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: DuPont Teijin Films
Facility Address: 1 Discovery Drive, Chester, Virginia
Facility EPA ID #: VAD000019273

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?

   __√__ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ If data are not available, skip to #8 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).

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?

__√__ 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):

Site Background

This EI evaluation has been prepared for the DuPont Teijin Films (DTF) facility which is located west of the city of Hopewell, Virginia, in Chesterfield County on the southern bank of the James River (see Figure 1). The site began construction under ICI Polyester in May 1970, with manufacturing operations beginning in 1972. DuPont purchased the site in 1998 and later formed a joint venture with Teijin Films in 1999. Various polymer film materials have been manufactured at the facility and are marketed as Melinex and Mylar®. Currently, the DTF facility consists of several buildings that contribute to the manufacturing of over 50 types of polyester film.

Data Set for EI Evaluation

Groundwater sampling has been conducted at the site as part of site-wide groundwater monitoring (DuPont CRG, 2005) and the RCRA Facility Investigation (RFI) (DuPont CRG, 2008 and URS, 2010). Groundwater data collected from these investigations, which were conducted in April 2005, April 2008 and June 2010, were used in the evaluation. During the historical investigation and RFIs, groundwater samples were collected from seven in-situ groundwater monitoring points, up to 43 monitoring wells and two on-site production wells (see Figure 2).

Screening Levels Used to Evaluate Site Data

There is no potable use of groundwater at the DTF facility or at neighboring facilities and exposure to the production well water does not occur except possibly during short-term, intermittent maintenance activities (such as draining lines or repairing pumps) or during use as fire water. However, as a conservative measure, constituents detected in groundwater and production well water were compared to the lower of the Federal Maximum Contaminant Level (MCL) or USEPA Regional Screening Levels (SLs) for tap water (November 2010 edition). The SLs, which assumes a combined exposure including inhalation of volatile compounds and ingestion for residential use, were based on a cancer risk of one in one million (1×10^{-6}) and a hazard quotient of 0.1.

[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).

Constituents of Potential Concern (COPCs) in Groundwater

Table 1 provides a comparison of constituents detected in site-wide groundwater to the screening criteria (MCLs or tap water SLs). Monitoring well locations are detailed in Figure 2. As shown in Table 1, 11 VOCs, 12 SVOCs, Dowtherm® constituents (biphenyl and diphenyl ether), and 11 metals (total and dissolved) were identified as COPCs in groundwater. Constituents most frequently detected above tap water SLs and Federal MCLs (where applicable) included three organics (tetrachloroethylene [PCE], 1,4-dioxane, one Dowtherm constituent [diphenyl ether]) and two metals (total cobalt and total arsenic).

Cconclusions presented in the *Phase II RFI Report* (URS, 2010) relative to COPC distribution included the following:

- There are two distinct plumes with low concentrations of chlorinated compounds (one in the upper aquifer and one in the lower aquifer). The plumes appear to be spatially separated but may overlap in the center of the site where a highly transmissive zone was identified.
- Phase II RFI activities did not identify an on-site source of chlorinated compounds in the upper aquifer. Detections of PCE and its degradation products (such as trichloroethene [TCE] and vinyl chloride) were observed in the upper aquifer in the northeastern portion of the site near monitoring wells MW-101A and MW-102A.
- Phase II RFI activities confirmed that chlorinated compounds are migrating onto the site in the lower aquifer from an upgradient (off-site) source.
- Glycol exceedances observed during the Phase I RFI were not observed during the Phase II RFI. Non-detects where glycol isomers were previously detected is not unusual, since glycols are susceptible to rapid biodegradation.

References:

DuPont Corporate Remediation Group (CRG). 2005. Hopewell Supplemental Groundwater Monitoring Report. DuPont Teijin Films, Hopewell, Virginia. March.

DuPont CRG. 2008. Phase I RFI Report. DuPont Teijin Films, Hopewell, Virginia. Submitted October 2008. Revised April 2009.

URS. 2010. Phase II RFI Report. DuPont Teijin Films, Hopewell, Virginia. Submitted December 2010.

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)?

__√__ 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):

Two aquifers exist within the undifferentiated sediments at the site. An upper unconfined unit (Columbia Aquifer) and a lower semi-confined aquifer (Potomac Formation), and have reported thickness in excess of 50 feet and 100 feet, respectively. The upper and lower aquifer appear to be hydraulically connected in portions of the site. The lithologic data collected during the Phase II RFI indicated an absence of significant clay/silt deposits within a lower portion of the Columbia Aquifer near the center of the site. This highly transmissive area lies within the reach of tidal influence and displays an upward vertical hydraulic gradient. This area is also potentially hydraulically affected by high production pumping rates at the North Well. These conditions provide the potential for mixing of dissolved-phase COPCs between the two aquifers in this area.

