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FINAL Proposed Plan

FGGM 013, Former Pesticide Shop Fort George G. Meade, Maryland

August 2012

FINAL PROPOSED PLAN FOR
the Former Pesticide Shop (FGGM-13)
FORT GEORGE G. MEADE, MARYLAND
August 2012

INTRODUCTION AND PURPOSE

This Proposed Plan (PP) provides information necessary to allow the public to participate with the U.S. Department of the Army (Army), the Lead Agency, in selecting the appropriate Remedial Alternative (RA) for the Former Pesticide Shop (FGGM-13) at Fort George G. Meade (FGGM), Maryland. FGGM-13 ("the Site") is located centrally at FGGM, on the northwest corner of the intersection of Gordon Street and York Avenue. **Figure 1** illustrates the location of the Site. Throughout this document figure and table references are bolded. In addition, bolded terms are defined in the Glossary Section.

This PP summarizes information found in detail in the ***Remedial Investigation*** (RI) and the ***Focused Feasibility Study*** (FFS) as well as other reports that are available for review as part of the ***Administrative Record*** file for this site. This PP highlights the preferred RA for the remediation of soil and groundwater at the Site and outlines all RAs identified during the FFS (ARCADIS U.S., Inc, 2012).

The Army and United States Environmental Protection Agency (USEPA) will finalize and present the selected RA for the Site in a ***Record of Decision*** (ROD). The final selection will not take place until after the public comment period. During the public comment period all comments will be taken into consideration as appropriate. The public is encouraged to comment on the preferred RA presented in this PP as well as the other RAs considered. Information about how to submit comments may be found in the "Community Participation" section of this Plan.

The Army at FGGM and USEPA, with support from the Maryland Department of the Environment (MDE), jointly issue this PP in order to fulfill the public participation requirements under Section 117(a) of the ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980*** (CERCLA), as amended by the ***Superfund Amendments and Reauthorization Act of 1986*** (SARA) and the ***National Oil and Hazardous Substances Pollution Contingency Plan*** (NCP) Section 300.430(f)(2). The Army, USEPA, and MDE encourage the public to review all of the documents relevant to activities conducted at the Site in order to assist in the selection of an appropriate RA for the Site. Pertinent information regarding the public meeting and comment period is provided.

IMPORTANT DATES AND LOCATIONS

Public Meeting: August 15, 2012 at 6:30 p.m.
The Army will hold a public meeting to explain the PP and all Response Actions presented in the FFS. Oral and written comments will also be accepted at the meeting. The meeting will be held at the Captain John Smathers Army Reserve Center on MD HWY 175 (Annapolis Road) between 20 ½ and 21st Streets, Odenton, Maryland.

Public Comment Period:
August 8th to September 7th
The Army will accept written comments on the PP during the public comment period.

The Administrative Record, containing information used in selecting the preferred Response Action, is available for public review at the following location:

Anne Arundel County Public Library
West County Area Branch
1325 Annapolis Rd.
Odenton, Maryland 21113

Additional information is maintained at the following locations:

Fort Meade Environmental Division Office
239 Chisholm Avenue
Fort Meade, Maryland 20755

Remedial Alternatives

Remedial Alternative 1: No Action.

Remedial Alternative 2: Land Use Controls (LUCs) with Long-Term Monitoring (LTM) of Groundwater.

Remedial Alternative 3: Soil Excavation with Off-Site Disposal, LUCs, and Enhanced Reductive Dechlorination (ERD) with LTM of Groundwater.

Relevant documents used in the preparation of this PP are listed in the "References" section found at the end of this document.

Based on the RI and FFS, the Army's preferred RA is:

- Remedial Alternative 3 – Soil Excavation with Off-Site Disposal, Land Use Controls (LUCs), and Enhanced Reductive Dechlorination (ERD) with Long-Term Monitoring (LTM) of Groundwater

This RA addresses both soil and groundwater contamination at the Site.

The results of the ***Human Health Risk Assessment (HHRA)*** indicate that adverse non-cancer health effects are likely to occur from exposure to contaminants in soil and groundwater at the Site for the future construction worker and hypothetical resident. This indicates adverse health effects are likely to occur to people from exposure to site constituents under hypothetical land use scenarios. No adverse health effects are indicated for current land use.

Because the Site is intended for non-residential use, the primary future receptors at risk are:

- Future construction workers who might construct buildings at the Site.

The contaminants that pose unacceptable risk to future construction workers are chlordane and heptachlor epoxide in soil.

RI activities identified MCL exceedances in groundwater samples for arsenic, alpha-chlordane, gamma-BHC, gamma-chlordane, heptachlor, heptachlor epoxide, trichloroethene (TCE), and tetrachloroethylene (PCE). These compounds would also be addressed as part of the preferred remedial action in addition to those contaminants identified in soil.

Estimated reasonable maximum exposure (RME) cancer risks for other future use scenarios, the current and future military office worker and military maintenance worker, are within the acceptable risk range and adverse non-cancer health effects are not expected to occur. .

The preferred RA presented in this PP addresses the current MCL exceedances at the Site and removes and/or reduces contaminant concentrations in soil and groundwater at the Site through excavation of soil and implementation of ERD through Emulsified Vegetable Oil (EVO) injections into the aquifer, thereby reducing future risks to human receptors identified during the HHRA. Further, the preferred RA meets the CERCLA threshold criteria, and provides the best combination of balancing criteria when evaluated against the CERCLA requirements.

SITE BACKGROUND

Fort George G. Meade is located approximately midway between Washington, D.C. and Baltimore, Maryland in Anne Arundel County, Maryland, as illustrated on the regional map in **Figure 2**. FGGM became an Army installation in 1917 and encompassed 9,349 acres. During World War I (WWI), over 100,000 soldiers passed through FGGM. The 79th, 92nd and 11th Infantry Divisions trained at the installation and an Ordnance Supply School was established in 1918. When the war ended, FGGM served as a demobilization center for returning troops. FGGM became a permanent Army installation after WWI.

By 1940, there were 251 permanent and 218 temporary buildings and over 2,100 enlisted soldiers on post. By December 1941, the total land acquired by FGGM had grown to approximately 13,800 acres. After World War II (WWII), the National Security Agency (NSA) relocated to FGGM and Tipton Airfield was constructed in 1960. In 1988, FGGM was realigned under the first round of Base Realignment and Closure (BRAC). The BRAC program authorized 9,000 acres to be divested from FGGM. The Army retained 900 acres of the BRAC parcel which includes Tipton Airfield, which was transferred to Anne Arundel County in 1999. Following the 1988 BRAC realignment, the installation covers 5,145 acres. The current installation boundaries encompass the area previously referred to as the cantonment area, which is used for administrative, recreational, and housing facilities. FGGM contains approximately 65.5 miles of paved roads, 3.3 miles of secondary roads, and about 1,300 buildings. Major tenants at Fort Meade include a Department of Defense facility, the Defense Information School, the Defense Information Systems Agency, Defense Media Activity, the U.S. Army Intelligence and Security Command, the Naval Security Group, the 70th Intelligence Wing (Air Force), USEPA, and the Environmental Science Center (URS, 2009). The USEPA placed FGGM on the ***National Priority List*** (NPL) on July 22, 1998 after an evaluation of contamination due to past storage and disposal of hazardous substances.

Former Pesticide Shop (FGGM-13) History

The building was reportedly labeled "Mess Hall" in the Real Property records and had been used during WWII as a mess hall for prisoners of war. This structure was used as a pesticide shop for 20 years between 1958 and 1978. As shown on Figure 1, areas of Building 6621 that were used for pesticide shop activities were located in the north-central parts of the building. During its operation as a pesticide shop, this building also housed a maintenance facility for lawn mowers, tractors, and other landscaping equipment. It was demolished, and the Site was graded in 1996 (NuTec, 1997).

Current and Future Use

The Site is presently a fenced-in lot used for storage. The FGGM Real Property Master Plan (RPMP) does not currently indicate any specific intended development for the Site.

Historical Investigations

All investigations at the Site were conducted after the Former Pesticide Shop (Building 6621) was demolished, and the Site was re-graded in 1996. The initial field investigation of the Site was the Comprehensive Site Assessment and Relative Risk Site Evaluation conducted in 1997 (NuTec, 1997). Between 2003 and 2006, three soil investigations and one groundwater investigation were completed. In 2010, a supplemental groundwater investigation was completed to fully characterize site conditions. Data obtained during these investigations is documented within the RI report (ARCADIS, 2011).

SITE CHARACTERISTICS

Former Pesticide Shop (FGGM-13) Description

The Site is located at the northwest corner of the intersection of Gordon Street and York Avenue (**Figure 1**). There are no buildings present at the Site, which has a perimeter fence to control access. There are no surface water bodies at the Site. The local topography indicates that surface water runoff flows toward the east and southeast and into a drainage ditch that runs north-south, parallel to the west side of York Avenue, which runs along the east side of the Site. This drainage ditch discharges into Midway Branch, located approximately 600 feet east of the Site and York Avenue (**Figure 3**). Midway Branch continues southward, crossing the southern FGGM boundary at a location about 3,800 feet south-southeast of the Site. Midway Branch then flows into Lake Allen (formerly known as Soldier Lake) located approximately 2,000 feet beyond (south of) where Midway Branch crosses the southern FGGM boundary. Discharge from Lake Allen then flows into the Little Patuxent River, about 1.5 miles south of Lake Allen.

Extent of Contamination in Soil

Analytical results for soil samples collected at the Site were screened using USEPA industrial soil Regional Screening Levels (RSLs), residential soil RSLs, and the Fort Meade soil background metal concentrations (Malcolm Pirnie, 2001), as appropriate. **Table 1** and **Table 2** present a summary of RSL exceedances for surface and subsurface soil, respectively.

Surface Soil

Chemicals detected within surface soils (0-2 feet below ground surface (ft bgs)) at the Site during the 1997, 2003, 2004 and 2006 soil investigations include various metals and pesticides. Two herbicides were detected (2,4,5-T and 2,4-D) in samples collected in 1997, and only one semi-volatile organic compound (SVOC) (pentachlorophenol) was detected in samples collected in 2004. The chemicals were detected at concentrations below their respective residential soil RSLs, indicating that herbicides and SVOCs are not constituents of potential concern (COPCs). No polychlorinated biphenyls were detected in surface soil samples. Volatile organic compounds (VOCs) were not analyzed during these sampling events.

Twelve metal constituents were detected in surface soil samples at concentrations exceeding the upper-limit of the Fort Meade background concentration range (Malcolm Pirnie, 2001). These twelve constituents include:

- arsenic
- barium
- cadmium
- calcium
- chromium
- copper
- lead
- magnesium
- manganese
- mercury
- nickel
- zinc

Table 1: Surface Soil Regional Screening Level (RSL) Exceedances

Analyte	Range of Concentrations (mg/kg)		Frequency of Detection	Soil Residential RSL		Soil Industrial RSL		Surface Soil Maximum Background Level	
	Minimum	Maximum		RSL (mg/kg)	Number of Exceedances	RSL (mg/kg)	Number of Exceedances	Max. Conc. (mg/kg)	Number of Exceedances
Metals									
Arsenic[1]	0.677	42.8	47/56	0.39	47	1.6	38	4.84	14
Vanadium[1]	9.8	27.1	3/11	5.5	3	72	0	44.52	0
Pesticides									
4,4-DDD	0.0014	260	41/56	2	10	7.2	6	--	--
4,4-DDE	0.0022	24	41/56	1.4	5	5.1	2	--	--
4,4-DDT	0.002	130	47/56	1.7	14	7	9	--	--
Alpha-chlordane	0.0802	91.1	7/13	1.5	4	6.5	4	--	--
Chlordane	0.015	1000	44/56	1.5	22	6.5	17	--	--
Dieldrin	0.00097	1.5	10/56	0.03	5	0.11	3	--	--
Gamma-chlordane	0.0566	80.7	7/13	1.5	4	6.5	4	--	--
Heptachlor	0.007	18	8/56	0.11	6	0.38	6	--	--
Heptachlor Epoxide	0.044	4.4	4/56	0.053	3	0.19	2	--	--

Notes:
[1] – Arsenic and vanadium concentrations detected in surface soil samples at the Site were delineated to background levels rather than the RSLs.
-- - Not Applicable mg/kg – milligram per kilogram
Regional Screening Levels were obtained from the USEPA Mid-Atlantic Risk Assessment Regional Screening Level Master Table, updated December 2009.
Surface Soil Maximum Background Levels were obtained from the Soil Background Concentration Report of Fort George G. Meade (Malcolm Pirnie, 2001).
Surface soil samples were collected during three investigations completed between 2003 and 2006 at depths between 0 and 2 feet below ground surface.

Table 2: Subsurface Regional Screening Level Exceedances

Analyte	Range of Concentrations (mg/kg)		Frequency of Detection	Soil Residential RSL		Soil Industrial RSL		Subsurface Soil Maximum Background Level	
	Minimum	Maximum		RSL (mg/kg)	Number of Exceedances	RSL (mg/kg)	Number of Exceedances	Max. Conc. (mg/kg)	Number of Exceedances
Metals									
Arsenic[1]	0.647	71.2	75/77	0.39	75	1.6	39	1.67	38
Pesticides									
4,4-DDD	0.00086	19.5	30/77	2	8	7.2	4	--	--
4,4-DDT	0.00056	230	49/77	1.7	10	7	8	--	--
Alpha-chlordane	0.0015	10.7	12/14	1.5	3	6.5	2	--	--
Chlordane	0.0049	60.3	19/30	1.5	10	6.5	10	--	--
Dieldrin	0.00044	1.9	14/77	0.03	3	0.11	2	--	--
Gamma-chlordane	0.014	8.32	10/14	1.5	2	6.5	2	--	--
Heptachlor	0.00057	1.89	23/77	0.11	6	0.38	4	--	--

Notes;
[1] – Arsenic concentrations detected in subsurface soil samples at the Site were delineated to background levels rather than the RSLs.
-- - Not Applicable mg/kg – milligram per kilogram
Regional Screening Levels were obtained from the USEPA Mid-Atlantic Risk Assessment Regional Screening Level Master Table, updated December 2009.
Subsurface Soil Maximum Background Levels were obtained from the Soil Background Concentration Report of Fort George G. Meade (Malcolm Pirnie, 2001).
Subsurface soil samples were collected during three investigations completed between 2003 and 2006 at depths between 2 and 20 feet below ground surface.

Except for arsenic, eleven of these constituents did not exceed their residential or industrial RSLs. Arsenic concentrations exceeded both its residential or industrial RSL. Because the upper-limit of the arsenic surface soil background concentration range (4.84 milligrams per kilogram [mg/kg]) is greater than the residential and industrial RSLs of 0.39 mg/kg and 1.6 mg/kg, respectively, surface soil samples with arsenic concentrations within the range of background concentrations may exceed residential or industrial RSLs. Therefore, arsenic concentrations detected in surface soil samples at the Site were delineated to 4.84 mg/kg rather than the RSLs. Arsenic background exceedances are presented on **Figure 4**. Arsenic concentrations detected above the background concentration range are mainly clustered near the central portion of the Site area. These arsenic surface soil background exceedances are suggestive of arsenic associated with historical activities at the Former Pesticide Shop.

