')	Aug-08	70		92		32		**54**		35		9		6.9		44	
HCMESS07 01 (0-1.0')	Nov-08	160	X	120	Y	74		**110**		66		**24**		6	U	67	
ME SS01 (0-0.5')	Apr-06	7400		**8600**	M	**4500**	M	**5900**		**4200**		**1500**		NA		4600	
ME03 (0-0.5')	Jul-96	740		**680**		300		**630**		**560**		**300**		NA		270	
ME02 (15-18')	Jul-96	9.8	U	4.9	U	2.8	U	0.39		2.4	U	4.9	U	NA		4.9	U

Units: ug/kg

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-6. Analysis results, PAHs in surface soils from Vehicle Wash Rack

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria*		**3900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSS01 01 (0-1.0')	Aug-08	5.5	U	5.9	U	2.2	J	2.2	J	39		6.3	J	100		81		43	
HCVWSS02 01 (0-1.0')	Aug-08	4.2	J	3.3	J	5.5	J	5.9	J	160		27		580		460		**220**	
HCVWSS02 02 (0-1.0')	Aug-08	3.8	J	2.9	J	4.8	J	4.6	J	120		20		420		330		**240**	
HCVWSS03 01 (0-1.0')	Aug-08	3	J	2.2	J	5.3	J	4	J	98		8.6		220		170		93	
HCVWSS04 01 (0-1.0')	Aug-08	11	UD	4.5	JD	24	D	19	D	460	D	66	D	1000	D	790	D	**450**	D
HCVWSS05 01 (0-1.0')	Aug-08	6.7	JD	6.5	JD	18	D	16	D	420	D	57	D	910	D	700	D	**420**	D
HCVWSS06 01 (0-1.0')	Aug-08	53	UD	26	JD	160	D	170	D	4600	D	620	D	9000	D	7900	D	**4700**	D
HCVWSS08 01 (0-1.0')	Nov-08	61		120		570		440		8000	D	1900	D	22000	D	19000	D	**8400**	DX
HCVWSS09 01 (0-1.0')	Nov-08	6	U	6.4	U	6.4	U	7.3	U	11		7.3	U	34		26		17	
VW SS01 (0-0.5')	Apr-06	12	Ja	41	U	170		130		2100		260		2500		2300		**950**	
VW SS02 (0-0.5')	Apr-06	42	U	42	U	30	Ja	33	Ja	640		100		1400		1000		**510**	
VW SS03 (0-0.5')	Apr-06	18	Ja	41	U	77		75		1500		230		2300		2100		**900**	
WR01 (0-0.5')	Jul-96	900		94	U	480		22		410		36		1100		850		**300**	

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

H - Alternate peak selection upon analytical review.

E - Exceeds the highest concentration level on the standard curve for the comopund.

Table 2-6. Analysis results, PAHs in surface soils from Vehicle Wash Rack (continued)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSS01 01 (0-1.0')	Aug-08	46		74		21		**41**		37		11		5.8	U	46	
HCVWSS02 01 (0-1.0')	Aug-08	320		**550**		160		**320**		**290**		**70**		2.6	J	360	
HCVWSS02 02 (0-1.0')	Aug-08	340		**470**		140		**260**		**210**		**50**		2.2	J	260	
HCVWSS03 01 (0-1.0')	Aug-08	140		**180**		58		**100**		81		**19**		3.6	J	100	
HCVWSS04 01 (0-1.0')	Aug-08	530	D	**660**	D	200	D	**380**	D	**260**	D	**68**	D	6.3	JD	340	D
HCVWSS05 01 (0-1.0')	Aug-08	530	D	**620**	D	200	D	**350**	D	**230**	D	**60**	D	13	D	290	D
HCVWSS06 01 (0-1.0')	Aug-08	5900	D	**7500**	D	**2300**	D	**4200**	D	**2800**	D	**710**	D	56	UD	3400	D
HCVWSS08 01 (0-1.0')	Nov-08	8000	D	**8800**	DY	**4400**	D	**7900**	D	**4200**	D	**2300**		40		4800	D
HCVWSS09 01 (0-1.0')	Nov-08	23	X	16		11		**17**		9.8		6.4	U	6.3	U	6.4	U
VW SS01 (0-0.5')	Apr-06	1200		**1300**		870	M	**1100**		**770**		**290**		NA		910	
VW SS02 (0-0.5')	Apr-06	640		**720**		470	M	**600**		**430**		**160**		NA		520	
VW SS03 (0-0.5')	Apr-06	1100		**1100**		790	M	**1000**		**680**		**220**		NA		820	
WR01 (0-0.5')	Jul-96	450		**480**		200		**430**		**430**		**300**		NA		240	