In the aquifers, constituent concentrations have remained stable or decreased as supported by maps presented in the Hopewell Supplemental Groundwater Monitoring Report (DuPont CRG, 2005), Phase I RFI Report (DuPont CRG, 2008) and Phase II RFI Report (URS, 2010). The distribution of constituents in shallow and deep groundwater during the RFIs is consistent with historical results from the 2005 site-wide groundwater monitoring event. For instance, in the Manufacturing Area, a Dowtherm plume extends in a relatively compact area extending from MW-04 to MW-08 (see Figure 15 in URS, 2010). The plume depicts the same pattern observed during the 2005 monitoring event (DuPont CRG, 2007).

---

[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.

References:

DuPont CRG. 2005. Hopewell Supplemental Groundwater Monitoring Report. DuPont Teijin Films, Hopewell, Virginia. March.

DuPont CRG. 2007. Revised Phase I RFI Work Plan. DuPont Teijin Films, Hopewell, Virginia. March.

DuPont CRG. 2008. Phase I RFI Report. DuPont Teijin Films, Hopewell, Virginia. Submitted October 2008. Revised April 2009.

URS. 2010. Phase II RFI Report. DuPont Teijin Films, Hopewell, Virginia. Submitted December 2010.

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

__√__ 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):

At the DTF facility, most wells near the James River demonstrate variable hydraulic gradients toward the river indicating net discharge to the James River. Vertical hydraulic gradient also varies with the tidal cycle, and with the general stage of the river. Hydraulic gradient at the site is constantly inward from the west and south and reverses often from the north (to the river) and from the east. It is reasonable to assume that this inward hydraulic gradient is induced by the site production wells (URS, 2010). Potentiometric maps from the most recent period of measurement (late summer 2010) are included as Figures 3 and 4.

The James River is designated as a Class II (tidal freshwater) river by the state of Virginia. As a Class II river, water from the river is designated for recreational (e.g., swimming and boating); aquatic life propagation and maintenance; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish). In addition, the river is designated as a public water supply and nutrient enriched waterway. The nearest public water intake is downstream of the site along the Appomattox River near its confluence with the James River.

References:

URS. 2010. Phase II RFI Report. DuPont Teijin Films, Hopewell, Virginia. Submitted December 2010.

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 ten 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)?

_____ 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 - enter "IN" status code in #8.

Rationale and Reference(s):
A multi-tiered risk-based screening approach was used for this evaluation. Maximum detected concentrations in nine perimeter monitoring well locations (DMW-5, MW-109A, MW 100A/B/C, MW-101A, MW-200B, MW-10 and MW-11) were first compared to appropriate groundwater criteria (i.e., MCLs or tap water SLs). Constituents whose maximum detected concentration exceeded the screening criteria were then compared to the groundwater criteria with an applied conservative dilution factor of ten to account for groundwater and surface water interaction. The use of a conservative dilution factor is consistent with current EI guidance and the 1996 Advanced Notice of Proposed Rule Making (ANPRM) regarding establishing point of compliance for surface water discharges (EPA, 1996).

The results of these two screening steps indicate that one inorganic COPC (total arsenic) and three organic COPCs (chloroform, PCE and 1,3-dinitrobenzene) were in excess of ten times the screening criteria (Table 2).

---

[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 eco-systems), 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 can not be shown to be **"currently acceptable"**) - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

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

Rationale and Reference(s):
Step six of the EI process addresses the acceptability of discharge COPC-containing groundwater to surface water. For this step, only constituents whose maximum detected concentration exceeded ten times the USEPA SL or MCL, as identified in Step Five, were retained for the evaluation.

An evaluation of groundwater release to the James River was performed in order to determine whether concentrations of constituents detected in perimeter groundwater monitoring wells are likely to result in exceedances of relevant surface-water quality criteria in the river. The surface water quality criteria used in the evaluation was conservatively based on the lower of the to 9 VAC 25-260 Virginia Water Quality Standards (WQS) for protection of freshwater organisms (chronic) and protection of human health (drinking water and fish consumption). National recommended ambient water quality criteria (AWQC) were used where Virginia WQS were unavailable. A comparison to EPA Region III Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmark values, where Virginia WQS or AWQC values for aquatic life were not available. Similarly, a comparison to tap water SLs were used where Virginia WQS or AWQC values for protection of human health were not available. Both maximum and average detected concentrations in perimeter groundwater monitoring wells were compared to the surface

[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.

water screening criteria with an applied conservative dilution factor of 10 to account for groundwater to surface water interaction.