The concentrations of nine pesticides exceed industrial soil RSLs:

- 4,4- dichlorodiphenyldichloroethane (DDD)
- 4,4-dichlorodiphenyldichloroethylene (DDE)
- 4,4-dichlorodiphenyltrichloroethane (DDT)
- alpha-chlordane
- chlordane
- dieldrin
- gamma-chlordane
- heptachlor
- heptachlor epoxide

Surface soil pesticide sample locations and results are presented on **Figure 5**. The majority of the industrial RSL exceedances, and, therefore, residential RSL exceedances, in surface soil are located in the sample locations near the central portion of the Site. This geographical distribution is consistent with the findings previously described for arsenic background exceedances. In four locations south of and beyond the immediate vicinity of the reported pesticide management area, sample concentrations exceeded residential and industrial RSLs. These samples are: 49-S (chlordane, dieldrin, and heptachlor epoxide exceed the industrial RSL), 50-S (chlordane exceeds the industrial RSL), 51-S (4,4-DDT, chlordane, dieldrin and heptachlor exceed the industrial RSL), and 52-S (chlordane exceeds the industrial RSL).

Exceedances at these four locations are shallow and are believed to have been spread during site grading activities associated with Building 6621 demolition in 1996.

Subsurface Soil

Chemicals detected within subsurface soil samples at the Site during the 2004 and 2006 soil investigations include arsenic, chromium, mercury, and various pesticides. One herbicide (parathion) and no SVOCs were detected during the 2006 investigation. Parathion was detected well below its respective residential RSL. Therefore, herbicides and SVOCs are not COPCs in subsurface soil.

Three metals were detected in subsurface soil samples at concentrations exceeding the upper-limit of their respective Fort Meade subsurface soil background concentration range. However, the only maximum background concentration for subsurface soils that is greater than the industrial RSL is arsenic. Because the upper-limit of the arsenic subsurface soil background concentration (1.67 mg/kg) is greater than the residential and industrial RSLs of 0.39 mg/kg and 1.6 mg/kg, respectively, soil samples with arsenic concentrations within the range of the background concentrations may exceed residential or industrial RSLs. Therefore, arsenic concentrations detected in subsurface soils at the Site were delineated to 1.67 mg/kg, rather than to the RSLs. No metals other than arsenic exceeded their respective residential or industrial RSLs.

The vertical extent of arsenic detected above the background concentration range was identified in three locations (55, 56, and 57) centrally located within the Site area. Arsenic concentrations above background were delineated by samples with concentrations below background at sample location 55 at a depth of 15 feet below ground surface (bgs), at location 56 at a depth of 8 feet bgs, and from location 57 at a depth of 10 feet bgs, as presented on **Figures 6** through **8**. These arsenic subsurface soil background exceedances are suggestive of arsenic associated with historic pesticide shop activities.

Seven pesticides in subsurface soil samples exceeded both residential and industrial soil RSLs: 4,4-DDD, 4,4-DDT, alpha-chlordane, chlordane, dieldrin, gamma-chlordane, and heptachlor. These subsurface soil results for pesticides are graphically illustrated in **Figures 9** through **14**.

Analytical data indicate that the residential and industrial RSL exceedances are located near the central portion of the Site area. This is consistent with the findings previously described for pesticides in surface soil and arsenic concentrations in surface soil samples that exceed the Fort Meade surface soil background concentration range. Additionally, the horizontal area with exceedances decreases with depth. Therefore, vertical delineation is considered complete for the Site area. No pesticide concentrations exceeded the industrial RSLs in samples collected deeper than 8 feet bgs.

Extent of Contamination in Groundwater

Groundwater samples were collected during investigations in 2006 and 2010. Data from groundwater samples collected in 2006 is not presented because those samples were obtained using temporary monitoring wells. That data was not reproducible and therefore not included in the Site evaluation in the RI report.

In April 2010 and June 2010, groundwater samples were collected from all permanent site monitoring wells (MW-1R through MW-8). Monitoring well locations are displayed on **Figure 15**. Each sample was analyzed for target compound list VOCs, pesticides, and target analyte list metals. **Table 3** presents chemical compounds that exceeded USEPA tapwater RSLs and USEPA maximum contaminant levels (MCLs). The RSL for carcinogens is based on a target risk of $1x10^{-6}$. The RSL for non-carcinogens is based on a target hazard quotient of 1. MCL exceedances are discussed below.

Table 3: Groundwater Regional Screening Level Exceedances

Analyte	Range of Concentrations (µg/L)		Frequency of Detection	Tapwater RSL		USEPA MCL	
	Minimum	Maximum		RSL (µg/L)	Number of Exceedances	MCL (µg/L)	Number of Exceedances
Metals							
Arsenic	5.04	5.04	1/20	0.045	1	10	--
Cobalt	2.57	130	7/20	11	4	--	--
Lead	3.2	23	10/20	--	--	15	2
Thallium	0.0655	17	4/20	--	--	2	2
Pesticides							
4,4-DDD	3.5	5.6	2/20	0.28	2	--	--
4,4-DDE	0.15	0.7	2/20	0.2	1	--	--
4,4-DDT	0.0088	1.2	4/20	0.2	2	--	--
Aldrin	0.0077	0.67	4/20	0.004	4	--	--
Alpha-BHC	0.023	0.91	6/20	0.011	6	--	--
Alpha-chlordane	0.0073	4.5	12/20	--	--	2	3
Beta-BHC	0.075	0.11	2/20	0.037	2	--	--
Dieldrin	0.0051	1.4	5/20	0.0042	4	--	--
Gamma-BHC	0.012	0.8	9/20	0.061	5	0.2	1
Gamma-chlordane	0.0085	5.1	12/20	--	--	2	3
Heptachlor	3.3	3.3	1/20	0.015	1	0.4	1
Heptachlor Epoxide	0.0032	0.23	6/20	0.0074	5	0.2	1
VOCs							
1,1,2,2-Tetrachloroethane	0.8	1.3	2/16	0.067	2	--	--
Chloroform	0.32	2.6	10/16	0.19	10	--	--
Tetrachloroethene	1.6	260	6/16	0.11	6	5	4
Trichloroethene	1.4	76	4/16	2	3	5	1

Notes:
-- - Not Applicable
(µg/L) – micrograms per liter
MCL – Maximum Contaminant Level

VOC Results

Four exceedances of the tetrachloroethene (PCE) MCL of (5 micrograms per liter [µg/L]) were detected in samples MW-02R and MW-03R collected during both the April and June 2010 sampling events. Detected concentrations range from 1.6 µg/L (MW-04R) to 260 µg/L (MW-02R). One exceedance of the trichloroethene (TCE) MCL (5 µg/L) was detected in sample MW-02R collected during the June 2010 sampling event. Detected concentrations range from 1.4 µg/L (MW-03R) to 76 µg/L (MW-02R).

Metals Results

There were no MCL exceedances for metals in groundwater samples collected during the April 2010 and June 2010 sampling events from on-site wells (MW-2R and MW-3R) or downgradient wells (MW-4R, MW-5 through MW-8). Total and dissolved lead and thallium were detected at concentrations exceeding their respective MCLs in the June 2010 sample from well MW-1R, which is off the Site and upgradient of the Former Pesticide Shop to the northwest. Total and dissolved lead were detected at concentrations of 20 µg/L and 23 µg/L, respectively, and total and dissolved thallium were detected at estimated concentrations of 17 µg/L and 16 µg/L, respectively.

Pesticides Results

Three exceedances of the alpha-chlordane MCL (2 µg/L) were detected in samples MW-02R and MW-03R collected during the April and June 2010 sampling events. Detected concentrations range from 0.0073 µg/L (MW-5) to 4.5 µg/L (MW-03R). One exceedance of the gamma-BHC (Lindane) MCL (0.2 µg/L) was detected in sample MW-02R collected during the April 2010 sampling event. Detected concentrations range from 0.012 µg/L (MW-8) to 0.8 µg/L (MW-02R). Three exceedances of the gamma-chlordane MCL (2 µg/L) were detected in samples MW-02R and MW-03R collected during the April and June 2010 sampling events. Detected concentrations range from 0.0085 µg/L (MW-05) to 5.1 µg/L (MW-03R). One exceedance of the heptachlor MCL (0.4 µg/L) was detected in sample MW-02R at a concentration of 3.3 µg/L during the June 2010 sampling event. Heptachlor was not detected in any other sample. One exceedance of the heptachlor epoxide MCL (0.2 µg/L) was detected in sample MW-02R collected during the April 2010 sampling event. Detected concentrations range from 0.0032 µg/L (MW-08) to 0.23 µg/L (MW-02R).

MCL exceedances in groundwater appear to be limited to wells located on the Former Pesticide Shop Site (wells MW-2R and MW-3R). Samples collected from well MW-2R, which is centrally located in the northern portion of the former central courtyard area, had five constituents (three pesticides and two VOCs) with concentrations exceeding MCLs. Samples collected from downgradient monitoring well MW-3R only had three constituent concentrations (two pesticides and one VOC) that exceeded their respective MCLs. No MCL exceedances were detected in samples from wells downgradient of MW-3R, indicating that constituents are not present above the MCLs in groundwater downgradient of the Site.

SCOPE AND ROLE OF THE RESPONSE ACTION

This response action represents the overall strategy for remediation at the Former Pesticide Shop. The Site is one of many sites at FGGM that are in the CERCLA process. The Site Management Plan (URS, 2011) provides details on other sites at Fort Meade that will be addressed in separate response actions from this one. The anticipated schedule for each of those sites in also provided in the Site Management Plan.

Based on historical investigations, unacceptable risks were determined for future use scenarios due to exposure to contaminants in soil and groundwater at the Site. These risks must be eliminated or controlled.

This PP provides a summary of the RAs considered for soil and groundwater at the Site and recommends the preferred RA (Remedial Alternative 3 – Soil Excavation with Off-Site Disposal, LUCs, and ERD with LTM of Groundwater).

SUMMARY OF THE SITE RISKS

As presented in the RI Report (ARCADIS, 2011), an HHRA was performed to identify COPCs at the Site to be evaluated as part of a hazard evaluation. Surface soils (0 to 2 feet bgs) and indoor air exposure were evaluated to assess current potential exposures associated with accessible soils at the Site. Surface/subsurface soils (0 to 10 feet bgs), groundwater, and indoor air exposure were evaluated to assess potential future exposures associated with direct contact by humans.

For the purposes of the screening evaluation, constituents were identified as COPCs for soil when the maximum concentrations exceeded the USEPA RSLs for residential soil (USEPA, 2011). Constituents were identified as COPCs for groundwater when the maximum concentration exceeded the USEPA's RSLs for 'Tap water' which are protective of potable uses of groundwater (USEPA, 2011). Those RSLs based on non-cancer endpoints were divided by 10 to adjust from a target hazard quotient of 1 to 0.1 for identification of COPCs. If a constituent's maximum concentration did not exceed its screening value, then that constituent was excluded from the risk assessment. Details of the HHRA methodology are presented in the RI Report (ARCADIS, 2011).

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the contaminants of concern at the site in various media (i.e., soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a RME scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines exposure information and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk). For non-cancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected.

A Screening Level Ecological Risk Assessment (SLERA) was also performed as part of the RI. A SLERA is a conservative assessment that provides a high level of confidence in determining a low probability of adverse risk to potential ecological receptors that aids in determination if further ecological assessments are required. The SLERA indicated that no further evaluation was required and is not discussed further in this PP.

<u>Human Health Risk Assessment</u>

The HHRA identified potential risks associated with exposure to COPCs in soil and groundwater. Evaluated populations include:

Current receptors:

- Commercial/military office worker in commercial buildings located within 100 feet of the groundwater plume (e.g. the building south of Gordon Street, which is approximately 100 feet from the plume).
- Outdoor military maintenance worker at the Former Pesticide Shop property

Future receptors:

- Commercial/military office worker in a hypothetical building at the Site
- An outdoor military maintenance worker
- Hypothetical resident
- Construction worker

Although there are no plans for residential use at the Site in the foreseeable future, the risks associated with future potential residential exposure scenarios (incidental ingestion, dermal absorption, and inhalation of chemicals) were also quantified.

The following exposure pathways were evaluated for current land-use scenarios:

- Incidental ingestion, dermal adsorption and inhalation of chemicals in surface soils and ambient air above the Site by military maintenance workers.
- Incidental inhalation of indoor air as a result of intrusion of chemical vapors in groundwater into downgradient buildings by commercial/military office workers. The particular building in this scenario is south of Gordon Street, approximately 100 feet from the groundwater plume.

The following exposure pathways were evaluated for future land-use scenarios:

- Incidental ingestion, dermal adsorption and inhalation of chemicals in surface soils, subsurface soils, and ambient air above the Site by military maintenance workers and construction workers.

- Incidental ingestion, dermal adsorption and inhalation of chemicals in surface soils, subsurface soils, groundwater, ambient air above the Site, and indoor air as a result of intrusion of chemical vapors in groundwater into on-site buildings by commercial/military office workers, hypothetical adult residents, and hypothetical child residents.
- Incidental inhalation of chemical vapors in indoor air as a result of intrusion of chemical vapors in groundwater into on-site buildings and while showering by hypothetical residents (homebound).
- Incidental inhalation of chemical vapors in a trench by construction workers.

Results of the HHRA

A summary of the HHRA results is presented on **Table 4**. The HHRA evaluation of the cancer risk and non-cancer hazard for the soil and groundwater media concluded the following:

- Estimated RME cancer risk for the current and future military office worker (within commercial buildings downgradient of the Site) is within the acceptable risk range (1 x 10^{-4} to 1 x 10^{-6}) and the non-cancer hazard estimate is below 1.
- Estimated RME cancer risk for the current and future military maintenance worker and the future military office workers are within the acceptable risk range (1 x 10^{-6} to 1 x 10^{-4}) and the non-cancer hazard estimates are below 1.

Table 4: Summary of Site-Specific Cancer Risk/Non-Cancer Hazard Estimates

Scenario Timeframe and Receptor	Exposure Medium	Estimated Potential Cancer Risk	Estimated Potential Non-Cancer Risk
Current			
Downgradient Commercial/ Military Office Worker	Indoor Air (Groundwater)	6E-6	0.0002
On-Site Military Maintenance Worker	Surface Soil (0-2 feet)	2E-5	0.3
On-Site Military Maintenance Worker	Surface/Subsurface Soil (0-10 feet)	3E-5	0.3
Future			
On-Site Commercial/ Military Office Worker	Surface/Subsurface Soil (0-10 feet), Tap water (Groundwater), Indoor Air (Groundwater)	4E-5	0.3
On-Site Military Maintenance Worker	Surface/Subsurface Soil (0-10 feet)	2E-5	0.2
Hypothetical Resident(1)	Surface/Subsurface Soil (0-10 feet), Tap water (Groundwater), Indoor Air (Groundwater)	**2E-3**	Total HI: **20** Liver Endpoint Specific HI: **17** Skin Endpoint Specific HI: **1.6** Vascular System Endpoint Specific HI: **1.6**
Hypothetical Resident(2)	Surface/Subsurface Soil (0-10 feet), Tap water (Groundwater), Indoor Air (Groundwater)	**2E-3**	Total HI: **20** Liver Endpoint Specific HI: **17** Skin Endpoint Specific HI: **1.6** Vascular System Endpoint Specific HI: **1.6**
Construction worker	Surface/Subsurface Soil (0-10 feet), Trench Air (Groundwater)	6E-6	Total HI: **4** Liver Endpoint-Specific HI: **3**
Construction worker	Surface Soil (0-2 feet), Trench Air (Groundwater)	7E-6	Total HI: **6** Liver Endpoint Specific HI: **5**

Notes:
1. Cancer risk estimates are for combined adult and child exposure. Non-cancer hazard estimates are for the child resident. Highlighted values exceed the upper end of the acceptable EPA risk range (1E-4) or have endpoint-specific HI values greater than the acceptable non-cancer hazard index of 1.
2. Cancer risk estimates are for combined adult and child exposures representing a homebound resident. Highlighted values exceed the upper end of the acceptable EPA risk range (1E-4) or have endpoint-specific HI values greater than the acceptable non-cancer hazard index of 1.
3. Shaded cells and bold numbers indicate elevated risk.

