DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name:	**Genie Facility, Shenandoah, Philips Electronics North America Corporation (PENAC)**
Facility Address:	**611 Williams Avenue, Shenandoah, VA 22849**
Facility EPA ID #:	**VAD000019620**

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   __X__ If yes – check here and continue with #2 below.

   _____ If no – re-evaluate existing data, or

   _____ If data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)
Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI
A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies
While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations
EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

The following references: were used in the preparation of this Environmental Indicator Determination:

- ENSR, 2005. *Supplemental Remedial Investigation Work Plan, The Genie Company Inc., Shenandoah, Virginia*, January 2005.
- ENSR, 2005. *Thomas House Residence – Focused Investigation Results*, April 25, 2005.
- ENSR, 2005. *Supplemental Remedial Investigation Work Plan Addendum – Bedrock Investigation*, October 19, 2005.
- ENSR, 2006. 2005 Annual Groundwater Monitoring Report. November 2006.
- ENSR, 2006. *Final Pre-Design Investigation Report- The Genie Company, Inc., Shenandoah, Virginia.* February 2006.
- ENSR, 2007. *Risk Assessment Work Plan*, Genie Company Site, Shenandoah, Virginia. October 2007.
- ENSR, 2007. *Supplemental Remedial Investigation Work Plan Addendum (Additional Intermediate Soil Borings, Sub-Slab Soil Investigation, Sub-Slab Vapor Investigation)*, April 17, 2007.
- ENSR, 2007. *Supplemental Remedial Investigation Work Plan Addendum –Genie Facility Indoor Ambient Air Sampling*, July 25, 2007.
- ENSR, 2007. *2006 Annual Groundwater Monitoring Report- Genie Company Facility, Shenandoah, Virginia.* September 10, 2007.
- ENSR, 2007. *Project Work Plan- Genie Facility, Shenandoah, Virginia.* September, 2007.
- ENSR, 2007. Technical Memo – "Preliminary Results, Genie and KVK Facility Sub-slab Vapor Sampling", July 30, 2007.
- Indoor Ambient Air Sampling Results for Genie Plant and 600 Shenandoah River Road – sampling occurred 2007 and 2008.
- Key Environmental, 2004. Phase I Remedial Investigation Report, Genie Company Site, Shenandoah, Virginia. 2004.
- AECOM, June 5, 2009, Annual Progress Report, 2008-2009, Genie Company Site, Shenandoah, VA

2. Is **groundwater** known or reasonably suspected to be "**contaminated**" [1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   __X__ If yes – continue after identifying key contaminants, citing appropriate "levels", and referencing supporting documentation.

   _____ If no – skip to #8 and enter "YE" status code, after citing appropriate "levels", and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   _____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The groundwater is currently monitored semi-annually (May and November) for volatile organic compounds analysis. Historically, semi-volatiles and metals have also been evaluated. Regular groundwater monitoring began at the site in 2004. Initial site assessment work began in 1990/1991, with groundwater sampling intermittent since. The following constituents in groundwater exceed the respective US EPA Region III Maximum Contaminant Levels (MCL) for drinking water at the Genie Plant facility in Shenandoah, Virginia. Trichloroethylene is the most prevalent constituent reaching concentrations of 1,600 mg/l.

Constituent	MCL (µg/l)	Maximum Detected Concentration (µg/l)	Date
Benzene	5	80	May 2004
Carbon tetrachloride	5	20,000	May 2008
1,2-Dichloroethane	5	66	May 2006
Cis 1,2-Dichloroethene	70	40,000	November 2007
1,1-Dichloroethylene	7	20,000	November 2007
Dichloromethane	5	80,000	November 2007
Tetrachloroethene	5	65	May 2006
1,1,1-Trichloroethane	200	47,000	November 2007
1,1,2-Trichoroethane	5	880	May 2006
Trichloroethylene	5	1,600,000	November 2006, 2007, 2008

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

[2] Region III Risk-based Concentrations (RBCs) are used when a Maximum Contaminant Levels (MCLs) are not applicable.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes – continue after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) – skip to #8 and enter "NO" status code, after providing an explanation.