As shown in Table 3, none of the COPCs exceeded the adjusted screening levels. As a result, groundwater discharge to surface water is considered acceptable. Over time while attenuation and degradation of COPCs takes place, current concentrations measured in groundwater will diminish further reducing potential discharge concentrations.

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?"

   __√__ 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.

   _____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

A site-wide groundwater monitoring program will be developed as part of the Corrective Measures Study (CMS) to be prepared for the site in 2011.

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).

__√__ 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 **DuPont Teijin Films**, EPA ID # **VAD000019273**, located at **1 Discovery Drive, Chester, Virginia**. 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 (signature) _____ Date 1/28/11

(print) Will Geiger

(title) _____

Supervisor (signature) _____ Date 1/31/11

(print) Luis Pizarro

(title) _____

(EPA Region or State) _____

Locations where References may be found:

_____

_____

_____

Contact telephone and e-mail numbers

(name) _____
(phone #) _____
(e-mail) _____

Table 1
Constituents of Potential Concern in Site-Wide Groundwater
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) / Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Minimum Detection	Maximum Detection	Screening Criteria[2]	
								EPA SL Tap Water	Federal MCL
Volatile Organic Compounds									
1,1,1-TRICHLOROETHANE	71556	T	UG/L	113	4	0.1	0.96	910	200
1,1,2-TRICHLOROETHANE	79005	T	UG/L	113	1	0.1	0.1	0.24	5
1,1-DICHLOROETHANE	75343	T	UG/L	113	22	0.1	**9.4**	2.4	-
1,1-DICHLOROETHENE	75354	T	UG/L	113	16	0.3	**20**	34	7
1,2-DICHLOROETHANE	107062	T	UG/L	113	4	0.1	**0.3**	0.15	5
ACETALDEHYDE	75070	T	UG/L	100	5	**20**	**39**	2.2	-
ACETONE	67641	T	UG/L	113	17	2.7	770	2200	-
BENZENE	71432	T	UG/L	113	4	0.1	0.3	0.41	5
BROMODICHLOROMETHANE	75274	T	UG/L	113	7	0.1	**0.4**	0.12	80
CARBON DISULFIDE	75150	T	UG/L	113	3	0.2	0.7	100	-
CHLOROBENZENE	108907	T	UG/L	113	3	0.1	2.4	9.1	100
CHLOROFORM	67663	T	UG/L	113	58	0.07	**3.9**	0.19	80
CIS-1,2 DICHLOROETHENE	156592	T	UG/L	113	15	0.2	**71**	7.3	70
ETHYL CHLORIDE	75003	T	UG/L	113	8	0.1	0.6	2100	-
ETHYLBENZENE	100414	T	UG/L	113	2	0.1	0.2	1.5	700
IODOMETHANE	74884	T	UG/L	113	4	**0.1**	**0.2**	-	-
META- AND PARA-XYLENE	EVS0253	T	UG/L	108	2	0.069	0.1	-	10000
METHYL CHLORIDE	74873	T	UG/L	113	4	0.18	0.3	19	-
METHYL ETHYL KETONE	78933	T	UG/L	113	3	29	520	710	-
METHYL TERTIARY BUTYL ETHER	1634044	T	UG/L	13	1	0.14	0.14	12	-
METHYLENE CHLORIDE	75092	T	UG/L	113	10	0.2	**27**	4.8	5
TETRACHLOROETHYLENE	127184	T	UG/L	113	33	0.1	**110**	0.11	5
TOLUENE	108883	T	UG/L	113	23	0.077	5.1	230	1000
TRANS-1,2-DICHLOROETHENE	156605	T	UG/L	113	4	0.1	0.6	11	100
TRICHLOROETHENE	79016	T	UG/L	113	23	0.061	**8**	2	5
TRICHLOROFLUOROMETHANE	75694	T	UG/L	113	16	0.1	0.9	130	-
VINYL CHLORIDE	75014	T	UG/L	131	13	0.014	**1**	0.016	2
XYLENES	1330207	T	UG/L	18	1	0.069	0.069	20	10000