- For the future hypothetical resident, the RME cancer risk estimates are above the upper end of the acceptable cancer risk range (1×10^{-4}) and the cumulative non-cancer hazard estimates are above 1. The compounds within surface/ subsurface soils identified as risk-drivers for the hypothetical resident receptor are aldrin, gamma-chlordane, chlordane, 4,4-DDD, 4,4-DDT, heptachlor epoxide, arsenic, and dieldrin concentrations. The compounds within groundwater identified as risk-drivers for the hypothetical resident receptor are aldrin, 4,4-DDD, 4,4-DDT, 4,4-DDE, alpha BHC, alpha-chlordane, gamma-chlordane, dieldrin, heptachlor, heptachlor epoxide, PCE, and arsenic.
- The cumulative non-cancer hazard estimates are greater than 1 for the future construction worker. The liver is the only target organ with a target organ-specific HI greater than 1. Chlordane and heptachlor epoxide in soil are the primary contributors to the cumulative non-cancer hazard estimate.

The results of the HHRA indicate that soil and groundwater media at the Site do not pose a risk under current land use. Future land use at the Site will be restricted to non-residential use. Therefore, the receptor at risk due to soil and groundwater media at the Site is:

- Future construction workers who might construct buildings at the Site.

The HHRA assumed that future commercial/military workers or residents could theoretically use shallow groundwater for drinking purposes. There is not an elevated risk to future commercial/military workers due to the theoretical drinking water pathway. However, the theoretical drinking water pathway is a major contributor to the elevated cumulative cancer risks and non-cancer hazards calculated for the hypothetical resident. However, the groundwater at FGGM-13 is not currently used as a source of drinking water.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are based on human health and environmental factors, which are considered in the formulation and development of RAs. Such objectives are developed based on the criteria outlined in Section 300.430(e)(2) of the NCP and Section 121 of SARA.

The RAOs for the Site have been developed in such a way that attainment of these goals will result in the protection of human health and the environment.

The RAOs for the Site are:

- Prevent human exposure to soil that would cause unacceptable risk to human health.
- Prevent human exposure to groundwater that would cause unacceptable risk over the duration of the response action.
- Achieve MCLs for the identified COCs in groundwater over time, thereby restoring groundwater to its beneficial use.

Basis for the Establishment of Remedial Action Objectives

A statutory goal of the ***Defense Environmental Restoration Program*** is for the Army to take appropriate actions to investigate and, where necessary, address releases of hazardous substances or pollutants that create an imminent and substantial endangerment to the public health or welfare and/or to the environment. The Army is required to select remedies that attain a degree of cleanup that assures protection of human health and the environment.

It is the Army's current judgment that the preferred RA identified in this PP will continue to provide protection to human health and the environment from actual or threatened releases of hazardous substances into the environment.

Identification of Constituents of Concern and Site Cleanup Levels

As part of the FFS for FGGM-13 (ARCADIS, 2012), the contaminants detected in soil and groundwater were screened to identify Constituents of Concern (COCs). Details of the screening process are presented in Sections 3 and 4 of the FFS (ARCADIS, 2012). In summary, COCs are defined as contaminants that contribute to the majority of site-specific cancer risk or non-cancer hazards to human health based on the HHRA.

Through the RI it has been determined that a remedial action is necessary to address risks presented by soil and groundwater contamination at the Site under future land use scenarios.

Soil

For soils, the FFS identifies USEPA RSLs for industrial soils and the FGGM soil background concentrations (Malcolm Pirnie, 2001) as ***To Be Considered*** (TBC) guidance.

The conclusions of the HHRA were that soil concentrations of chlordane and heptachlor epoxide posed unacceptable risk to future construction workers. The HHRA also determined that arsenic, aldrin, chlordane, gamma-chlordane, 4,4-DDD, 4,4'-DDT, heptachlor epoxide and dieldrin posed an unacceptable risk to future residents. Institutional controls to restrict the Site to industrial use will be incorporated into all remedial alternatives. Therefore, draft Preliminary Remediation Goals (PRGs) were calculated based on the COCs (chlordane and heptachlor epoxide) for the future construction worker scenario. PRGs for these

COCs were also derived for future military worker scenarios where potential exposure is limited by means of an institutional control (e.g., deed or use restriction) to commercial and military office workers, or workers involved with minimal landscape activity (e.g., lawn mowing).

Because land use controls will be used to restrict the site to industrial use only, soil PRGs protective of only those scenarios were retained as SCLs. All PRGs were evaluated in order to select the lowest, and therefore most protective, PRG among all industrial use scenarios. Consequently, the SCL for chlordane is based on the PRG for the commercial/military office worker scenario, and the SCL for heptachlor epoxide is based on the PRG for the construction worker. Therefore, the site-specific SCLs for chlordane and heptachlor epoxide are protective of potential soil exposure pathways under all future industrial use scenarios.

These SCLs are summarized and presented in **Table 5**.

Table 5: Site Cleanup Levels for Soil

Compounds of Concern	Site Cleanup Levels (based on Preliminary Remediation Goals)[1]
	(mg/kg)
Chlordane	16.21
Heptachlor Epoxide	0.77

(1) The SCLs are based on the lowest PRGs derived based on site-specific chronic exposures to the commercial/military outdoor worker and the commercial/military indoor worker, and subchronic exposures to the construction worker. The derived PRGs are based on a target cancer risk of one in one million excess cancer risk ($1x10^{-6}$) and an adjusted target hazard limit. For subchronic construction worker exposure scenario, the PRGs are based on a target hazard index limit of 0.25 (representing a target liver hazard index of 1 divided by 4 COPCs sharing that endpoint). For chronic worker exposures, the PRGs are based on a target hazard index limit of 0.17 (representing a target liver hazard index of 1 divided by 6 COPCs sharing that endpoint).

Groundwater

For groundwater, potential ***Applicable or Relevant and Appropriate Requirements*** (ARARs) are USEPA MCLs. A detailed discussion of ARAR evaluation and analysis is provided in the FFS (ARCADIS, 2012).

Based on the groundwater data in the RI, site cleanup levels will be the MCLs for those constituents with concentrations that exceeded MCLs. For the wells on-site, these constituents include two VOCs (TCE and PCE) and five pesticides (alpha-chlordane, gamma-BHC [Lindane], gamma-chlordane, heptachlor, and heptachlor epoxide). The MCLs for these constituents are presented on **Table 6**.

Table 6: Site Cleanup Levels for Groundwater

Compounds of Concern	Federal Maximum Contaminant Level (μg/L)
TCE	5
PCE	5
Alpha-chlordane	2
Gamma-BHC	0.2
Gamma-chlordane	2
Heptachlor	0.4
Heptachlor Epoxide	0.2

Summary of Site Cleanup Levels

Site cleanup levels in soil will be PRGs as determined for the constituents chlordane and heptachlor epoxide. Site cleanup levels in groundwater will be MCLs as described above. These are shown in **Tables 5** and **6**.

SUMMARY OF REMEDIAL ALTERNATIVES

RAs for soil and groundwater contamination at the Site were developed and evaluated in the FFS (ARCADIS, 2012). The remedial measures considered for soil and groundwater remediation during the evaluation presented in the FFS included:

- No Action
- LUCs with LTM of groundwater
- Soil excavation with off-site disposal, LUCs, and ERD with LTM of groundwater

These measures, retained during the preliminary technology evaluation and screening phase (detailed in Section 5 of the FFS), were then further refined into the three RAs listed below. The RAs are described below with their respective estimated ***Capital Costs***, estimated cost for ***Operation and Maintenance*** (O&M) activities, and an estimate of the ***Present Worth Costs*** for the RA.

Remedial Alternative 1: No Action

Estimated Capital Cost: $0
Estimated O&M Cost Over 30 Years: $0
Estimated Present Worth Cost: $0

CERCLA and the NCP require that a No Action alternative be evaluated at every site to establish a baseline for the comparison of other RAs. Under this alternative, no remedial action would take place.

Remedial Alternative 2: LUCs with LTM of Groundwater

Estimated Capital Cost: $18,600
Estimated O&M Cost Over 30 Years: $169,100
Estimated Present Worth Cost: $113,900

RA 2 would involve the combination of LUC maintenance with LTM of groundwater.

Land Use Controls

Under Alternative 2, existing LUCs already in place at FGGM, specifically institutional controls (ICs), would be maintained and enhanced, and engineering controls (ECs) would be added. These LUCs would restrict the Site to industrial use only. ICs are administrative measures put in place in order to control current and future land use. The four general categories of ICs evaluated or already in use at FGGM, and which provide layers of protection, are: governmental controls, proprietary controls, enforcement and permitting, and informational devices, which assist with the management and implementation of LUCs. Most of these measures are already in place as elements of required procedures at FGGM. These elements include requirements to obtain dig permits from the Department of Public Works office for any intrusive activity at FGGM; Master Plan Regulations; FGGM Geographic Information System Database, where restricted areas are demarcated; FGGM Access Restrictions; and Army Military Construction Program requirements. These existing requirements are detailed below. These controls have been developed with consideration of all reasonably anticipated land uses at FGGM, including administrative and industrial military operations, and outdoor recreation. All existing LUCs, together with any additional requirements, would be incorporated into the CERCLA remedy for the Site under this alternative.

The following LUC is in place at FGGM:

- **Master Plan Regulations, Army Regulation (AR) 210-20**: The Army regulation, Master Planning for Army Installations, AR 210-20, issued on 13 July 1987 requires all Army installations to develop and maintain a Real Property Master Plan (RPMP). This regulation provides for comprehensive planning at Army installations and not only allows, but requires incorporation of existing land-use and conditions into the RPMP. The RPMP regulations provide a framework for comprehensive planning through the use of component plans. The five main components of the FGGM RPMP include the Short Range Component, Long Range Component, RPMP Digest, Capital Investment Strategy, and the Installation Design Guide.

The overall objective is to provide each installation with a master plan through the integration of each component plan into the installation master plan. The component plans form a series of narrative, tabular and graphic plans. Their integration into an installation master plan provides many benefits as outlined in AR 210-20.

Engineering controls, including signage (warning signs) describing restrictions on site use at key locations of the Site would be installed. An existing perimeter fence surrounds the Site and a second perimeter fence surrounds the entire FGGM installation. Annual visual inspections of the Site would be performed to establish that all on-site LUCs (for example, signage) are in good condition, to confirm that the land use of the Site has not changed, and that no unauthorized excavations have been performed.

LUCs would include an evaluation of the potential for vapor intrusion in future buildings at the Site or the use of engineering controls to eliminate the vapor intrusion pathway.

Long-Term Monitoring

RA 2 includes LTM of groundwater. The LTM activities would monitor the expected decline in COC concentrations due to attenuation. LTM would include groundwater monitoring for pesticides and VOCs at all Site monitoring wells during the first year, then annual monitoring at select monitoring wells for five years, and once every five years thereafter from select wells at the Site for a total of 30 years of LTM. Annual groundwater monitoring would be performed to determine whether the RAO to achieve compliance with MCLs for identified COCs within approximately 10 years would be met. Actual LTM frequency would depend on how quickly trends in concentrations decline and would require approval from USEPA and MDE.

Remedial Alternative 3: Soil Excavation with Off-Site Disposal, LUCs, and ERD with LTM of Groundwater

Estimated Capital Cost: $207,826
Estimated O&M Cost Over 30 Years: $166,800
Estimated Present Worth Cost: $303,000

RA 3 consists of soil excavation with approved off-site disposal along with ERD to treat Chlorinated Volatile Organic Compounds (CVOCs) in groundwater. The combination of the two technologies would address pesticide constituents in soil and CVOCs in groundwater through active remediation and address pesticides in groundwater through potential source removal and continued monitoring. The application of these technologies through this alternative is described below.

Soil Excavation with Off-Site Disposal

The excavation footprint would focus on the central portion of the Site where the highest concentrations of arsenic and pesticides were detected and would be defined by areas of the Site where samples exceed PRGs for pesticides in soil. Arsenic detections observed above industrial RSLs were sporadic and close to the upper limit of the FGGM background concentration range (4.84 mg/kg) (Malcolm Pirnie, 2001) and are therefore not the driver for the excavation area. Removal of soil that exceeds PRGs would have the additional effect of removing potential source material, which would facilitate attenuation of the minimal remaining pesticide concentrations in groundwater. Monitoring well MW-2R is located within the excavation area, but would be protected during excavation activities in order to maintain the well in its current location. Additionally, surface soil sample locations 49-S and 51-S would also be included in the excavation plan. The approximate area and depth of excavation are displayed on **Figure 16**.

Pre-excavation soil confirmation samples would be collected using direct-push drilling methods from the perimeter and base of the proposed excavated area in order to delineate the excavation prior to commencing removal activities. Confirmation samples would be submitted for laboratory analysis of chlordane, heptachlor epoxide and VOCs via USEPA Methods 8081 and 8260, respectively, to confirm and document the required excavation area and volume. Excavated material would be placed directly into roll-off containers or dump trucks and transported to an approved land disposal facility.

After the excavation is complete, the excavated areas would be backfilled with clean soil imported from off-post, unless an approved on-post source is identified. Samples of the backfill material would be submitted for laboratory analysis to ensure that contaminants are not imported to the Site. Upon completion of the backfill activities, the area would be final graded and seeded with grass to minimize the potential for erosion. If required, erosion and sediment controls would be established and maintained throughout the duration of the removal action in accordance with the ARARs identified in the FFS.

Land Use Controls

Following excavation, existing LUCs already in place at FGGM, specifically ICs, would be maintained and enhanced and ECs would be added. LUCs used following excavation would be similar to those described under RA 2, including restricting the Site to industrial use only. Annual visual inspections of the Site would be performed to establish that all on-site LUCs (for example, signage prohibiting intrusive activities) were in good condition, to confirm that the land use of the Site had not changed, and that no unauthorized excavations were performed.

LUCs would also include an evaluation of the potential for vapor intrusion in future buildings at the Site or the use of engineering controls to eliminate the vapor intrusion pathway.

Enhanced Reductive Dechlorination

Following excavation activities, ERD technology would be implemented to address CVOC constituents in groundwater. Emulsified Vegetable Oil (EVO) has been selected as the carbon source for ERD implementation because it is a slower release/longer term carbon source than soluble substrates like molasses, lactate, and ethanol. The primary benefit of using EVO is that less frequent injections would be necessary due to its longer residence time and slow release of organic carbon (typically a year or more). The EVO injection/application generates excess organic carbon which initiates a succession of anaerobic processes in which electron acceptors, including oxygen, nitrate, ferric iron, manganic manganese, sulfate, and carbon dioxide, are subsequently consumed by indigenous bacteria. The result is a strongly reducing zone in which reductive dechlorination is favorable.