Units: ug/kg

NA - No analysis result reported.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

D - Values obtained from a dilution run.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

H - Alternate peak selection upon analytical review.

E - Exceeds the highest concentration level on the standard curve for the compound.

Table 2-7. Analysis results, PAHs in subsurface soils from Vehicle Wash Rack

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene	
Soil Criteria*		**3900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	5.7	U	6.2	U	6.2	U	7.1	U	7.1	U	7.1	U
HCVWSB01 01 (4-5')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB02 01 (2-3')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB02 01 (4-5')	Nov-08	5.6	U	6.1	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB02 02 (4-5')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB04 01 (2-3')	Nov-08	5.8	U	6.2	U	6.2	U	7.1	U	7.1	U	7.1	U
HCVWSB04 01 (4-5')	Nov-08	5.7	U	6.2	U	6.2	U	7	U	5.6	J	7	U
HCVWSB05 01 (2-3')	Nov-08	5.6	U	6.1	U	6.1	U	6.9	U	6.9	U	6.9	U
HCVWSB05 01 (4-5')	Nov-08	5.6	U	6	U	6	U	6.9	U	20		4.1	J
HCVWSB06 01 (2-3')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB06 01 (4-5')	Nov-08	5.6	U	6.1	U	6.1	U	6.9	U	6.9	U	6.9	U
HCVWSB07 01 (2-3')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB07 01 (4-5')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
VW SB01 (4-5')	Apr-06	11	Ja	43	U	30	Ja	29	Ja	660		130	
VW SB04 (4-5')	Apr-06	43	U	43	U	30	Ja	31	Ja	480		94	
VW SB02 (4-5')	Apr-06	42	U	42	U	42	U	42	U	85	U	42	U
WR01 (15-18')	Jul-96	14		24		19		10		10	U	0.52	U

Units: ug/kg

*The criteria that have been used are the lower of the IEPA TACO Soil Component of the Class I Groundwater Ingestion Exposure Route Values and the USEPA Region 9 RSL Values.

NA - No Anaylsis Result.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

J - Result is an estimated value below the reporting limit.

U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-7. Analysis results, PAHs in subsurface soils from Vehicle Wash Rack (continued)

Parameters		Fluoranthene		Pyrene		Benzo(a)anthracene		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene	
Soil Criteria		**2,300,000**		**1,700,000**		**150**		**15,000**		**150**		**1500**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	7.1	U	6.2	U	6.2	U	7.1	U	6.2	U	6.2	U
HCVWSB01 01 (4-5')	Nov-08	3.1	J	2.8	J	6.1	U	7	U	6.1	U	6.1	U
HCVWSB02 01 (2-3')	Nov-08	7	U	6.1	U			7	U	6.1	U	6.1	U
HCVWSB02 01 (4-5')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	U	6	U
HCVWSB02 02 (4-5')	Nov-08	7	U	6.1	U	6.1	U	7	U	6.1	U	6.1	U
HCVWSB04 01 (2-3')	Nov-08	7.1	U	6.2	U	6.2	U	7.1	U	6.2	U	6.2	U
HCVWSB04 01 (4-5')	Nov-08	17		13		4.5	J	6.6	J	6.5		2.6	J
HCVWSB05 01 (2-3')	Nov-08	6.9	U	6.1	U	6.1	U	6.9	U	6.1	U	6.1	U
HCVWSB05 01 (4-5')	Nov-08	64		51		18		29		28		11	
HCVWSB06 01 (2-3')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	U	6	U
HCVWSB06 01 (4-5')	Nov-08	6.9	U	6.1	U	6.1	U	6.9	U	6.1	UY	6.1	U
HCVWSB07 01 (2-3')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	UY	6	U
HCVWSB07 01 (4-5')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	UY	6	U
VW SB01 (4-5')	Apr-06	1500		1400		**510**		670		**730**	M	530	M
VW SB04 (4-5')	Apr-06	1100		810		**400**		480		**570**	M	350	M
VW SB02 (4-5')	Apr-06	42	U	85	U	42	U	42	U	42	U	42	U
WR01 (15-18')	Jul-96	5.2	U	10	U	0.21	U	10	U	2.6	U	1	U