Table 1
Constituents of Potential Concern in Site-Wide Groundwater
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) / Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Minimum Detection	Maximum Detection	Screening Criteria[2]	
								EPA SL Tap Water	Federal MCL
Dowtherm Constituents									
1,1'-OXYBISBENZENE	101848	T	UG/L	112	23	**2**	**9000**	-	-
BIPHENYL	92524	T	UG/L	112	11	1	**2900**	180	-
Semivolatile Organic Compounds									
1,3-DINITROBENZENE	99650	T	UG/L	100	1	**6**	**6**	0.37	-
1,4-DIOXANE	123911	T	UG/L	125	49	0.41	**89**	0.67	-
2-METHYLNAPHTHALENE	91576	T	UG/L	100	4	0.013	1	15	-
2-NITROPHENOL	88755	T	UG/L	87	1	**2**	**2**	-	-
4-NITROANILINE	100016	T	UG/L	100	1	1	1	3.4	-
ACENAPHTHENE	83329	T	UG/L	100	2	0.012	0.02	220	-
ACENAPHTHYLENE	208968	T	UG/L	100	2	**0.013**	**0.013**	-	-
ANTHRACENE	120127	T	UG/L	100	1	0.018	0.018	1100	-
BENZO(A)ANTHRACENE	56553	T	UG/L	100	3	0.013	0.021	0.029	-
BENZO(B)FLUORANTHENE	205992	T	UG/L	100	3	0.017	0.02	0.029	-
BENZO(G,H,I)PERYLENE	191242	T	UG/L	100	2	**0.013**	**0.015**	-	-
BENZO(K)FLUORANTHENE	207089	T	UG/L	100	1	0.023	0.023	0.29	-
BENZO[A]PYRENE	50328	T	UG/L	100	2	**0.017**	**0.02**	0.0029	0.2
BIS(2-ETHYLHEXYL)PHTHALATE	117817	T	UG/L	100	2	2	3	4.8	-
CHRYSENE	218019	T	UG/L	100	3	0.014	0.02	2.9	-
DIALLATE	2303164	T	UG/L	100	2	**2**	**2**	1.1	-
DIBENZ(A,H)ANTHRACENE	53703	T	UG/L	100	1	**0.014**	**0.014**	0.0029	-
DIBENZOFURAN	132649	T	UG/L	100	4	1	**5**	3.7	-
DI-N-BUTYL PHTHALATE	84742	T	UG/L	100	2	4	9	370	-
FLUORANTHENE	206440	T	UG/L	100	3	0.014	0.031	150	-
FLUORENE	86737	T	UG/L	100	3	0.013	0.041	150	-
INDENO (1,2,3-CD) PYRENE	193395	T	UG/L	100	2	0.01	0.014	0.029	-
NAPHTHALENE	91203	T	UG/L	100	47	0.01	**11**	0.14	-
PHENANTHRENE	85018	T	UG/L	100	6	**0.01**	**0.023**	-	-
PHENOL	108952	T	UG/L	102	18	1	**2500**	1100	-
PYRENE	129000	T	UG/L	100	3	0.019	0.023	110	-

Table 1
Constituents of Potential Concern in Site-Wide Groundwater
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) / Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Minimum Detection	Maximum Detection	Screening Criteria[2]	
								EPA SL Tap Water	Federal MCL
Glycols									
ETHYLENE GLYCOL	107211	T	UG/L	113	11	**12000**	**26000**	7300	-
DIETHYLENE GLYCOL	111466	T	UG/L	113	12	**9400**	**17000**	-	-
PROPYLENE GLYCOL	57556	T	UG/L	113	29	8290	12100	73000	-
TRIETHYLENE GLYCOL	112276	T	UG/L	113	6	**6900**	**12000**	-	-
Metals									
ANTIMONY	7440360	D	UG/L	48	5	1.1	**31.4**	1.5	6
ANTIMONY	7440360	T	UG/L	100	18	0.3	**35.2**	1.5	6
ARSENIC	7440382	D	UG/L	48	5	**0.97**	**9.4**	0.045	10
ARSENIC	7440382	T	UG/L	100	49	**0.79**	**23**	0.045	10
BARIUM	7440393	D	UG/L	48	48	2[illegible]	196	730	2000
BARIUM	7440393	T	UG/L	100	100	17.6	605	730	2000
BERYLLIUM	7440417	T	UG/L	100	38	0.054	**4.9**	7.3	4
CADMIUM	7440439	D	UG/L	48	7	0.22	**17.2**	1.8	5
CADMIUM	7440439	T	UG/L	100	42	0.11	**21.2**	1.8	5
CHROMIUM	7440473	D	UG/L	48	1	4.9	4.9	5500	100
CHROMIUM	7440473	T	UG/L	100	38	2.6	**158**	5500	100
COBALT	7440484	D	UG/L	48	14	**2.3**	**53.9**	1.1	-
COBALT	7440484	T	UG/L	100	55	**2.2**	**171**	1.1	-
COPPER	7440508	D	UG/L	48	1	4.5	4.5	150	1300
COPPER	7440508	T	UG/L	100	39	2.3	104	150	1300
LEAD	7439921	D	UG/L	48	28	0.063	0.68	-	15
LEAD	7439921	T	UG/L	100	90	0.062	**49.4**	-	15
MERCURY	7439976	D	UG/L	48	3	**0.07**	**0.082**	0.057	2
MERCURY	7439976	T	UG/L	100	4	**0.059**	**0.08**	0.057	2
NICKEL	7440020	D	UG/L	48	18	3.1	30.3	73	-
NICKEL	7440020	T	UG/L	100	51	3.1	**163**	73	-
SILVER	7440224	T	UG/L	100	18	2	**52.7**	18	-
THALLIUM	7440280	T	UG/L	100	7	0.18	0.47	-	2
TIN	7440315	T	UG/L	100	1	10	10	2200	-