____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Recent groundwater analytical data (May 2008 and November 2008) indicates the groundwater plume has been delineated and is stable (see attached figures). Shallow groundwater impacts appear to be limited to the horizontal extents of the Genie property boundary except for offsite migration to the north (defined by three offsite shallow monitoring wells: MW-36, MW-44, and MW-45). Shallow groundwater impacts at the KVK property extend horizontally offsite to the west and southwest (defined by five offsite shallow monitoring wells: MW-33, MW-39, MW-40, MW-41, and MW-42). Additionally, geotechnical evaluations demonstrate that overburden soils have very low permeability and hydraulic conductivity (1.94E-06 to 2.50E-07 cm/sec).

Historical analytical data available since 2004 demonstrate that contaminant concentrations in the overburden are relatively stable and do not suggest significant movement of the contaminant plume. Two individual plumes have been defined: one centered on the Genie Plant and one centered on the KVK Property. The plumes have been defined to the west of the Genie Plant and the KVK Property by non-detectable levels of TCE in MW-24S and MW-42S for six or more consecutive sampling events. In addition, MW-12S (northwest of the Genie Plant) has had non-detect levels for the past three sampling events, with a maximum TCE concentration of 29 µg/l detected in November 2006. Well MW-44S, located due north of the Genie Plant, has had non-detectable levels of TCE contamination for 6 of the last 7 sampling periods. TCE concentrations in well MW-45S, located west of MW-44S and north of the Genie Plant, have consistently been below a reported peak of 53 µg/l, the level detected in January 2005. Monitoring wells MW-30S, located east of the Genie Plant, and MW-43S, located southeast of the KVK Property, have not reported detectable levels of TCE since 2006. TCE concentrations in MW-39S, located south of the KVK property, have generally ranged between 4 µg/l to 16 µg/l since 2004, with a maximum concentration of 67 µg/l reported in November 2007. The peak in November 2007 was reported in several other wells on the property, and may be related to historically low groundwater levels during the fall of 2007.

Bedrock groundwater impacts have been detected onsite and offsite extending to private wells adjacent to the Shenandoah River, along Shenandoah River Road approximately 3,200 feet northwest of the site. Vertical impacts have been evaluated onsite extending to 248 feet below land surface and up to 700 feet below land surface offsite to the northwest.

Historical analytical data available since 2004 demonstrate that contaminant concentrations in the bedrock are relatively stable and do not suggest significant movement of the contaminant plume. The plume has been defined to the west, north, and east by non-detect levels of TCE by MW-30D, MW-50, MW-52, and MW-53 since 2006; TCE detections in these wells in January 2005 correspond to detection of TCE in the laboratory blank. TCE concentrations in well MW-35D, located south of the KVK Property, have been below 40 µg/l since November 2005, indicating the plume is stable to the south.

The shallow wells located at 700 and 800 Shenandoah River Road are hand dug wells that extend 10-15 feet below ground surface (bgs). TCE concentrations in these wells have been at or below 20 µg/l since December 2007. The bedrock TCE plume extends the farthest to the northwest to private wells along Shenandoah River Road. The private well at 600 River Road was installed in 1979 to a depth of 122 feet bgs and is cased to 105 feet bgs. Since November 2007, TCE concentrations at 600 River Road have ranged from 175 µg/l to 288 µg/l. TCE has not been detected during sampling of private wells west of the Shenandoah River. Overall, the TCE concentrations along River Road have not changed significantly over time, indicative of a stable plume.

Footnotes:

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

__X__ If yes – continue after identifying potentially affected surface water bodies

_____ If no – skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies

_____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Surface water analytical results of samples collected from a manmade pond located offsite approximately 600 feet to the northeast indicate no contaminants present. Other surface water bodies in the project vicinity include an intermittent stream 500 feet north of the site and a manmade pond located approximately 2,000 feet northwest. Neither of these water bodies have been sampled because of access issues or lack of significant flow (dry conditions), but it is believed that no impacts exist.