The primary degradation pathways for the CVOCs are shown below:

- Tetrachloroethene → Trichloroethene → Dichloroethene → Vinyl Chloride → Ethene → Ethane → Carbon Dioxide

Because EVO distribution is primarily achieved at the time of injection, it serves as an on-going slow-release carbon source across the achieved injection radius. As a result, it is important to determine the achieved radius of influence (ROI) from a given volume of injected material. It is anticipated that injections would be completed in two stages to gather sufficient data to determine the achieved ROI leading to optimum injection spacing. The first stage would serve to determine whether the second stage of injections could be completed through direct-push locations or whether permanent injection wells would be necessary.

It is assumed that a 3 percent EVO/water solution would be injected one time into the subsurface via proposed direct-push borings along two transects perpendicular to groundwater flow (**Figure 17**). Transect 1, upgradient of MW-2R, would be approximately 40 feet long. Transect 2, upgradient of MW-3R, would be approximately 60 feet long. These transects are spaced approximately 125 feet apart, which represents approximately six months travel time based on the Site geology. The target ROI for the EVO solution is 2.5 feet. The target injection depth is 15 to 30 feet bgs, which is based on the typical depth to water and the total depth of monitor wells MW-2R and MW-3R. The final target injection depth would be determined based on groundwater elevations when the remedy is implemented. The estimated volume of solution is 220 gallons for each of 20 injection points, or a total of 4,400 gallons; however, the number of injection points and estimated injection volumes would be refined during field implementation. Based on field observations (e.g., subsurface lithology, soil classification, etc.), volumes and injection point spacing may be adjusted to ensure delivery across the target area. Additional detail regarding this conceptual feasibility level design is provided in the In-situ Biological Treatment Study memorandum – Enhanced Reductive Dechlorination for FGGM-13 which is included in Appendix B of the FFS. This additional detail was used to determine the probable cost of this alternative and does not supersede the parameters for the eventual remedial design for the Site.

The data collected during the first stage would be utilized to determine whether additional application of EVO is appropriate, as well as the appropriate delivery method, throughout the impacted area that was defined during RI activities. It is expected that if the first stage proves favorable then the second stage application of the 3 percent EVO/water solution throughout the defined area would be completed.

ERD performance monitoring would be conducted following completion of the injection using monitoring wells MW-2R and MW-3R. Data collected from monitoring wells located within the injection ROI would be used to evaluate the adequate concentration and distribution of reagent. Performance and operational data would be collected to satisfy the following criteria:

- Confirm that the presence of excess organic carbon does not result in pH levels that inhibit microbial activity within the In-Situ Reactive Zone (IRZ).
- Observe IRZ propagation at monitoring wells MW-2R and MW-3R.
- Collect additional data to evaluate progress of the ERD process and to monitor the level of methanogenesis (dissolved methane concentrations) occurring within the IRZ. Trends in concentrations of parent compounds (PCE and TCE) and dechlorination products (cis-dichloroethene, vinyl chloride, ethene, and ethane) would be assessed over time within and downgradient of each IRZ system to evaluate IRZ system performance.

Long Term Monitoring

RA 3 includes LTM for groundwater. The LTM activities would monitor the performance of the ERD and the expected decline in pesticide concentrations as a result of the removal of potential source material during excavation activities. An additional monitoring well would be installed near the intersection of York and Gordon Streets. Boring logs during well installation would be used to confirm the depth and thickness of the clay layer in the vicinity of the Site. LTM would include groundwater monitoring for pesticides and VOCs at all Site monitoring wells during the first year, then annual monitoring at select monitoring wells for five years, and then once every five years thereafter from select wells at the Site for a total of 30 years of LTM. Actual LTM frequency would depend on how quickly trends in concentrations decline and would require approval from USEPA and MDE. Annual groundwater monitoring would be performed to determine whether the RAO to achieve MCLs for identified COCs within approximately ten years would be met.

Key ARARs

RA 3 includes actions not included in RAs 1 and 2, and therefore must meet action-specific ARARs that do not apply to other the remedial alternatives. For excavation, these include ARARs identified in the FFS: Erosion and Sediment Control (COMAR 26.17.01) and Disposal of Controlled Hazardous Substances (26.13).

EVALUATION OF REMEDIAL ALTERNATIVES

Nine balancing criteria are used to evaluate the different RAs individually, and against one another in order to select a remedy. These criteria are as follows:

Threshold Criteria – Must be met for the RA to be eligible for selection as a remedial option.

1. Overall Protection of Human Health and the Environment – Determines whether an RA eliminates, reduces, or controls threats to public health and the environment through ICs, engineering controls, or treatment.
2. Compliance with ARARs – Evaluates whether the RA meets the requirements set forth in Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified. Identification of ARARs is dependent on the hazardous substances present at the Site, site characteristics, the Site location, and the actions selected to remediate the Site. Thus, requirements may be chemical-, location-, or action-specific. Please refer to Section 4.2 of the FFS (ARCADIS, 2012) for a more detailed discussion of ARARs.

Primary Balancing Criteria – Used to weigh major trade-offs among RAs.

3. Long-term Effectiveness and Permanence – Considers the ability of an RA to maintain protection of human health and the environment over time.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment – Evaluates an RA's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. Short-term Effectiveness – Considers the length of time needed to implement an RA and the risks the RA poses to workers, residents, and the environment during implementation.
6. Implementability – Considers the technical and administrative feasibility of implementing the RA, including factors such as the relative availability of goods and services.
7. Cost – Includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an RA over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of –30 to +50 percent.

Modifying Criteria – May be considered to the extent that information is available during the FFS, but can be fully considered only after public comment is received on this PP.

8. State/Support Agency Acceptance – Considers whether the State agrees with the Army's analysis and recommendations, as described in the RI/FS and PP.
9. Community Acceptance – Considers whether the local community agrees with the Army's analysis and preferred RA. Comments received on the PP are an important indicator of community acceptance.

Comparative Analysis of Remedial Alternatives

This section summarizes the comparative analysis of RAs for FGGM-13 that were presented in the FFS (ARCADIS, 2012). A chart summarizing this comparative analysis is included as **Table 7**. Each alternative is ranked 1 (being the best) through 3 (being the worst) for each of the criteria. The rankings are then averaged for each alternative.

Overall Protection of Human Health and the Environment

Under current land use, all alternatives provide protection to human health and the environment. However, future land use scenarios at the Site present unacceptable risks. Since Alternative 1 does not prevent unacceptable risks for potential future use scenarios, Alternative 1 does not satisfy this criterion and will not be discussed further in this analysis. Alternatives 2 and 3 either remove or control possible future exposure to COCs in impacted soil and groundwater. Alternative 3 provides a greater degree of protection than Alternative 2, since it removes contaminated soil from the Site and actively treats contaminated groundwater.

Compliance with ARARs

Under Alternative 2, chemical-specific ARARs are anticipated to be met eventually, over time, due to attenuation processes. Alternative 3 would achieve compliance with chemical-specific ARARs more quickly due to the active treatment employed. Alternatives 2 and 3 either control exposure to site COCs or actively remove and treat the COCs. Location-specific and action-specific ARARs would be met by Alternatives 2 and 3.

Long-Term Effectiveness and Permanence

Alternative 2 and Alternative 3 are effective in the long-term because they would reduce risk to human health by controlling or removing pathways of exposure to COCs in soil and groundwater. For Alternative 2, LUCs are required to restrict land use and remove pathways of exposure. Alternative 3 also includes LUCs in conjunction with soil cleanup levels based on PRGs for non-residential future use scenarios. Of these three alternatives, Alternative 3 would be most effective in the long-term since it removes impacted soils and treats impacted groundwater at the Site.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 2 does not employ treatment; therefore, it does not satisfy this criterion. Alternative 3 would reduce the toxicity, mobility, and volume through treatment by excavating and removing contaminated soil, and by treating groundwater.

Short-Term Effectiveness

Alternative 2 is considered effective in the short-term as there are no risks under current land use scenarios. Alternative 3 is effective in the short-term because it can be implemented quickly, and risks posed by the alternative itself to workers and residents can be mitigated.

Implementability

The most readily implementable alternative is Alternative 2. Alternative 3 presents the most complex alternative to implement. However the more complex implementation can be addressed using industry-standard engineering and planning.

Cost

Based on the capital and annual O&M present worth estimates of probable costs for the alternatives, Alternative 3 is the most costly and Alternative 2 is the least costly.

State/Support Agency Acceptance

Approval of the preferred RA presented in this PP is expected. Regulatory approval will be further evaluated in the ROD following the public comment period.

Permit equivalency approvals are being documented and will be obtained through the CERCLA process for all work that would otherwise require a State of Maryland permit if that work were being completed under State authority.

Community Acceptance

The U.S. Army has approved the release of this Plan to the public. Community acceptance of the preferred RA will be evaluated at the conclusion of the public comment period. Community acceptance will be addressed in the ***Responsiveness Summary*** prepared for the ROD.

Table 7: Comparative Analysis Chart

	Remedial Alternative 1 - No Action		Remedial Alternative 2 - LUCs with LTM of Groundwater		Remedial Alternative 3 -Soil Excavation with Off-Site Disposal, LUCs, and ERD with LTM of Groundwater	
Evaluation Criteria	**Description**	**Rank**	**Description**	**Rank**	**Description**	**Rank**
Overall Protection of Human Health and the Environment	Unacceptable risk under future land use scenarios	3	Human health risk controlled for future scenarios but ecological risk present	2	Human health risk and ecological risk eliminated through removal of impacted soil and treatment of groundwater	1
Compliance with ARARs	ARARs not applicable	3	Complies with location-specific and action-specific ARARs, and may comply with chemical-specific ARARs in the long term	2	Complies with chemical-specific, location-specific and action-specific ARARs	1
Long-term Effectiveness and Performance	Ineffective in long-term due to unacceptable risk remaining	3	Effective through control of exposure	2	Effective through removal and treatment of impacted media	1
Reduction of Toxicity, Mobility, and Volume through Treatment	No treatment used	2	No treatment used	2	Treatment of groundwater through the use of ERD will reduce toxicity, mobility and volume of contaminants in groundwater	1
Short-term Effectiveness	Effective in short-term because there is no risk under current use	1	Effective in short-term because there is no risk under current use	1	Effective in short-term because it can be implemented quickly and risks to workers and residents can be mitigated	1
Implementability	Readily implemented (no action)	1	Readily implemented through existing LUCS	2	Moderately complex to implement	3
Cost	No cost	1	Low cost	2	Most costly	3
State/Support Agency Acceptance	TBD		TBD		TBD	
Community Acceptance	TBD		TBD		TBD	
Averaged ranking	2.00		1.86		1.57	
Overall rank	3		2		1	

SUMMARY OF THE PREFERRED REMEDIAL ALTERNATIVE FOR FGGM-13

The preferred RA was recommended based on the best balance among the selection criteria for treatment of soil and groundwater contamination at the Site. The preferred RA is:

- Remedial Alternative 3 – Soil Excavation with Off-Site Disposal, LUCs, and ERD with LTM of Groundwater.

Based on the results of the comparative analysis and detailed evaluation presented in the FFS, the Army recommends that Remedial Alternative 3 (Soil Excavation with Off-Site Disposal, LUCs, and ERD with LTM of Groundwater) be implemented as the preferred alternative for remediation of contaminants in soil and groundwater at the Site. Alternative 3 is the most appropriate remedy for the Site contamination because it achieves the threshold criteria and provides the best balance of tradeoffs relative to the five primary balancing criteria described in the Evaluation of Remedial Alternatives section above.

Because Alternative 3 proposes removing contaminated soil, there will be no unacceptable risk under future non-residential use scenarios upon completion of the excavation. In addition, implementation of ERD will return groundwater to its beneficial use within the shortest reasonable timeframe. Alternative 2 controls but does not eliminate the potential hazard. Alternative 3 provides the best protection to human health and the environment by permanently removing COCs in soil.

It should be noted that the RAs recommended can be changed in light of new information or in response to public comment. Public comment will be received through the activities discussed in the next section.

Based on information currently available, the U.S. Army believes the preferred RA meets the threshold criteria and provides the best balance of tradeoffs among the other RAs with respect to the balancing and modifying criteria. The Army expects the preferred RA to satisfy the following statutory requirements of CERCLA 121(b): 1) to be protective of human health and the environment; 2) to comply with ARARs; 3) to be cost-effective; 4) to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and, 5) to satisfy the preference for treatment as a principal element.

COMMUNITY PARTICIPATION

Public participation is an important component of remedy selection. The Army, USEPA, and MDE are soliciting input from the community on the preferred RA. The comment period extends from **August 8, 2012 through September 7, 2012** (30 days). This period includes a public meeting at which the Army will present the PP as agreed to by the USEPA and MDE. The Army will accept both oral and written comments at this meeting and written comments following the meeting through September 7, 2012.

A critical component of the FGGM Installation Restoration Program to keep the public informed about the environmental cleanup activities and be involved in decision-making is the ***Restoration Advisory Board (RAB)***. The RAB gives community members, particularly those who may be affected by the cleanup activities, and government representatives a chance to exchange information and participate in meaningful dialogue. The Site has previously been discussed with the RAB in 2009 as part of commencing the overall Performance Based Contract activities, and prior to that was briefed during the August 29, 2007 RAB meeting.

Public Comment Period

The Army is providing a 30-day comment period from **August 8, 2012 to September 7, 2012** to provide an opportunity for public involvement in the decision-making process for the proposed action. The public is encouraged to review and comment on this PP. During the public comment period, the public is encouraged to review the following reports and other documents pertinent to this site and the Superfund process: FFS for FGGM-13 the Former Pesticide Shop (ARCADIS, 2012) and the RI Report for FGGM-13 the Former Pesticide Shop (ARCADIS, 2011). This information is available at the Anne Arundel County Library, West County Area Branch located at 1325 Odenton Road in Odenton, MD, and the Fort George G. Meade Environmental Division Office, located at 239 Chisholm Avenue at Fort George G. Meade. To obtain further information, the following representatives may be contacted:

Ms. Mary Doyle
U.S. Army Garrison Fort George G. Meade
Public Affairs Office
4409 Llewellyn Avenue
Fort Meade, MD 20755
(301) 677-1361

Mr. John Burchette
Remedial Project Manager - USEPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029
(215) 814-3378

Ms. Elisabeth Green, Ph.D.
Maryland Department of the Environment
Federal Facilities Division
1800 Washington Blvd. Suite 625
Baltimore, MD 21230-1719
(410) 537-3346

Written Comments

If the public would like to comment in writing on the PP or other relevant issues, comments should be delivered to the Army at the public meeting or mailed (postmarked no later than **September 7, 2012**) to Ms. Mary Doyle at the address provided.

Public Meeting

The Army will hold a public meeting to accept comments on this PP on **August 15, 2012, at 6:30 p.m**., at the Captain John Smathers Army Reserve Center on MD HWY 175 (Annapolis Road) between 20 ½ and 21st Streets, Odenton, MD. This meeting will provide an opportunity for the public to comment on the proposed action. Comments made at the meeting will be transcribed. A copy of the transcript will be included in the ROD Responsiveness Summary and will be added to the FGGM Administrative Record file and information repositories.