Table 1
Constituents of Potential Concern in Site-Wide Groundwater

EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) / Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Minimum Detection	Maximum Detection	Screening Criteria[2]	
								EPA SL Tap Water	Federal MCL
VANADIUM	7440622	T	UG/L	100	41	1.5	154	1.8	-
ZINC	7440666	D	UG/L	48	8	10.1	541	1100	-
ZINC	7440666	T	UG/L	100	45	8.2	621	1100	-

1- Detected Constituents. Monitoring wells and in-situ groundwater points sampled in 2005, 2008 and 2010.
2 - Screening Criteria = EPA Regional Screening Level (HQ=0.1) (November 2010 version) or Federal MCL
Yellow Shaded Cells = Concentration above criteria
- No value available
MCL for chloroform is trihalomethanes
1,1'-Oxybisbenzene (diphenyl ether) value is Dupont site-specific value with HQ=0.1
The following surrogates were used where SLs were unavailable
Acenaphthylene value is acenaphthene
Benzo(g,h,i)perylene value is pyrene
Phenanthrene value is anthracene
Chromium value is Chromium III
Cadmium value is Cadmium (water)
Mercury value is mercuric chloride
Ethylene glycol value used for diethylene glycol and triethylene glycol
P-Xylene value used for meta-and para-xylene
3 - Gycols not considered a COPC. Glycol isomers above tap water SLs during Phase I RFI (2008) were not detected in Phase II RFI (2010).
Glycols are susceptible to rapid biodegradation.

Table 2
Constituents of Potential Concern in Perimeter Groundwater
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) or Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Tier I Screen		Tier II Screen
						Perimeter Maximum Detection	MCL or Tap Water SL	10 X Screening Criteria
Volatile Organic Compounds								
1,1-DICHLOROETHANE	75343	T	UG/L	10	1	0.6	2.4	24
1,1-DICHLOROETHENE	75354	T	UG/L	10	1	1.7	34	340
BROMODICHLOROMETHANE	75274	T	UG/L	10	2	0.2	0.12	1.2
CHLOROFORM	67663	T	UG/L	10	4	2.5	0.19	1.9
CIS-1,2 DICHLOROETHENE	156592	T	UG/L	10	1	5	7.3	73
METHYLENE CHLORIDE	75092	T	UG/L	10	2	0.3	4.8	48
TETRACHLOROETHYLENE	127184	T	UG/L	10	3	7.2	0.11	1.1
TOLUENE	108883	T	UG/L	10	1	0.1	230	2300
TRANS-1,2-DICHLOROETHENE	156605	T	UG/L	10	1	0.1	11	110
TRICHLOROETHENE	79016	T	UG/L	10	1	0.6	2	20
VINYL CHLORIDE	75014	T	UG/L	16	2	0.036	0.016	0.16
Semivolatile Organic Compounds								
1,3-DINITROBENZENE	99650	T	UG/L	10	1	6	0.37	3.7
BIS(2-ETHYLHEXYL)PHTHALATE	117817	T	UG/L	10	1	2	4.8	48
NAPHTHALENE	91203	T	UG/L	10	9	0.025	0.14	1.4
Glycols								
PROPYLENE GLYCOL	57556	T	UG/L	10	6	9380	73000	730000
Metals								
ANTIMONY	7440360	D	UG/L	10	1	1.5	1.5	15
ANTIMONY	7440360	T	UG/L	10	1	1.6	1.5	15
ARSENIC	7440382	T	UG/L	10	3	1.2	0.045	0.45
BARIUM	7440393	D	UG/L	10	10	83.4	730	7300
BARIUM	7440393	T	UG/L	10	10	155	730	7300
BERYLLIUM	7440417	T	UG/L	10	2	0.38	4	40
CADMIUM	7440439	D	UG/L	10	1	0.43	1.8	18
CADMIUM	7440439	T	UG/L	10	1	0.45	1.8	18
COBALT	7440484	D	UG/L	10	1	4	1.1	11
COBALT	7440484	T	UG/L	10	1	3.9	1.1	11