NA - No Anaylsis Result.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

J - Result is an estimated value below the reporting limit.

U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-7. Analysis results, PAHs in subsurface soils from Vehicle Wash Rack (continued)

Parameters		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15**		**150**		**15**		**1900**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	4.6	J	6.2	U	6.2	U	6.1	U	9.4	X
HCVWSB01 01 (4-5')	Nov-08	6.9		6.1	U	6.1	U	6.1	U	4.5	J
HCVWSB02 01 (2-3')	Nov-08	6.4		6.1	U	6.1	U	6	U	6.1	U
HCVWSB02 01 (4-5')	Nov-08	5.9	J	6	U	6	U	6	U	6	U
HCVWSB02 02 (4-5')	Nov-08	8.1		6.1	U	6.1	U	6	U	6.1	U
HCVWSB04 01 (2-3')	Nov-08	7.9		6.2	U	6.2	U	6.1	U	6.2	U
HCVWSB04 01 (4-5')	Nov-08	**15**		4.8	J	6.2	U	6.1	U	6.4	X
HCVWSB05 01 (2-3')	Nov-08	9.4		6.1	U	6.1	U	6	U	6.1	U
HCVWSB05 01 (4-5')	Nov-08	**35**		20		3	J	6	U	29	X
HCVWSB06 01 (2-3')	Nov-08	7.2		6	U	6	U	5.9	U	6	U
HCVWSB06 01 (4-5')	Nov-08	13		6.1	U	6.1	U	6	U	6.1	UY
HCVWSB07 01 (2-3')	Nov-08	7.5		6	U	6	U	5.9	U	6	U
HCVWSB07 01 (4-5')	Nov-08	4.9	J	6	U	6	U	6	U	6	U
VW SB01 (4-5')	Apr-06	**640**		**460**		**180**		NA		560	
VW SB04 (4-5')	Apr-06	**480**		**340**		**140**		NA		400	
VW SB02 (4-5')	Apr-06	42	U	42	U	42	U	NA		42	U
WR01 (15-18')	Jul-96	1	U	5.2	U	5.2	U	NA		5.2	U

NA - No Anaylsis Result.

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

J - Result is an estimated value below the reporting limit.

U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL.

a - Concentration is below the method reporting limit.

M - Manually integrated compound.

X - Indicates a positive bias.

Y - Indicates a negative bias.