Three surface water samples were collected from the Shenandoah River in July 2008. The samples were collected at locations assumed to be upstream, downstream, and at a location near the highest land-side impacts observed. Additionally, attempts were made to identify areas of underwater seeps or upflows. Results from the sampling show no detectable levels of VOCs in the water samples collected.

Although no contaminants were detected in the Shenandoah River samples, it is reasonable to assume that minimally impacted groundwater discharges into the Shenandoah River (3,200 feet to the northwest). This assumption is a result of the deep and shallow impacts detected in private wells along Shenandoah River Road adjacent to the river.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_X_ If yes -- skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no – (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The surface water samples collected from the Shenandoah River in July 2008 suggest that any impacted groundwater discharging into the River is insignificant (all results were non-detect for TCE).

Shallow wells located adjacent to the Shenandoah River (within 50 feet), report concentrations less than 50 µg/l of TCE (10 times the MCL). It is expected that any discharge to the Shenandoah River would be less that the reported well concentrations and significantly diffused by other feeder streams and seeps. Furthermore, there are no other conditions which would significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations. The Shenandoah River is approximately 150 to 200 feet wide at this point and swift flowing. Dilution affects would be overwhelming to the small potential TCE concentrations loading.

Footnotes:

[3]- As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes – continue after either:

(1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR

(2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination..

_____ If no – (the discharge of "contaminated" groundwater into surface water is potentially significant) continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of <u>each</u> contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Footnotes:

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes – continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no – enter "NO" status code in #8. skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies

_____ If unknown – skip to #8 and enter "IN" status code.

Rationale and Reference(s):

To ensure the stability of the plume and to plan routine monitoring, a groundwater monitoring work plan was developed and approved by the Virginia Department of Environmental Quality. The monitoring plan includes:

- Quarterly sampling of 8 private residential wells for volatile organic compounds (VOCs);
- Semi-annual gauging and sampling of existing monitoring wells. Monitoring wells will be sampled for VOCs using passive diffusion bag (PDB) technology.

This plan is open for modifications when deemed prudent (increase or decrease the number of sampling points and/or monitoring wells).

PENAC is additionally currently finalizing corrective measures for OU-1 (source area soil near the former drywell). A draft work plan of the corrective measures has been conditionally approved by the VDEQ. Remedial efforts are anticipated to begin in the summer or fall 2009. Furthermore, detailed deep aquifer characteristic tests (pump, yield, slug) are being developed to determine hydrologic values to assist in future anticipated corrective measures.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ YE – Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the **Genie Facility, EPA ID# VAD000019620,** located at **611 Williams Avenue, Shenandoah, VA 22849**. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO – Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN – More information is needed to make a determination.

Completed by		Erich Weissbart	Date	9/1/09
	(Print)	Erich Weissbart		
	(Title)	Environmental Engineer Senior		

Supervisor		Jutta Schneider	Date	9/1/09
	(Print)	Jutta Schneider		
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Locations where References may be found:

Virginia Department of Environmental Quality
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Attachments: Site Plan
Area Residential Wells

Piscataway on 'dcPiscataway'(J):Project/Philips-Shenandoah/05409-003/Cadd/Cadd/FIG 2 (1)