Table 2
Constituents of Potential Concern in Perimeter Groundwater
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Total (T) or Dissolved (D)	Units	No. of Samples[1]	No. of Detects	Tier I Screen		Tier II Screen
						Perimeter Maximum Detection	MCL or Tap Water SL	10 X Screening Criteria
LEAD	7439921	D	UG/L	10	6	0.11	15	150
LEAD	7439921	T	UG/L	10	10	4.8	15	150
MERCURY	7439976	D	UG/L	10	2	0.078	0.057	0.57
MERCURY	7439976	T	UG/L	10	1	0.066	0.057	0.57
NICKEL	7440020	D	UG/L	10	1	3.4	73	730
NICKEL	7440020	T	UG/L	10	1	3.1	73	730
VANADIUM	7440622	T	UG/L	10	3	4	1.8	18
ZINC	7440666	D	UG/L	10	1	10.1	1100	11000
ZINC	7440666	T	UG/L	10	3	10.4	1100	11000

Notes:
1 - Perimeter monitoring well locations (DMW-5, MW-109A, MW-100A/B/C, MW-101A, MW-200B, MW-10 and MW-11).
2 - Screening Criteria = Lower of EPA Regional Screening Level (HQ=0.1) or Federal MCL listed in Table 1

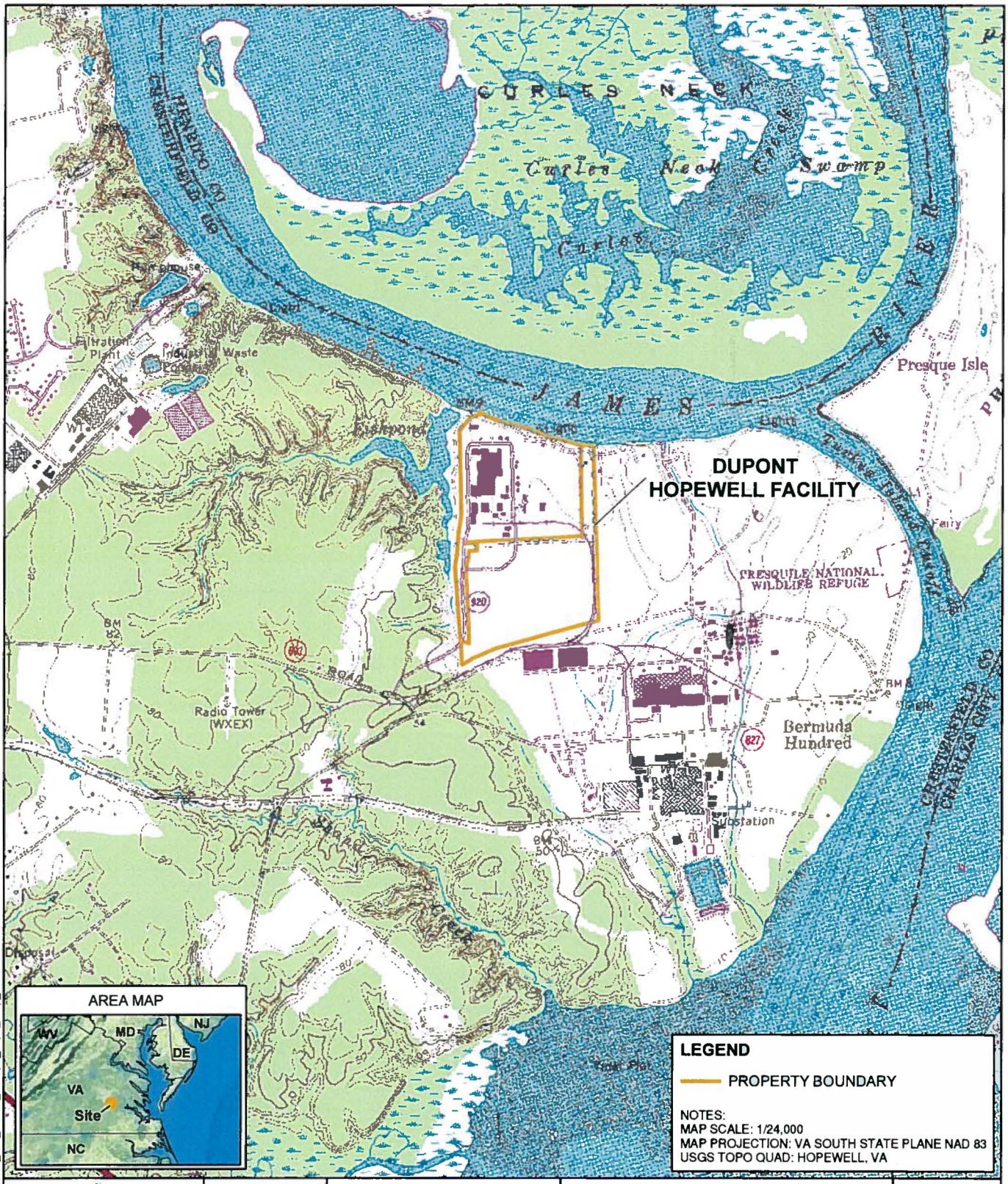
Highlighted cells indicate an exceedance
Tier 1 exceedance
Tier 2 exceedance