Table 2-8. Analysis results, arsenic in subsurface soils

Parameters		Arsenic	pH
UNITS		mg/Kg	Standard Unit
Soil Criteria*		**13**	
Sample Numbers & Depth	**Sampling Date**		
HCCASB 01 01 (2-3')	Nov-08	9.3	7.2
HCCASB01 01 (4-5')	Nov-08	11	
HCCASB02 01 (2-3')	Nov-08	8.8	
HCCASB02 01 (4-5')	Nov-08	9	
HCCASB03 01 (2-3')	Nov-08	12.2	
HCCASB03 01(4-5')	Nov-08	12.9	
HCCASB04 01 (2-3')	Nov-08	11.5	
HCCASB04 01 (2-3') DL	Nov-08	**15.2**	
HCCASB04 01 (4-5')	Nov-08	**14**	
HCCASB05 01 (2-3')	Nov-08	12.1	
HCCASB05 01 (4-5')	Nov-08	11.6	
HCCASB06 01 (2-3')	Nov-08	9.8	
HCCASB06 01 (4-5')	Nov-08	11.8	
HCCASB07 01 (2-3')	Nov-08	8.9	
HCCASB07 01 (4-5')	Nov-08	9.3	
CA SB01 (4-5')	Apr-06	**18**	
CA01 (5-8')	Jul-96	**14.60**	
CA SB02 (4-5')	Apr-06	9.5	
HCCBSB01 01 (2-3')	Nov-08	**13**	6.7
HCCBSB01 02 (2-3') DL	Nov-08	NA	6.9
HCCBSB01 01 (4-5')	Nov-08	8.8	
HCCBSB02 01 (2-3')	Nov-08	7	
HCCBSB02 01 (4-5')	Nov-08	9.1	
HCCBSB03 01 (2-3')	Nov-08	10.8	
HCCBSB03 01 (4-5')	Nov-08	**13.8**	
HCCBSB04 01 (2-3')	Nov-08	9.5	
HCCBSB04 01 (4-5')	Nov-08	9.4	
HCCBSB04 02 (4-5')DL	Nov-08	11.7	
HCCBSB05 01 (2-3')	Nov-08	7.6	
HCCBSB05 01 (4-5')	Nov-08	10.7	
HCCBSB06 01 (2-3')	Nov-08	7	
HCCBSB06 01 (4-5')	Nov-08	10.2	
HCCBSB09 01 (2-3')	Nov-08	7	
HCCBSB09 01 (4-5')	Nov-08	11.1	
CB SB01 (4-5')	Apr-06	6.2	
CB SB02 (4-5')	Apr-06	12	
CB SB04 (4-5')	Apr-06	12	
CA03 (5-8')	Jul-96	3.90	
HCCCSB01 01 (2-3')	Nov-08	10	6.7
HCCCSB01 01 (4-5')	Nov-08	10.4	
HCCCSB02 01 (2-3')	Nov-08	11.4	
HCCCSB02 01 (4-5')	Nov-08	10.7	
HCCCSB06 01 (2-3')	Nov-08	**13.1**	
HCCCSB06 02 (2-3') DL	Nov-08	9.4	
HCCCSB06 01 (4-5')	Nov-08	**14.3**	
HCCCSB07 01 (2-3')	Nov-08	8.8	
HCCCSB07 01 (4-5)	Nov-08	**14.7**	
CC SB01 (4-5')	Apr-06	10	
CC SB02 (4-5')	Apr-06	7.4	
CA07 (5-8')	Apr-06	7.4	
CC SB03 (4-5')	Apr-06	7.8	
HCPSSB03 01 (2-3')	Nov-08	**16.2**	
HCPSSB03 01 (4-5')	Nov-08	**13**	
HCPSSB03 02 (4-5') DL	Nov-08	7.3	
HCPSSB05 01 (2-3')	Nov-08	11.1	
HCPSSB05 01 (4-5')	Nov-08	10.7	
HCPSSB06 01 (2-3')	Nov-08	12.4	
HCPSSB06 01 (4-5')	Nov-08	**15.7**	

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

*Criteria - from Tired Approach to Corrective Action Objectives (TACO) Appendix A, Table G, Concentrations of Inorganic Chemicals in Background Soils, Counties Within Metropolitan Statistical Areas

Table 2-9. Summary of total incremental lifetime cancer risk for site receptors from surface and subsurface soils at the Exposure Units within the HCAFS