Army's Review of Public Comment

The Army will review the public's comments as part of the process in reaching a final decision on the most appropriate action to be taken. The Army's final choice of action will be issued in a ROD. A Responsiveness Summary, documenting and responding to written and oral comments received from the public, will be issued with the ROD. Once community response and input are received and the Army and USEPA sign the ROD, it will become part of the Administrative Record.

ACRONYMS AND ABBREVIATIONS

4,4-DDD .... 4,4- Dichlorodiphenyldichloroethane
4,4-DDE 4,4-Dichlorodiphenyldichloroethylene
4,4-DDT 4,4-dichlorodiphenyltrichloroethane
µg/L .... micrograms per liter
AR .... Army Regulation
ARARs .... Applicable or Relevant and Appropriate Requirements
Army.................................. U.S. Department of the Army
bgs .... Below Ground Surface
BRAC .... Base Realignment and Closure
CERCLA .... Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC .... Constituent of Concern
COMAR............................. Code of Maryland Regulations
COPC................................ Constituents of Potential Concern
CVOC................................ Chlorinated Volatile Organic Compounds
DDD .... dichlorodiphenyldichloroethane
DDE .... dichlorodiphenyldichloroethylene
DDT................................... dichlorodiphenyltrichloroethane
EC .... Engineering Control
ERD .... Enhanced Reductive Dechlorination
EVO .... Emulsified Vegetable Oil
FFS .... Focused Feasibility Study
FGGM .... Fort George G. Meade
FGGM-13 .... Former Pesticide Shop
HHRA................................ Human Health Risk Assessment
HI .... Hazard Index
IC .... Institutional Control
IRZ .... In-Situ Reactive Zone
LTM................................... Long-Term Monitoring
LUC................................... Land Use Control
MCL .... Maximum Contaminant Level
MDE.................................. Maryland Department of the Environment
Mg/kg .... milligrams per kilogram
NCP .... National Oil and Hazardous Substances Pollution Contingency Plan
NPL .... National Priority List
NSA................................... National Security Agency
O&M.................................. Operation and Maintenance
PCB................................... Polychlorinated Biphenyls
PCE................................... Tetrachloroethene
PP .... Proposed Plan
PRG .... Preliminary Remediation Goal
RA .... Remedial Alternative
RAB................................... Restoration Advisory Board
RAO .... Remedial Action Objective
RI .... Remedial Investigation
RME .... Reasonable Maximum Exposure
ROD .... Record of Decision
ROI.................................... Radius of Influence
RPMP................................ Real Property Management Plan
RSL .... Regional Screening Level
SARA .... Superfund Amendments and Reauthorization Act of 1986
SLERA .... Screening Level Ecological Risk Assessment
SVOC................................ Semi-Volatile Organic Compound
TBC................................... To-Be-Considered
TCE................................... trichloroethene
USEPA.............................. U.S. Environmental Protection Agency
VOC .... Volatile Organic Compound
WWI .... World War I
WWII .... World War II

GLOSSARY OF TERMS

Administrative Record: This is a collection of documents (including plans, correspondence and reports) generated during site investigation and remedial activities. Information in the Administrative Record is used to select the preferred Response Action and is available for public review.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and State requirements that a selected remedy must attain. These requirements may vary among sites and RAs.

Capital Costs: This includes costs associated with construction, treatment equipment, site preparation, services, transportation, disposal, health and safety, installation and start-up, administration, legal support, engineering, and design associated with Response Actions.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): This federal law was passed in 1980 and is commonly referred to as the Superfund Program. It provides for liability, compensation, cleanup, and emergency response in connection with the cleanup of inactive hazardous waste disposal sites that endanger public health and safety or the environment.

Defense Environmental Restoration Program (DERP): Addresses the cleanup of Department of Defense hazardous waste sites consistent with the requirements of CERCLA. The three main objectives of DERP are: 1) the identification, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants; 2) the correction of other environmental damage that creates an imminent and substantial endangerment to public health or the environment; and 3) the demolition and removal of unsafe buildings and structures at sites formerly used by or under the jurisdiction of the Secretary of Defense.

Focused Feasibility Study (FFS): This CERCLA document reviews the chemicals of concern at a site, and evaluates multiple remedial technologies for use at the site. Finally, it identifies the most feasible Remedial Alternative.

Human Health Risk Assessment (HHRA): This assessment describes the formal step-by-step scientific process for quantifying health risks to human receptors (residents, workers, recreationalists), thereby estimating the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media under current or future scenarios. A risk assessment uses standardized tools, formats, and scientifically accepted assumptions.

National Contingency Plan (NCP): The National Oil and Hazardous Substances Pollution Contingency Plan. These CERCLA regulations provide the federal government the authority to respond to the problems of abandoned or uncontrolled hazardous waste disposal sites as well as to certain incidents involving hazardous wastes (e.g., spills).

National Priorities List (NPL): A list of contaminated sites that require cleanup under CERCLA and that are qualified to receive expenditures of CERCLA funds.

Operation and Maintenance (O&M): Annual post-construction cost necessary to ensure the continued effectiveness of a Response Action.

Present Worth Costs: Used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year. This allows the cost of the Response Actions to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover capital and O&M costs associated with each Response Action over its planned life.

Record of Decision (ROD): This legal document is signed by the Army and the USEPA and will be reviewed by the MDE for concurrence. It provides the cleanup action or remedy selected for a site, the basis for selecting that remedy, public comments, responses to comments, and the estimated cost of the remedy.

Remedial Investigation (RI): An investigation under CERCLA that involves sampling environmental media such as air, soil, and water to determine the nature and extent of contamination and human health and environmental risks that result from the contamination.

Responsiveness Summary: A part of the ROD in which the Army documents and responds to written and oral comments received regarding the remedial alternatives presented in the PP.

Restoration Advisory Board (RAB): The board provides a forum for exchange of information and partnership among citizens, the military installation, Unites States Environmental Protection Agency, and the State Agency. The RAB offers an opportunity for community members to provide input to the cleanup process.

Superfund Amendments and Reauthorization Act (SARA): A Congressional act that modified CERCLA. SARA was enacted in 1986 and again in 1990 to authorize additional funding for the Superfund Program.

To-Be-Considered (TBC): Information such as nonpromulgated criteria, advisories, guidance, and proposed standards issued by federal or state governments that may be considered in Response Actions. TBCs may be used to interpret ARARs, or to determine preliminary remediation goals when ARARs do not exist for particular contaminants.

REFERENCES

ARCADIS U.S., Inc. (ARCADIS), 2011. Remedial Investigation Report, FGGM-13 Former Pesticide Shop. Fort George G. Meade, Maryland. Final. October 2011.

ARCADIS, 2012. Focused Feasibility Study, FGGM-13 Former Pesticide Shop, Fort George G. Meade, Maryland. Draft Final. February 2012.

Malcolm Pirnie, 2001. Soil Background Concentration Report of Fort George G. Meade, Maryland. Final. October 2001.

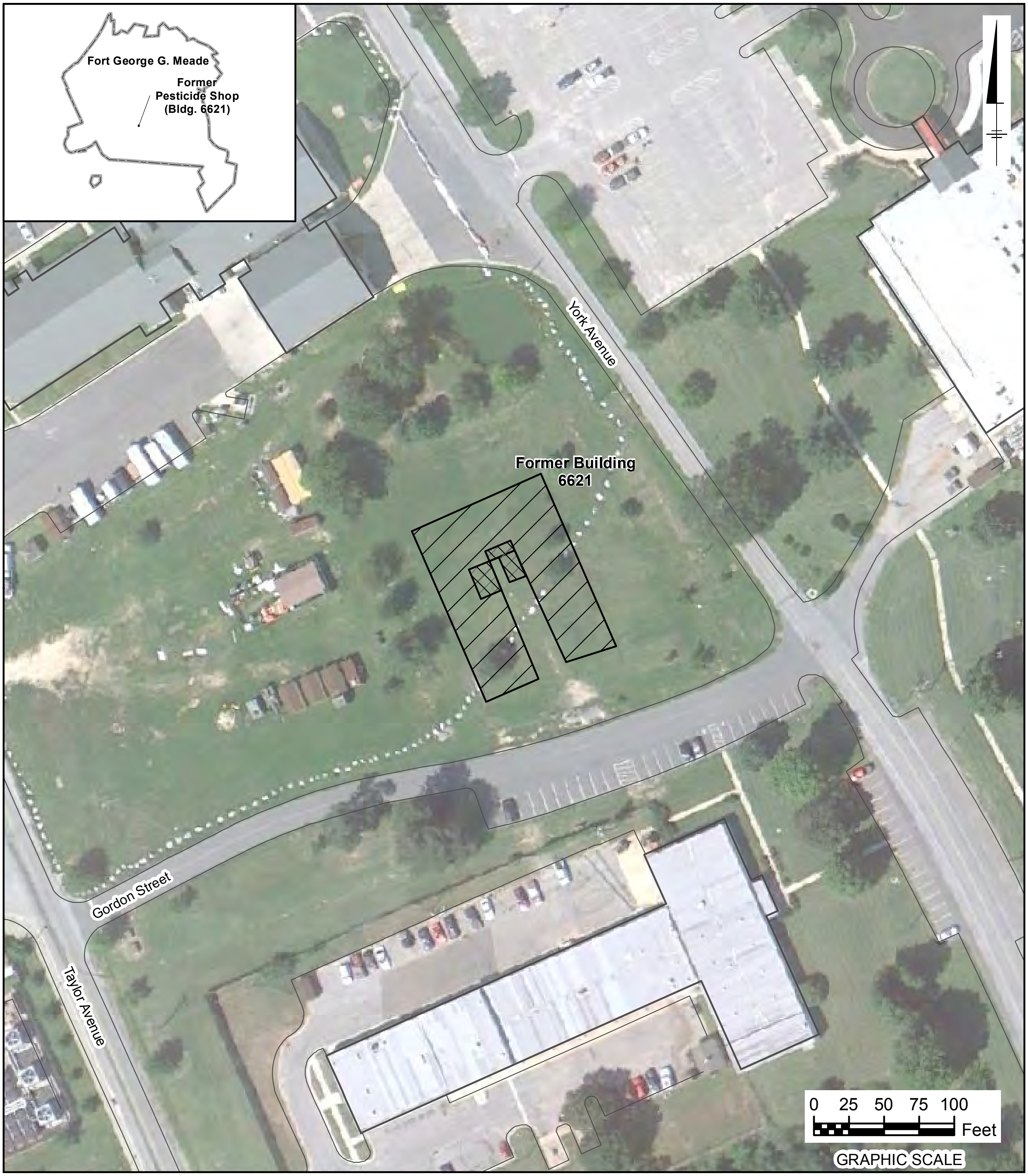
NuTec Design Associates, Inc. (NuTec) and Dewberry & Davis, 1997. Comprehensive Site Assessment and Relative Risk Site Evaluation for the Military District of Washington's Defense Environmental Restoration Program, DSERTS Site No. FGGM13, Fort George G. Meade Pesticide Shop (Building 6621), Final. 28 May 1997.

URS Group Inc. (URS), 2009. Site Management Plan, Fort George G. Meade, Maryland, Final. Prepared for U.S. Army Corps of Engineers Baltimore District. May 2009.

URS, 2011. Site Management Plan 2011 Annual Update Fort George G Meade, Maryland. September.

U.S. Environmental Protection Agency (USEPA), 2011. Regional Screening Level Master Table. Updated May 2011.

Figures



Legend:

Former Pesticide Shop Areas

Former Building 6621

Notes:

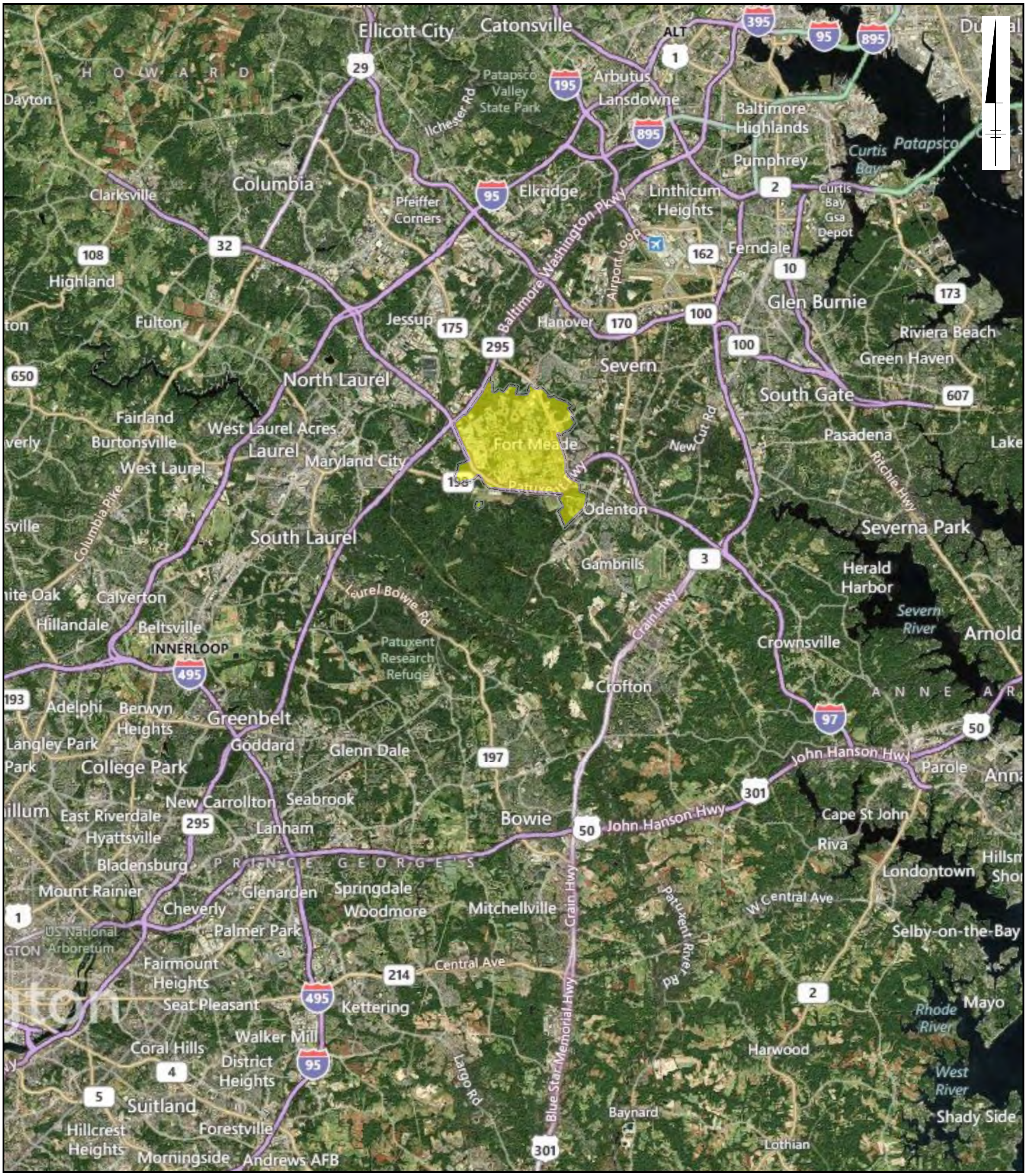
1. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Former Building 6621 Location