Table 3
Groundwater to Surface Water Evaluation
EI CA750
DTF Facility
Hopewell, VA

Analyte	CAS No.	Units	No. of Samples[1]	No. of Detects	Perimeter Average Detection	Perimeter Maximum Detection	Ecological Benchmarks		Human Health Criteria			Screening Criteria[2]	Source	Max > 10 X SC?	Avg > 10X SC?
							9 VAC 25-260 FW Chronic	Region III BTAG FW	9 VAC 25-260 HH PWS	NAWQC	Tap Water SL				
CHLOROFORM	67663	UG/L	10	4	5.90E-01	2.50E+00	-	1.80E+00	-	5.70E+00		1.80E+01	EPA_SL	No	No
TETRACHLOROETHYLENE	127184	UG/L	10	3	8.50E-01	7.20E+00	-	1.11E+02	8.00E+00			8.00E+01	VQ_WQS_HH	No	No
1,3-DINITROBENZENE	99650	UG/L	10	1	2.40E+00	6.00E+00	-	-	-		3.70E+00	3.70E+01	EPA_SL	No	No
ARSENIC	7440382	UG/L	10	3	9.91E-01	1.20E+00	1.50E+02		1.00E+01			1.00E+02	VQ_WQS_HH	No	No

Notes:
1 - Perimeter monitoring well locations (DMW-5, MW-109A, MW-100A/B/C, MW-101A, DMW-4, MW-10 and MW-11).
2 - Lower of the 9 VAC 25-260 values for protection of freshwater organisms (chronic) and protection of human health (drinking water and fish consumption).
If WQS was unavailable then USEPA tap water SL or Region III BTAG freshwater suface water benchmark values also utilized.

Highlighted cells indicate an exceedance



0 1,000 2,000

Feet

MAP FORMATTED FOR "A" (8.5" X 11") SIZE SHEET. SCALE NOT VALID FOR DIFFERENT PAGE SIZE.

Printed: Tuesday, December 14, 2010 3:03:30 PM By: matt_layton
U:\Hopewell_GIS\Projects\18985575_RFI_Phase_II\Hope_Topo_Map_A1.mxd