Exposure Unit	Medium	COPCs	Correctional Facility Inmate	Correctional Facility Worker	Resident Adult	Resident Child
Coal Area A	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.6E-05	1.8E-05	2.8E-04	2.4E-04
	Subsurface Soil	Arsenic	6.8E-06	7.7E-06	3.2E-05	2.2E-05
	Total		**2.3E-05**	**2.6E-05**	**3.1E-04**	**2.6E-04**
Coal Area B	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.8E-05	2.1E-05	3.2E-04	2.8E-04
	Subsurface Soil	Arsenic	5.7E-06	6.5E-06	2.7E-05	1.9E-05
	Total		**2.4E-05**	**2.7E-05**	**3.5E-04**	**2.9E-04**
Coal Area C (including Paint Shed and Maintenance Building)	Surface Soil	Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	5.9E-05	6.7E-05	1.0E-03	8.8E-04
	Subsurface Soil	Arsenic	6.4E-06	7.3E-06	3.1E-05	2.1E-05
	Total		**6.5E-05**	**7.4E-05**	**1.1E-03**	**9.0E-04**
Vehicle Wash Rack	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	2.69E-05	3.1E-05	4.7E-04	4.0E-04
	Subsurface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.73E-06	2.0E-06	3.0E-05	2.6E-05
	Total		**2.86E-05**	**3.3E-05**	**5.0E-04**	**4.3E-04**
Main Entrance	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	2.20E-05	2.5E-05	3.8E-04	3.3E-04
	Subsurface Soil	None	--	--	--	--
	Total		**2.20E-05**	**2.5E-05**	**3.8E-04**	**3.3E-04**

(shaded) Exceeds 10^{-4}

Table 2-10. Identification of ARARs and TBCs

Regulation	Description	Site Applicability
Chemical Specific		
35 IAC Part 742 [Illinois Environmental Protection Act (415 ILCS 5/22.4, 22.12, 27 and 58.5 and Title XVI and Title XVII)]	Tiered Approach to Corrective Action Objectives (TACO). TACO provides risk-based, site-specific remediation objectives for contaminated soil and groundwater.	While TACO is promulgated by the State of Illinois law, TACO is an option and not a requirement, criteria, or limitation. Accordingly, TACO is not an ARAR. However, TACO chemical-specific standards have been widely used for determining investigation endpoints (i.e. the 'decision criteria tables'). To-be-considered (TBC) guidelines include these TACO procedures incorporated into risk assessment methodologies and appropriate TACO residential remediation goals.
Action Specific		
35 IAC Part 900	Noise Pollution General Standards. This regulatory part establishes general rules for managing noise pollution. Title 35 Section 900.102 specifies: "No person shall cause or allow the emission of sound beyond the boundaries of his property, as property is defined in Section 25 of the Illinois Environmental Protection Act, so as to cause noise pollution in Illinois, or so as to violate any provision of this chapter." Title 35 Section 900.101 defines 'noise pollution' as "the emission of sound that unreasonably interferes with the enjoyment of life or with any lawful business or activity."	Remedial alternatives involve the use of machinery that will generate noise. However, it is noted that Sections 901.102 through 901.106 inclusive do not apply to sound emitted from equipment being used for construction, thereby rendering the standard not applicable or relevant and appropriate to construction related sounds.
Location Specific		
No location specific ARARs were identified.		

ARAR--Applicable or Relevant and Appropriate Requirements, IAC--Illinois Administrative Code, ILCS--Illinois Compiled Statues, TACO--Tiered Approach to Corrective Action Objectives, TBC--To Be Considered

Off-site activities specific to the remedial work at HCAFS will comply with Federal and Illinois laws governing off-site transportation, handling, and disposal of excavated soil.

Table 2-11. Preliminary remediation goals (PRGs) for the former Hanna City Air Force Station