ARCADIS

FIGURE 1



Legend:

Installation Boundary

0 1 2 3 4 Miles

GRAPHIC SCALE

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

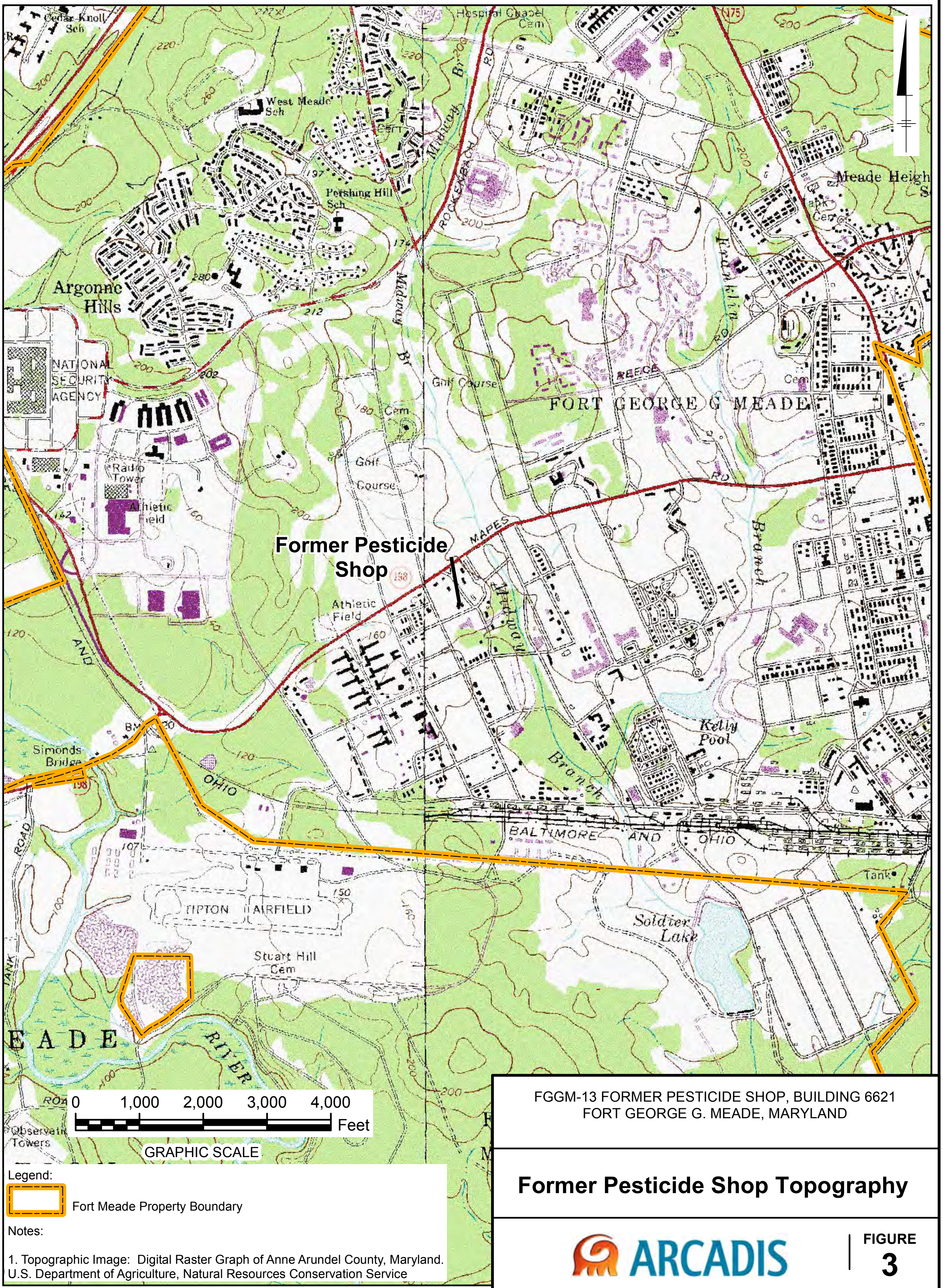
Fort George G. Meade
Location Map

ARCADIS

FIGURE
2

Notes:

1. Imagery accessed through Bing Maps via ArcGIS Online Layer Packages by ESRI (12/1/2010)
(C) 2010 Microsoft Corporation and its data suppliers accessed on 5/1/2012 through ArcGIS 10



FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Former Pesticide Shop Topography

ARCADIS

FIGURE
3

Analyte	Maximum Background Concentration (mg/kg)	Maximum Concentration Detected (mg/kg)	Location of Maximum Concentration
Arsenic	4.84	42.8	55-S

Legend:

▲ No Exceedance

▲ Exceeds Maximum Background Concentration

Former Pesticide Shop Areas

Former Building 6621

Notes:

1. Arsenic surface soil maximum background concentration = 4.84 mg/kg (Malcolm Pirnie, 2001)

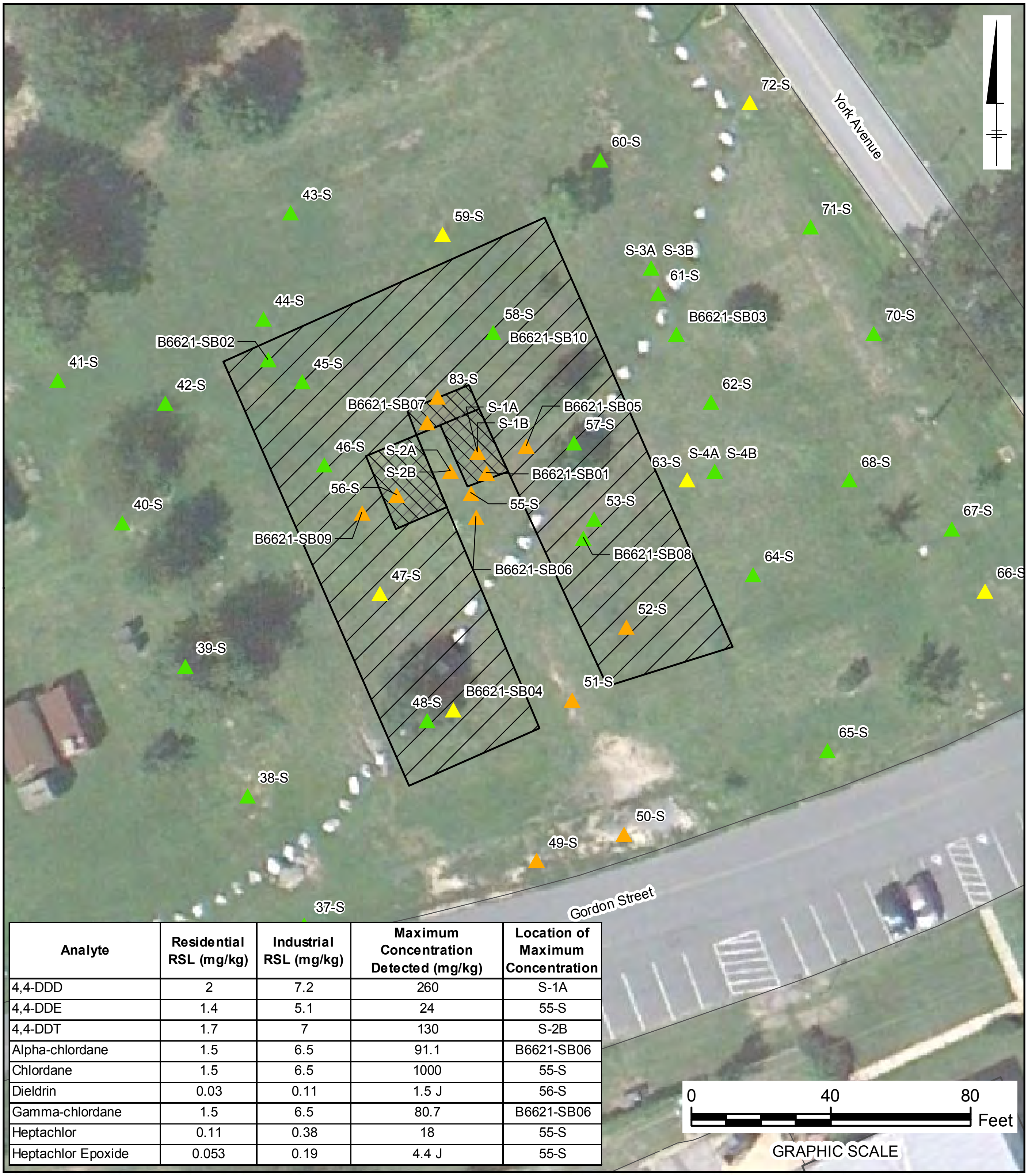
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Surface Soil (0-2') Arsenic Screening Results

ARCADIS

FIGURE
4



Analyte	Residential RSL (mg/kg)	Industrial RSL (mg/kg)	Maximum Concentration Detected (mg/kg)	Location of Maximum Concentration
4,4-DDD	2	7.2	260	S-1A
4,4-DDE	1.4	5.1	24	55-S
4,4-DDT	1.7	7	130	S-2B
Alpha-chlordane	1.5	6.5	91.1	B6621-SB06
Chlordane	1.5	6.5	1000	55-S
Dieldrin	0.03	0.11	1.5 J	56-S
Gamma-chlordane	1.5	6.5	80.7	B6621-SB06
Heptachlor	0.11	0.38	18	55-S
Heptachlor Epoxide	0.053	0.19	4.4 J	55-S

Legend:

- No Exceedance
- Exceeds Residential RSL
- Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

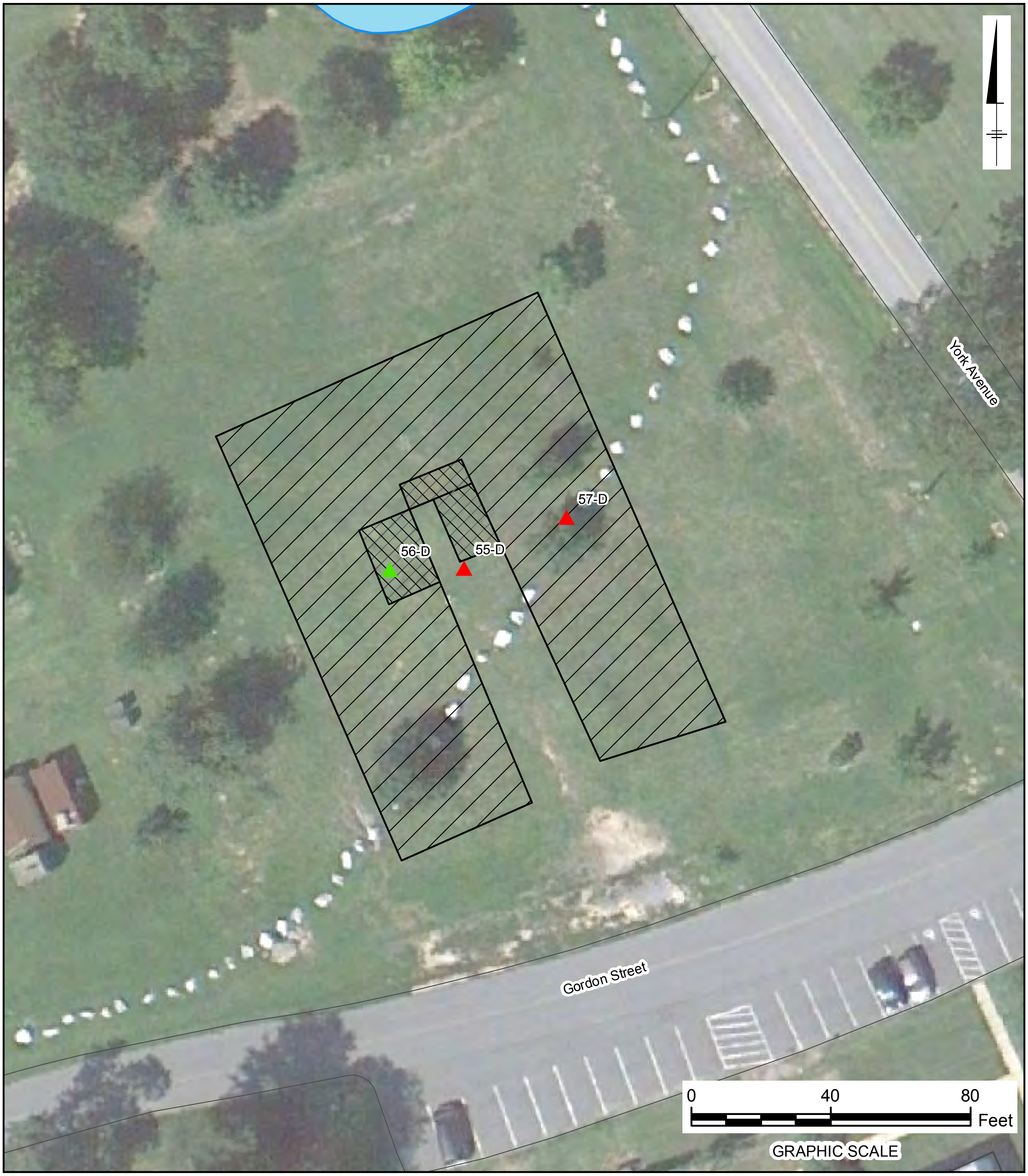
1. RSL = Regional Screening Level
2. mg/kg = Milligrams per kilogram
3. J = Analyte detected at an estimated concentration
4. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Surface Soil (0-2')
Pesticide Screening Results

ARCADIS

FIGURE
5



Legend:

- No Exceedance
- Exceeds Maximum Background Concentration
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