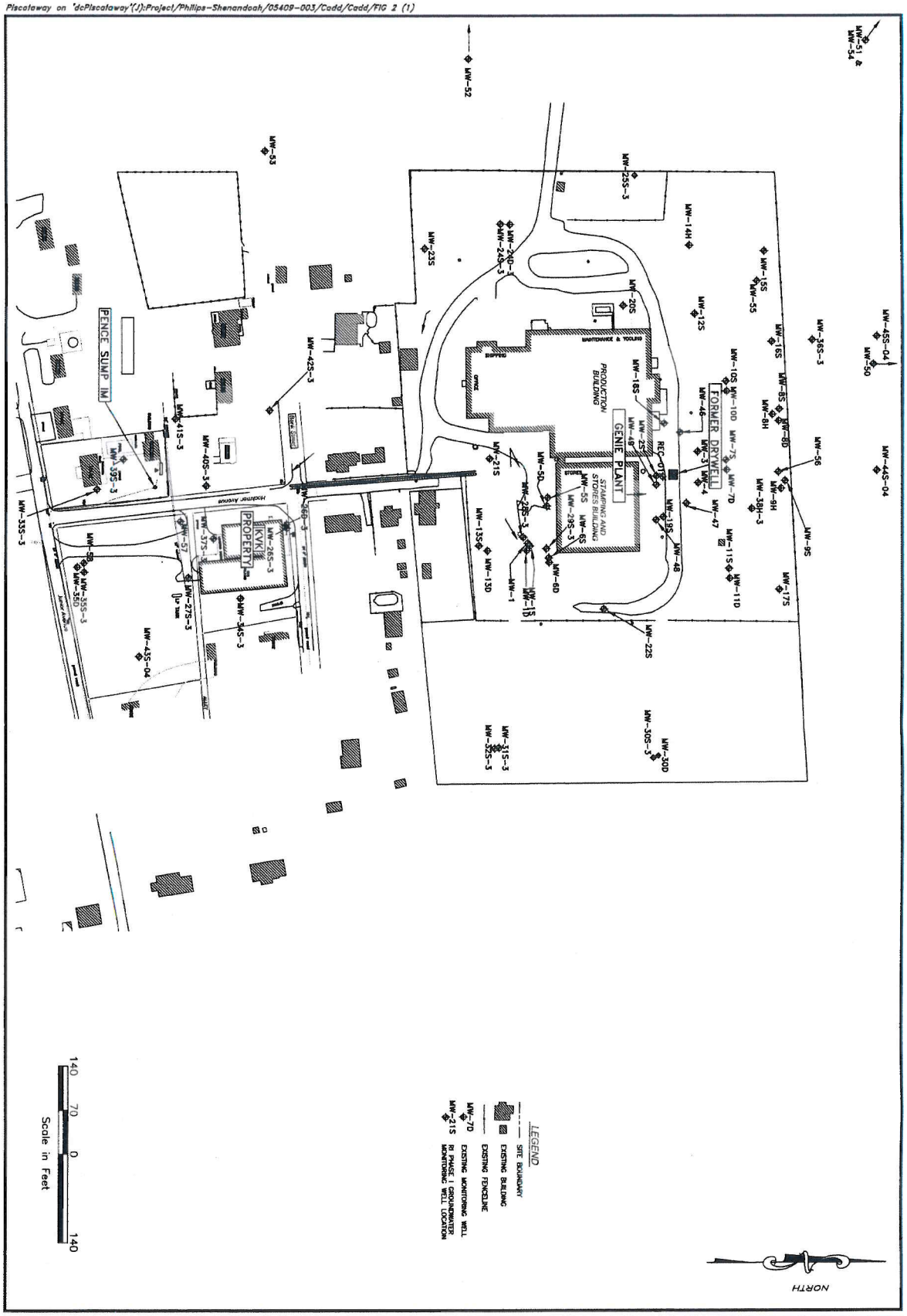

FIGURE NUMBER:	SHEET NUMBER:
2	1 of 1

SITE PLAN
THE GENIE COMPANY, INC.
SHENANDOAH, VIRGINIA

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	08/14/09	05409-003-0019

AECOM

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SB	NO.:	DESCRIPTION:	DATE:	BY:
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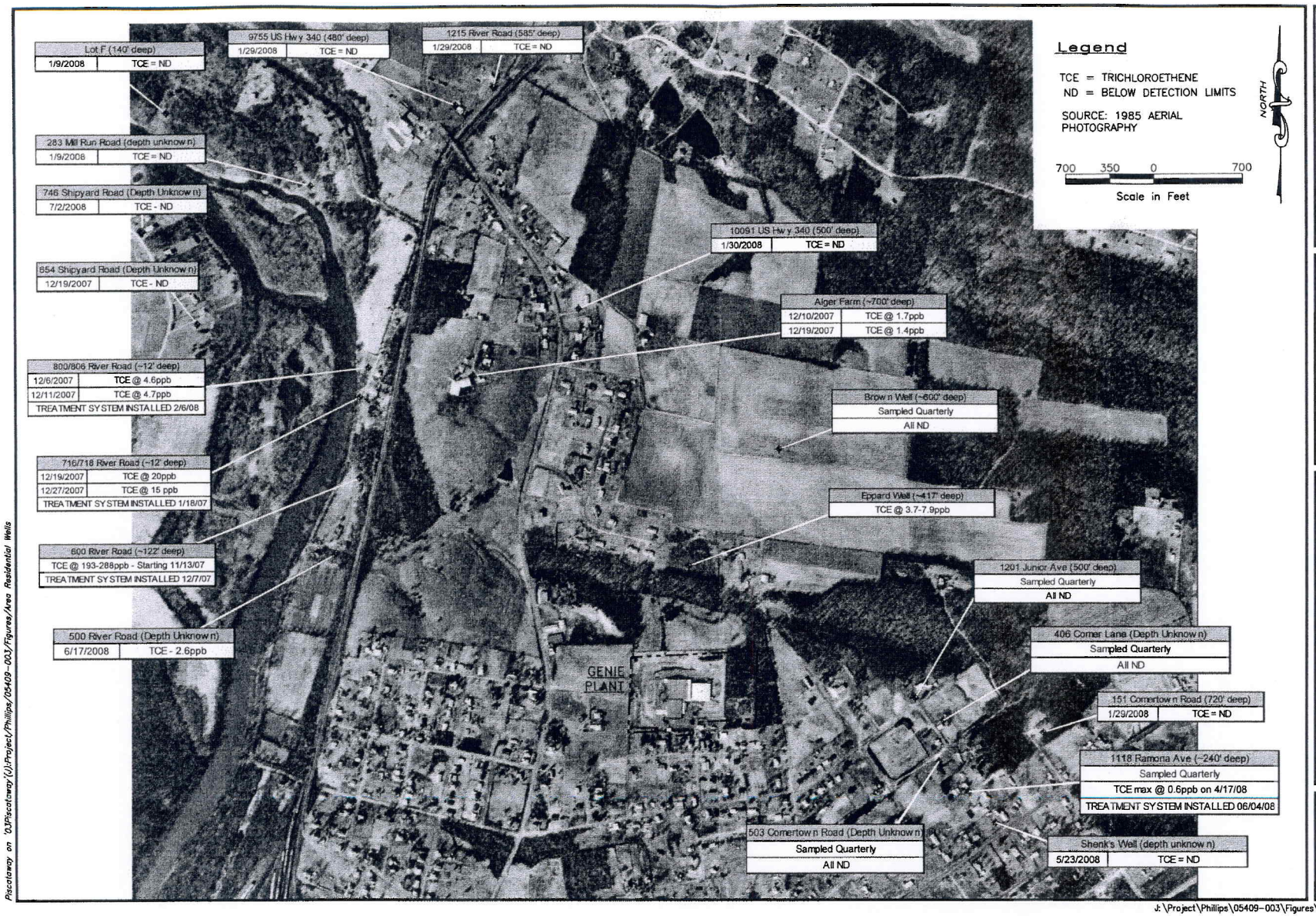
S.B.				



Piscataway on 'D:\Piscataway'(U):Project/Phillips/05409-003/Figures/Area Residential Wells

REVISIONS			
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SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	01/27/09	05409-003

FIGURE NUMBER: 3

SHEET NUMBER: 1 of 1

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