		Set 1 Preliminary Remediation Goals (TACO Residential; February 2007)		Set 2 Preliminary Remediation Goals		Incremental Lifetime Carcinogenic Risk for Residential Receptor under Set 2 PRGs ($ILCR_{Res-PRG}$) [b]
Chemical	**Carcinogen**	**(ug/kg)**	**Source [a]**	**(ug/kg)**	**Source [a]**	
Naphthalene	Yes	170000[c]	TACO Res Inhalation	1800[c]	TACO CW Inhalation	1.1E-08
Acenaphthylene	No	2300000[c]	TACO Res Ingestion	61000000[c]	Not in TACO I/C Ingestion[d]	NA
Acenaphthene	No	4700000[c]	TACO Res Ingestion	120000000[c]	TACO Ind/Comm Ingestion	NA
Fluorene	No	3100000[c]	TACO Res Ingestion	82000000[c]	TACO Ind/Comm Ingestion	NA
Phenanthrene	No	2300000[c]	TACO Res Ingestion	61000000[c]	Not in TACO I/C Ingestion[d]	NA
Anthracene	No	23000000[c]	TACO Res Ingestion	610000000[c]	TACO Ind/Comm Ingestion	NA
Fluoranthene	No	3100000[c]	TACO Res Ingestion	82000000[c]	TACO Ind/Comm Ingestion	NA
Pyrene	No	2300000[c]	TACO Res Ingestion	61000000[c]	TACO Ind/Comm Ingestion	NA
Benzo(a)anthracene	Yes	900	TACO Res Ingestion	8000	TACO Ind/Comm Ingestion	8.9E-06
Chrysene	Yes	88000	TACO Res Ingestion	780000	TACO Ind/Comm Ingestion	8.9E-06
Benzo(b)fluoranthene	Yes	900	TACO Res Ingestion	8000	TACO Ind/Comm Ingestion	8.9E-06
Benzo(k)fluoranthene	Yes	9000	TACO Res Ingestion	78000	TACO Ind/Comm Ingestion	8.7E-06
Benzo(a)pyrene	Yes	90	TACO Res Ingestion	800	TACO Ind/Comm Ingestion	8.9E-06
Indeno(1,2,3-cd)pyren	Yes	900	TACO Res Ingestion	8000	TACO Ind/Comm Ingestion	8.9E-06
Dibenzo(a,h)anthracer	Yes	90	TACO Res Ingestion	800	TACO Ind/Comm Ingestion	8.9E-06
2-Methylnaphthalene	No	310000[c]	TACO Res Ingestion	820000[c]	Not in TACO CW Ingestion[d]	NA
Benzo(g,h,i)perylene	No	2300000[c]	TACO Res Ingestion	61000000[c]	Not in TACO I/C/CW Ingestion[d]	NA

Notes:

[a] IL EPA provides risk-based soil cleanup criteria for different receptors/pathways. The risk-based criteria selected as PRGs are the lower of criteria for ingestion and inhalation pathways.

[b] $ILCR_{Res-PRG}$ = PRG x (10^{-6} / TACO-Res)

[c] Calculated using a target hazard quotient of 1

[d] Chemicals not in TACO Tier I Tables - http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html

IL EPA: Illinois EPA; TACO: Tiered Approach to Corrective Action Objectives (February 2007); Res: Residential;
CW: Construction Worker; I/C and Ind/Comm: Industrial/Commercial

Table 3-1. Summary of remediation technologies

Technology Type	Specific Technology	Technology Applicability to PAHs in Soil	Carried Forward for Evaluation	Comments
Engineered Barriers	Clay Cap Asphalt Cap Single Layer Soil Cap	Applicable - prevent contact with soils and water/wind transport of contaminants	No	Engineered barriers leave contaminated soils in place and require on-going maintenance. Either DoD would have to maintain involvement with the site, or Peoria County would have to sign a MOA to maintain the barrier and monitor the insitutional control.
In-situ Treatment	Soil Flushing Chemical Oxidation Bioremediation Thermal Treatment	Potentially applicable - additional data is needed to determine applicability	No	The effectiveness of in-situ technologies at HCAFS is limited by the low permeability of the soil and the non-contiguous distribution of the contaminated soil which would require installation of multiple systems.
Ex-situ Treatment	Soil Washing	Limited	No	Soil washing has limited effectiveness for PAHs and generates waste water that must also be treated.
	Chemical Oxidation	Potentially applicable	No	The quantity of soil to be treated is too small to make chemical oxidation a cost effective remediation technology. In addition, the non-contiguous distribution of contaminated soil will increase the cost to excavate and move the soil to the treatment location.
	Bioremediation	Potentially applicable	No	Bio-remediation likely has limited effectiveness for the particular PAHs in the soil at HCAFS.
	Thermal Treatment	Potentially applicable	No	Ex-situ thermal treatment is only cost competitive for soil quantities greater than 20,000 yd^3.
Soil Removal		Applicable - removes soil above the remediation objective	Yes	Removes contaminated soil permanently from the site.