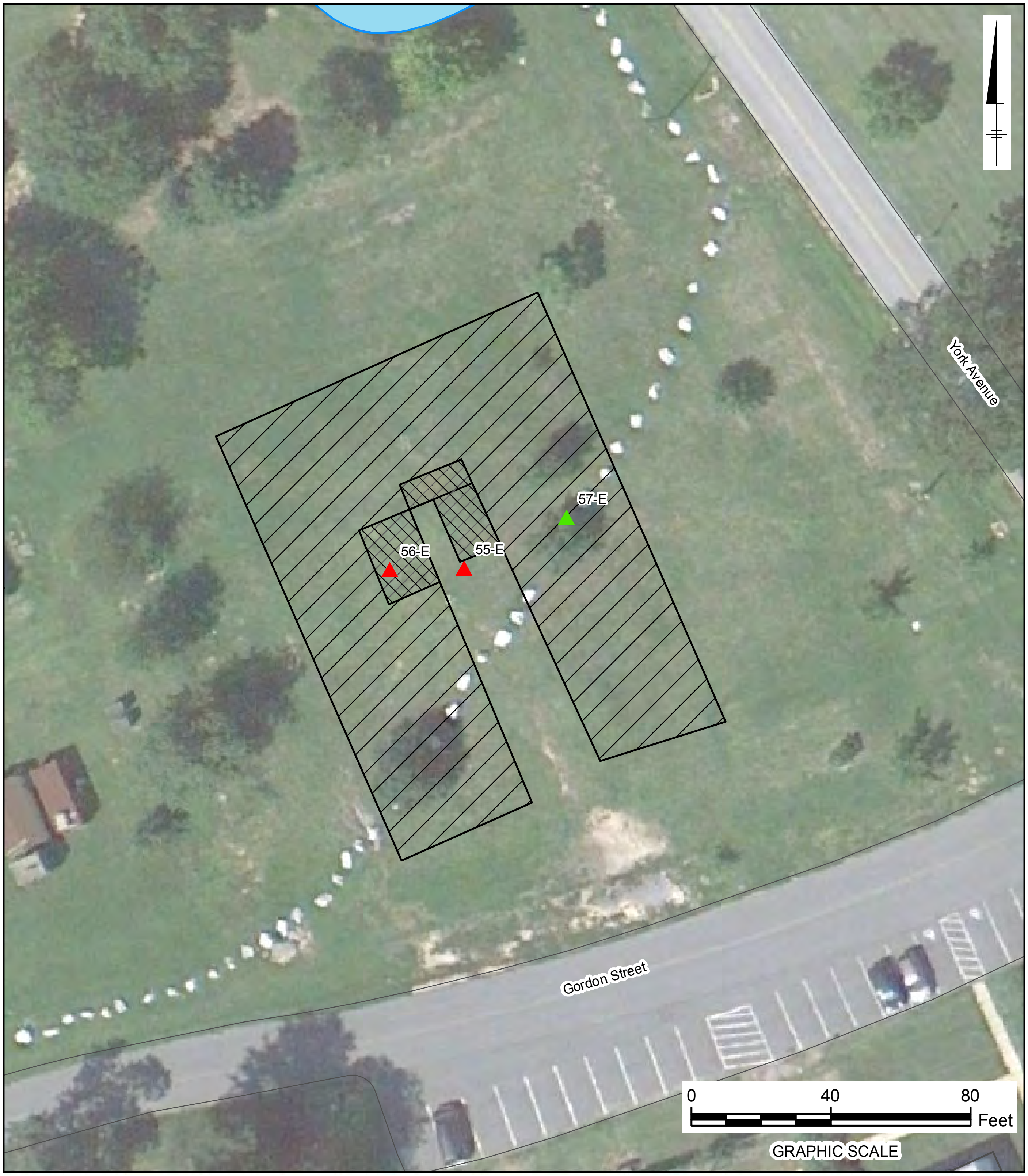
1. Arsenic subsurface soil maximum background concentration = 1.67 mg/kg (Malcom Pirnie, 2001)
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (8-10') Arsenic Screening Results

ARCADIS

FIGURE 6



Legend:

- No Exceedance
- Exceeds Maximum Background Concentration
- Former Pesticide Shop Areas
- Former Building 6621

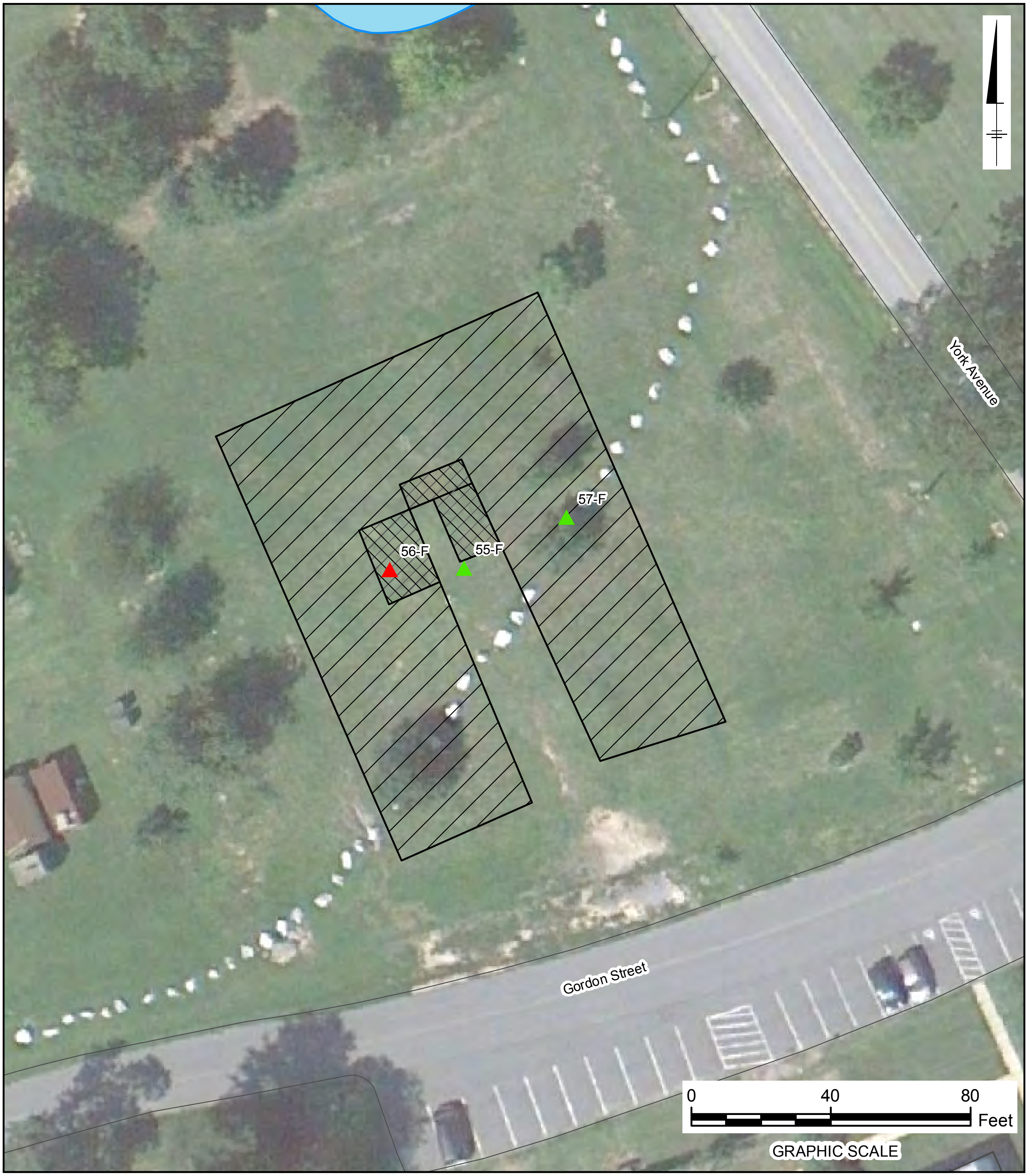
Notes:
1. Arsenic subsurface soil maximum background concentration = 1.67 mg/kg (Malcom Pirnie, 2001)
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (14-15') Arsenic Screening Results

ARCADIS

FIGURE
7



Legend:

- ▲ (green) No Exceedance
- ▲ (red) Exceeds Maximum Background Concentration
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

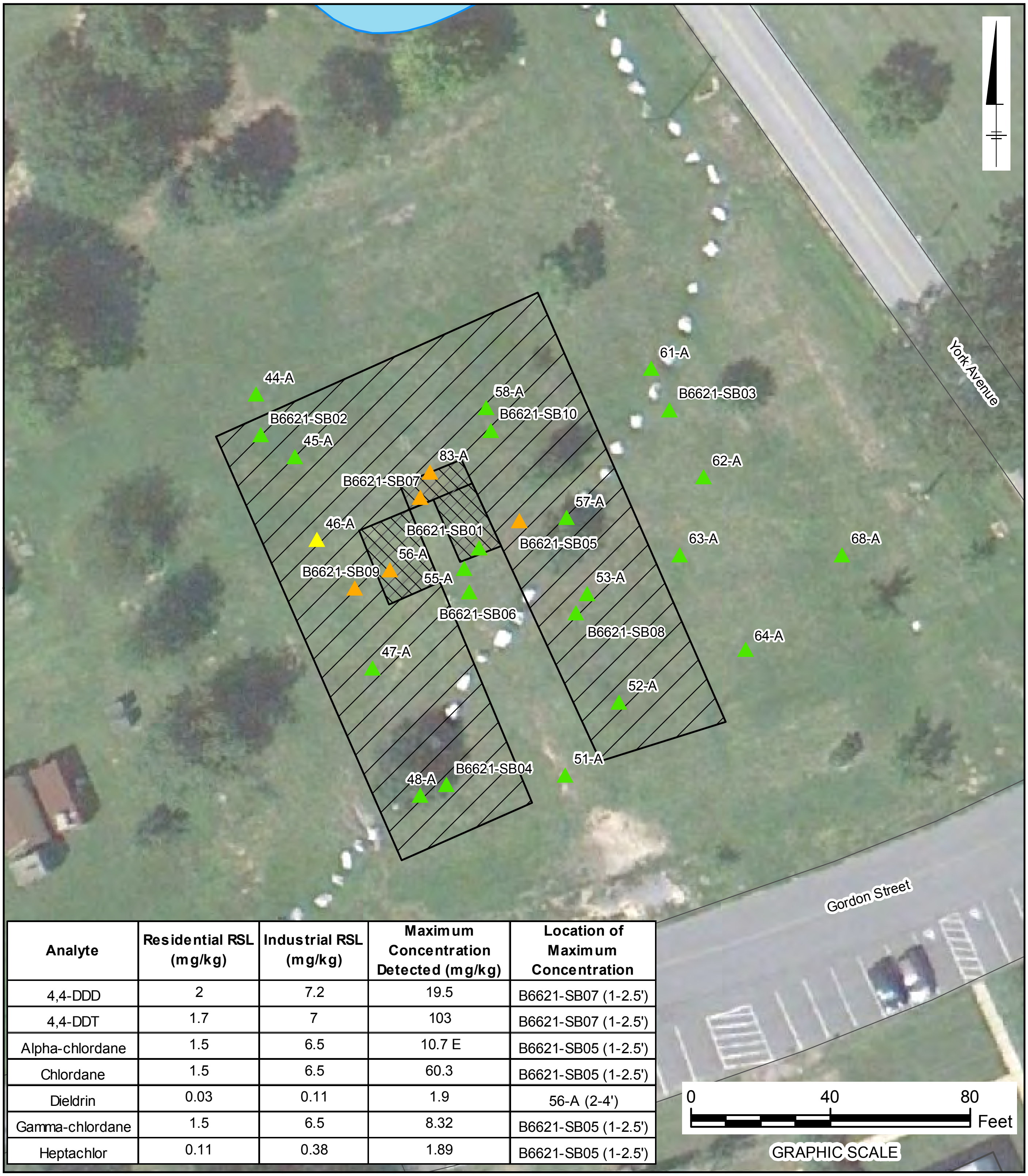
1. Arsenic subsurface soil maximum background concentration = 1.67 mg/kg (Malcom Pirnie, 2001)
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (19-20') Arsenic Screening Results

ARCADIS

FIGURE
8



Analyte	Residential RSL (mg/kg)	Industrial RSL (mg/kg)	Maximum Concentration Detected (mg/kg)	Location of Maximum Concentration
4,4-DDD	2	7.2	19.5	B6621-SB07 (1-2.5')
4,4-DDT	1.7	7	103	B6621-SB07 (1-2.5')
Alpha-chlordane	1.5	6.5	10.7 E	B6621-SB05 (1-2.5')
Chlordane	1.5	6.5	60.3	B6621-SB05 (1-2.5')
Dieldrin	0.03	0.11	1.9	56-A (2-4')
Gamma-chlordane	1.5	6.5	8.32	B6621-SB05 (1-2.5')
Heptachlor	0.11	0.38	1.89	B6621-SB05 (1-2.5')

Legend:

- No Exceedance
- Exceeds Residential RSL
- Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

1. RSL = Regional Screening Level
2. mg/kg = Milligrams per kilogram
3. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (2-4') Pesticide Screening Results

ARCADIS

FIGURE 9

Analyte	Residential RSL (mg/kg)	Industrial RSL (mg/kg)	Maximum Concentration Detected (mg/kg)	Location of Maximum Concentration
4,4-DDD	2	7.2	6.2	83-B
4,4-DDT	1.7	7	51	83-B
Heptachlor	0.11	0.38	0.18	55-B

Legend:

- No Exceedance
- Exceeds Residential RSL
- Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:
1. RSL = Regional Screening Level
2. mg/kg = Milligrams per kilogram
3. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (4-6') Pesticide Screening Results

ARCADIS

FIGURE 10

Analyte	Residential RSL (mg/kg)	Industrial RSL (mg/kg)	Maximum Concentration Detected (mg/kg)	Location of Maximum Concentration
4,4-DDD	2	7.2	19	83-C
4,4-DDT	1.7	7	230	83-C
Chlordane	1.6	6.5	53	83-C

Legend:

- No Exceedance
- Exceeds Residential RSL
- Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

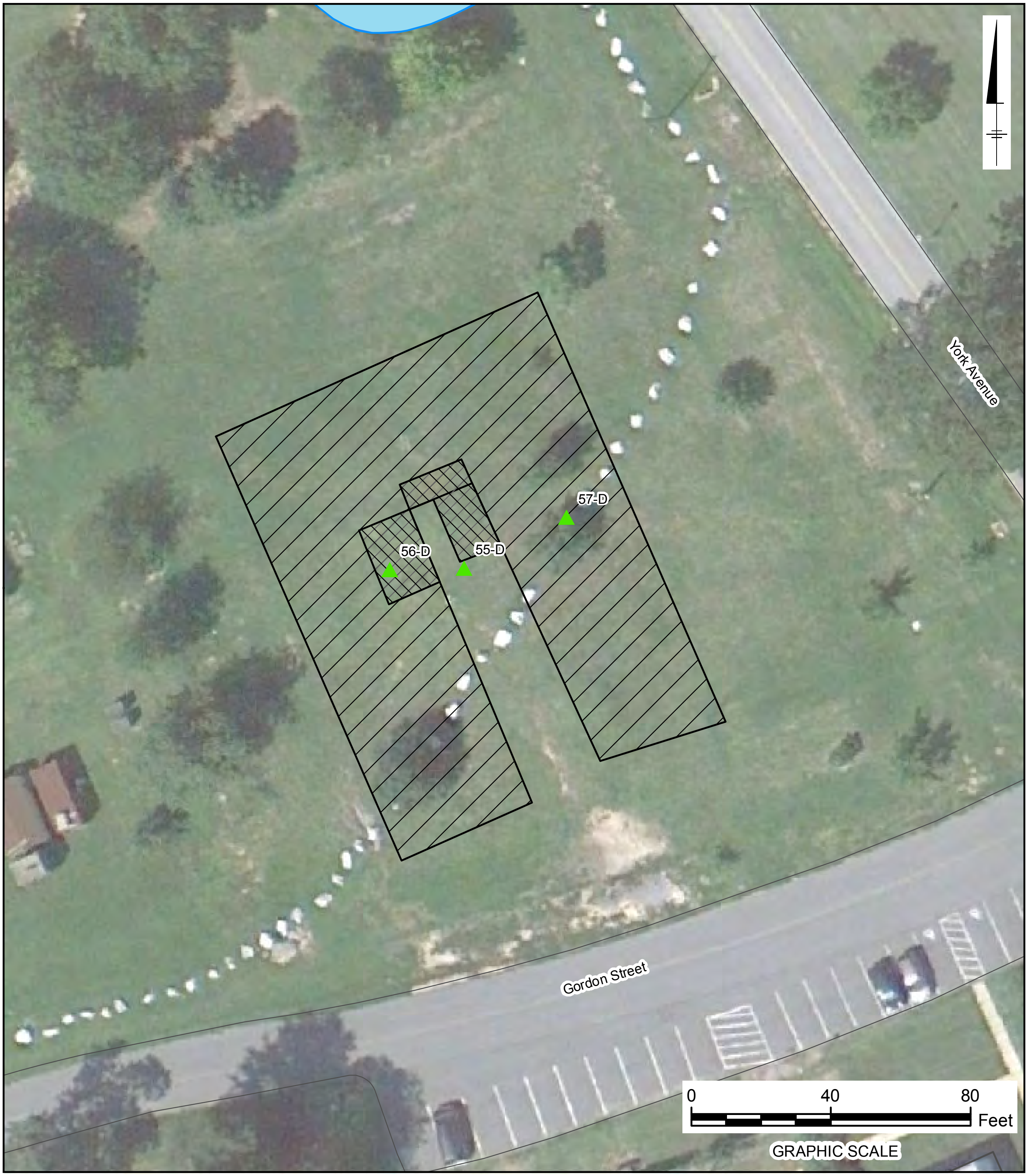
1. RSL = Regional Screening Level
2. mg/kg = Milligrams per kilogram
3. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (6-8')
Pesticide Screening Results