DoD-Department of Defense; MOA- Memorandum of Agreement; HCAFS: Hanna City Air Force Station
PAH: Polynuclear aromatic hydrocarbons

Table 3-2. Preliminary summary of data needs

Technology Type	Contaminant Distribution	Soil Particle-Size Distribution	Soil Homogeneity and Isotropy	Soil Permeability	Soil Moisture	Soil pH	Redox Potential	Humic content	BOD & COD
Engineered Barriers	Yes								
In-Situ Soil Flushing	Yes	Yes	Yes	Yes				Yes	Yes
In-Situ Soil Chemical Oxidation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In-Situ Bioremediation	Yes	Yes	Yes	Yes	Yes			Yes	Yes
In-Situ Thermal Treatment	Yes	Yes	Yes	Yes	Yes			Yes	
Ex-Situ Soil Washing	Yes	Yes						Yes	Yes
Ex-Situ Soil Chemical Oxidation	Yes	Yes				Yes	Yes	Yes	Yes
Ex-Situ Bioremediation	Yes					Yes		Yes	Yes
Ex-Situ Thermal Treatment	Yes	Yes			Yes			Yes	
Soil Removal	Yes								

BOD -- biochemical oxygen demand, COD -- chemical oxygen demand

Source: adapted from Federal Remediation Technologies Roundtable 2007. The Remediation Technologies Screening Matrix and Reference Guide, Version 4.0. http://www.frtr.gov/scrntools.htm

Table 6-1. Comparison of alternatives

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Mobility, Volume, or Toxicity Through Treatment	Short-Term Effectiveness	Implementability	Time Frame to Completion (in years)	Cost
Alternative 1 – No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration, or removal of, contaminants.	Does not comply with TACO standards.	Remedial goals are not met.	No reduction of mobility, volume, or toxicity is realized.	No short-term exposure to remedial workers or impact to community. Exposure risks would remain for recreational users and onsite workers.	None.	Since there is no action, the time frame is immediate (Review may be required at year 5)	$20,000 assuming a five year review is required
Alternative 2 – Removal of Surface Soil Exceeding the Set 1 PRG	Eliminates exposure pathways and reduces the level of risk. Disposal of soil isolates contamination and eliminates further migration.	Achieves the RAOs and complies with chemical-specific ARARs for the site contaminants. Off-site remedial work will comply with Federal and Illinois laws for off-site transportation, handling and disposal of excavated soil.	Long-term risk associated with surface soil is greatly reduced or eliminated.	Contaminants are removed from the site to an approved facility where potential for mobilization is controlled.	Impacts to community include increased truck traffic and noise. Hazards to on-site remedial action workers.	Grading and soil placement activity may result in release of potentially contaminated dust. Noise nuisance from use of heavy equipment.	6 months for design and plan development; 6 months for completion of removal and disposal	$502,398
Alternative 3 – Removal of Surface Soil Exceeding the Set 2 PRG	Eliminates exposure pathways and reduces the level of risk. Disposal of excavated soil isolates contamination and eliminates further migration.	Achieves the RAOs. Off-site remedial work will comply with Federal and Illinois laws for off-site transportation, handling and disposal of excavated soil.	Long-term risk associated with surface soil is greatly reduced or eliminated.	Contaminants are removed from the site to an approved facility where potential for mobilization is controlled.	Impacts to community include increased truck traffic and noise. Hazards to on-site remedial action workers.	Grading and soil placement activity may result in release of potentially contaminated dust. Noise nuisance from use of heavy equipment.	6 months for design and plan development; 6 months for completion of removal and disposal	$134,980

PRG: Preliminary remediation goal; RAO: Remedial action objective; ARAR: Applicable or Relevant and Appropriate Requirement

APPENDIX C

COST DETAILS FOR ALTERNATIVES 2 & 3

Cost Details - Soil Removal to Set 1 PRGs

Item	Activity/Component	Quantity	Unit	Unit Cost	Total Costs
Soil Delineation	Collection and analysis (PAH) of soil samples to determine extent	80	Sample	$ 375	$ 30,000
Site Preparation	Mobilization	1	Lump sum	$ 25,000	$ 25,000
	Setup staging area	1	Lump sum	$ 10,000	$ 10,000
	Site setup & erosion control measures	1	Lump sum	$ -	$ -
	Haul road construction	0	Linear foot	$ 6	$ -
Removal Activities	Soil excavation	2,577	Cubic yard	$ 7	$ 18,036
Waste Disposal	Load & transport waste material	3,092	Ton	$ 30	$ 92,756
	Landfill disposal	3,092	Ton	$ 30	$ 92,756
	Analytical (TCLP)	68	Sample	$ 330	$ 22,440
Site Restoration	Backfill Material	2,577	Cubic yard	$ 25	$ 64,414
	Vegetative cover (seed)	1.70	Acre	$ 228	$ 388
	Vegetative cover (straw/mulch)	1.70	Acre	$ 250	$ 425
	Vegetative cover (fertilize)	1.70	Acre	$ 120	$ 204
	Road repair/removal	0	Linear foot	$ 5	$ -
Demobilization	Decontamination & site tear-down	1	Lump sum	$ 5,000	$ 5,000
	Demobilization	1	Lump sum	$ 8,000	$ 8,000
Project Plans	Work Plan, Health & Safety Plan, Quality Control Plan, Environmental Protection Plan	1	Lump sum	$ 21,000	$ 21,000
Project Plans	Construction completion report	1	Lump sum	$ 11,500	$ 11,500
		Construction Subtotal:			$ 401,918
		Project Management (10%):			$ 40,192
		Contingency (15%):			$ 60,288
		Total Costs:			**$ 502,398**

Cost Details - Soil Removal to Set 2 PRGs

Item	Activity/Component	Quantity	Unit	Unit Cost	Total Costs
Soil Delineation	Collection and analysis (PAH) of soil samples to determine extent	50	Sample	$ 375	$ 18,750
Site Preparation	Mobilization	1	Lump sum	$ 12,000	$ 12,000
	Setup staging area	1	Lump sum	$ 5,000	$ 5,000
	Site setup & erosion control measures	0	Lump sum	$ -	$ -
	Haul road construction	0	Linear foot	$ 6	$ -
Removal Activities	Soil excavation	305	Cubic yard	$ 7	$ 2,131.63
Waste Disposal	Load & transport waste material	365	Ton	$ 30	$ 10,963
	Landfill disposal	365	Ton	$ 30	$ 10,963
	Analytical (TCLP)	6	Sample	$ 330	$ 1,980
Site Restoration	Backfill Material	305	Cubic yard	$ 25	$ 7,613
	Vegetative cover (seed)	0.14	Acre	$ 228	$ 32
	Vegetative cover (straw/mulch)	0.14	Acre	$ 250	$ 35
	Vegetative cover (fertilize)	0.14	Acre	$ 120	$ 17
	Road repair/removal	0	Linear foot	$ 5	$ -
Demobilization	Decontamination & site tear-down	1	Lump sum	$ 2,000	$ 2,000
	Demobilization	1	Lump sum	$ 4,000	$ 4,000
Project Plans	Work Plan, Health & Safety Plan, Quality Control Plan, Environmental Protection Plan	1	Lump sum	$ 21,000	$ 21,000
Project Plans	Construction completion report	1	Lump sum	$ 11,500	$ 11,500
		Construction Subtotal:			$ 107,984
		Project Management (10%):			$ 10,798
		Contingency (15%):			$ 16,198
		Total Costs:			**$ 134,980**