ARCADIS

FIGURE
11



Legend:

- ▲ No Exceedance
- ▲ Exceeds Residential RSL
- ▲ Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

1. RSL = Regional Screening Level
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (8-10')
Pesticide Screening Results

ARCADIS

FIGURE
12

Legend:

- No Exceedance
- Exceeds Residential RSL
- Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

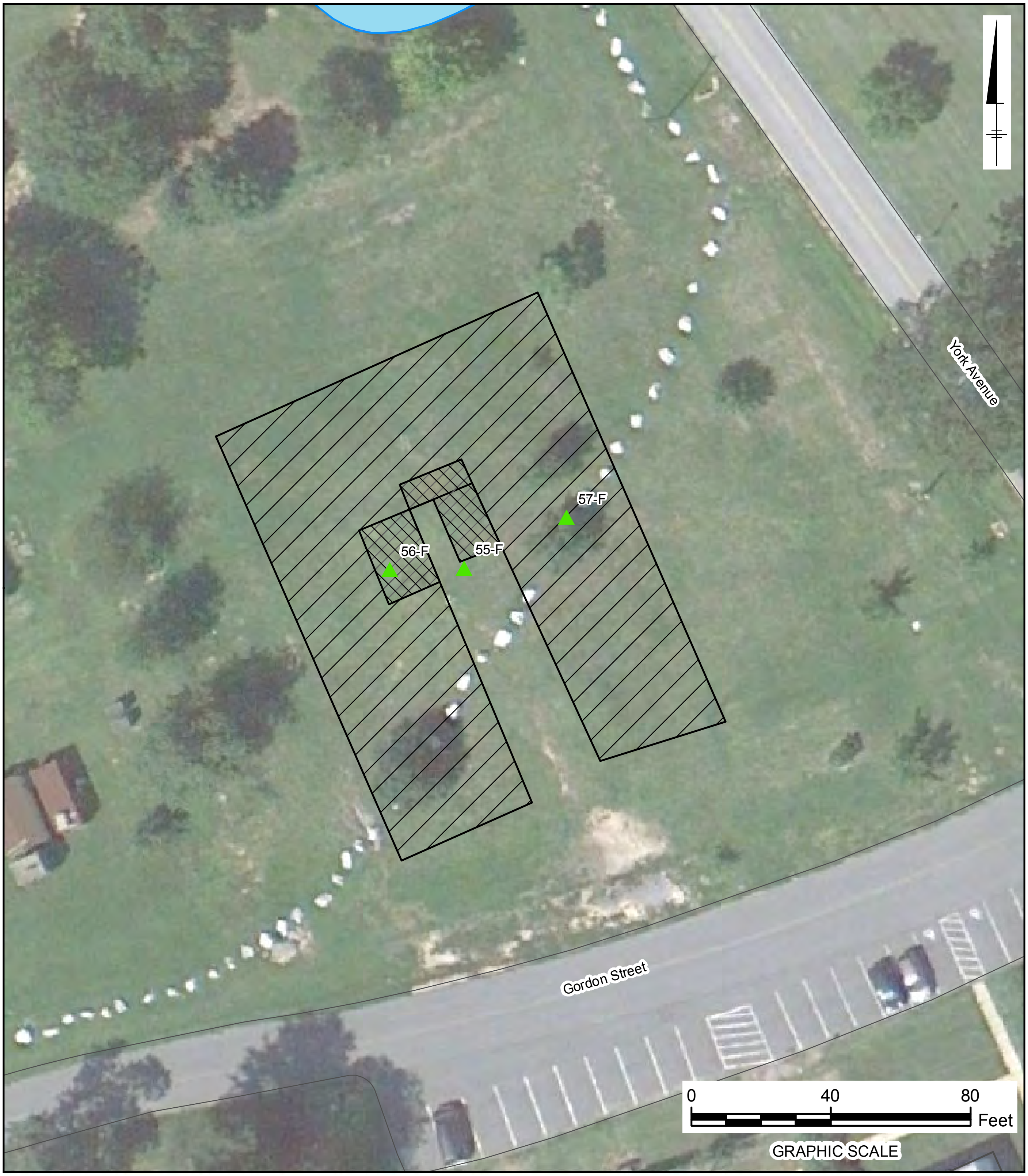
1. RSL = Regional Screening Level
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (14-15')
Pesticide Screening Results

ARCADIS

FIGURE
13



Legend:

- ▲ No Exceedance
- ▲ Exceeds Residential RSL
- ▲ Exceeds Residential and Industrial RSL
- Former Pesticide Shop Areas
- Former Building 6621

Notes:

1. RSL = Regional Screening Level
2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Subsurface Soil (19-20')
Pesticide Screening Results

ARCADIS

FIGURE
14

LEGEND:

- Well
- Stream Gauge
- Road
- Railroad
- Demolished Structures
- Existing Structures
- Surface Water
- Installation Boundary

0 100 200 Feet

GRAPHIC SCALE

Notes:

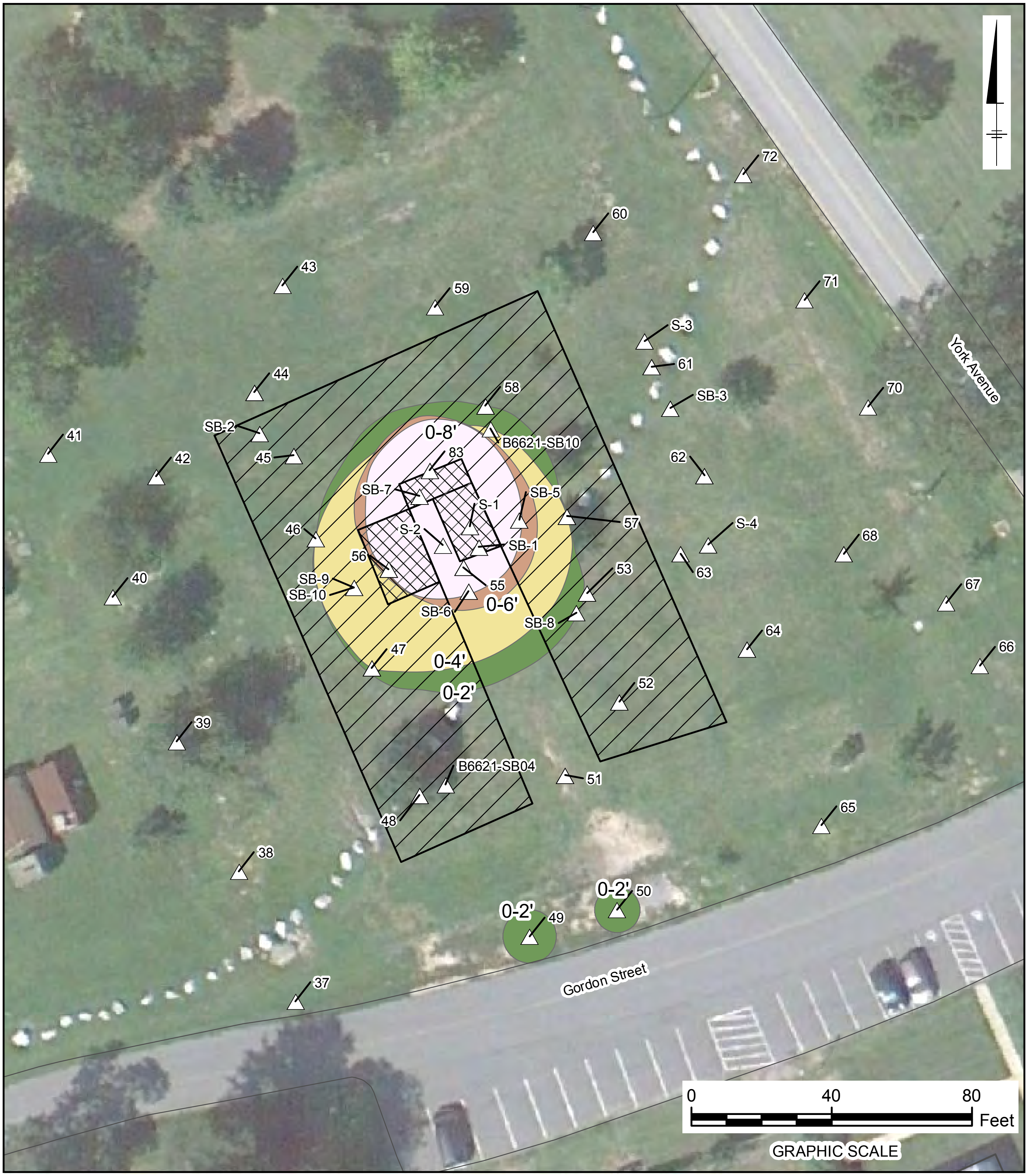
1. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Monitoring Well Locations

ARCADIS

FIGURE
15



Legend:

Former Pesticide Shop Areas

Soil Boring Location

Former Building 6621

Estimated Extent of Excavation in ft bgs

0-2'

0-6'

0-4'

0-8'

Notes:

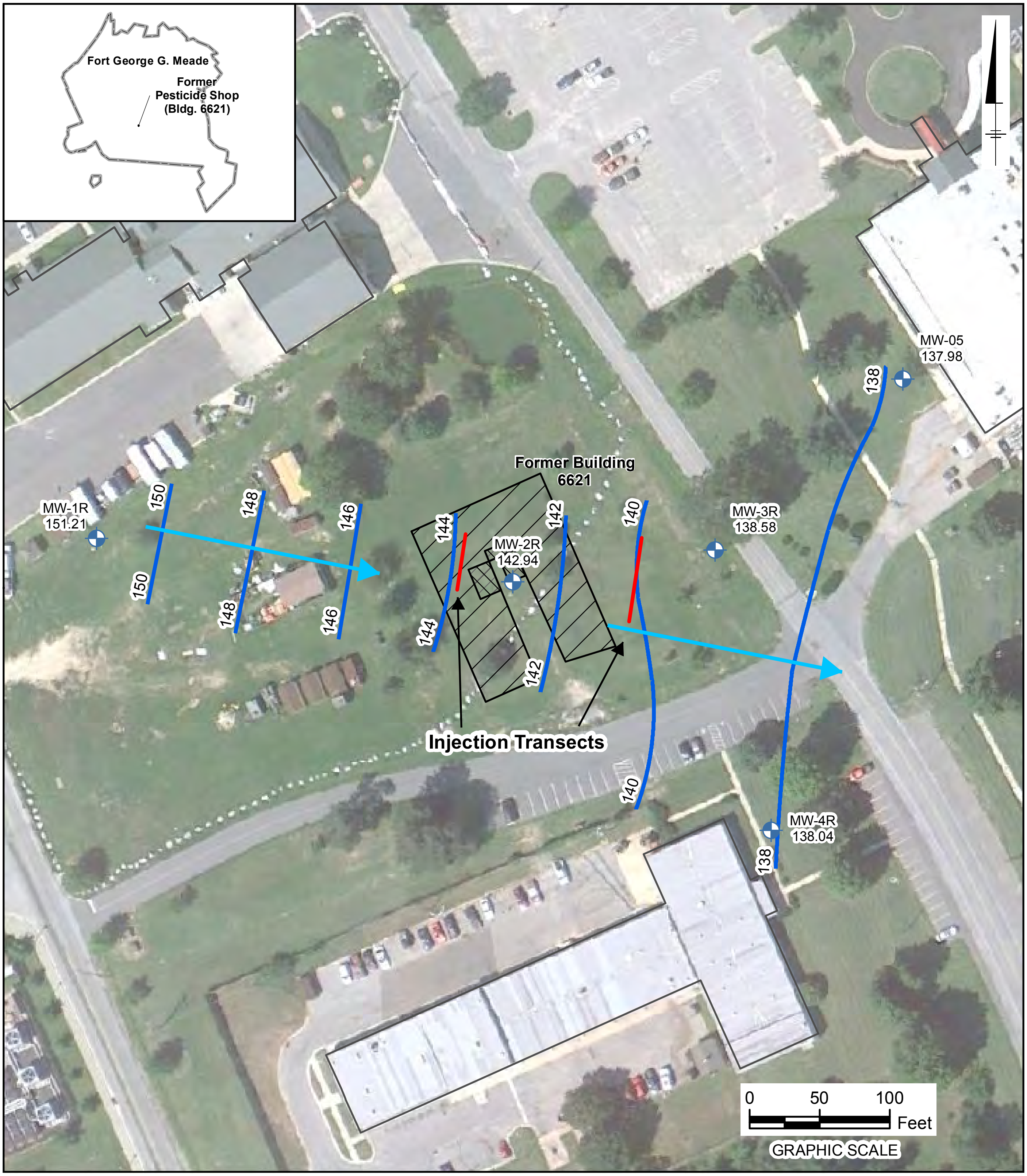
1. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012
© 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Estimated Excavation Limits

ARCADIS

FIGURE
16



Legend:

- Well
- Injection Transects
- Groundwater Elevation Contour
- Former Pesticide Shop Buildings
- Former Building 6621
- Groundwater Flow Direction

2 direct push injection transects spaced 125 feet apart (~6 months)
Transect 1 - 40 feet - 8 direct push points
Transect 2 - 60 feet - 12 direct push points
Direct push points spaced 5 feet on center
Direct push points to ~30 ft bgs
15 feet treatment thickness
220 gallons per point - 4,400 gallons of solution
3% Emulsified vegetable oil solution by weight

Notes:

1. Groundwater elevation data were collected on 1 June 2010 and are presented in feet above mean sea level.

2. Imagery 8/29/2010 Google Earth Pro, Accessed 5/1/2012 © 2012 Google, 2012 Geoeye, U.S. Geological Survey

FGGM-13 FORMER PESTICIDE SHOP, BUILDING 6621
FORT GEORGE G. MEADE, MARYLAND

Proposed ERD Technology

ARCADIS

FIGURE
17