FILE NUMBER:	
DESIGNED BY:	RK
DRAWN BY:	FND
DATA QUALITY CHECK BY	DEL

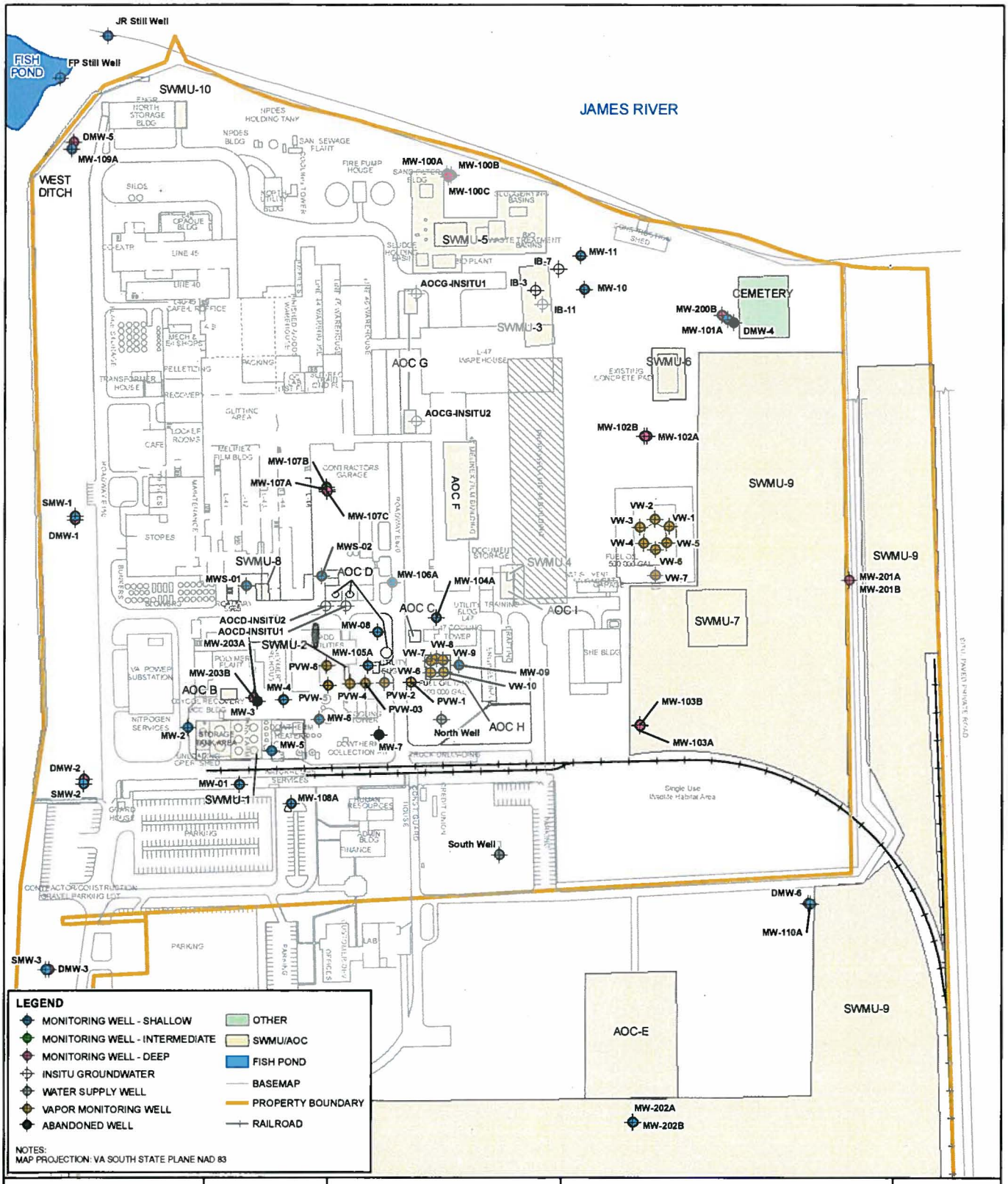
URS

URS Corporation
Iron Hill Corporate Center
4051 Ogletown Road, Suite 300
Newark, DE 19713

TOPOGRAPHIC SITE LOCATION MAP

EI CA750
DUPONT TEIJIN FILMS
HOPEWELL, VIRGINIA

PROJECT NUMBER:	18985575
DATE:	12/14/2010
FIGURE NUMBER:	1



LEGEND

- MONITORING WELL - SHALLOW
- MONITORING WELL - INTERMEDIATE
- MONITORING WELL - DEEP
- INSITU GROUNDWATER
- WATER SUPPLY WELL
- VAPOR MONITORING WELL
- ABANDONED WELL
- OTHER
- SWMU/AOC
- FISH POND
- BASEMAP
- PROPERTY BOUNDARY
- RAILROAD

NOTES:
MAP PROJECTION: VA SOUTH STATE PLANE NAD 83

0 150 300
Feet

MAP FORMATTED FOR "A" (8.5" X 11") SIZE SHEET. SCALE NOT VALID FOR DIFFERENT PAGE SIZE.

FILE NUMBER:	
DESIGNED BY:	CO
DRAWN BY:	FND
DATA QUALITY CHECK BY:	MKL

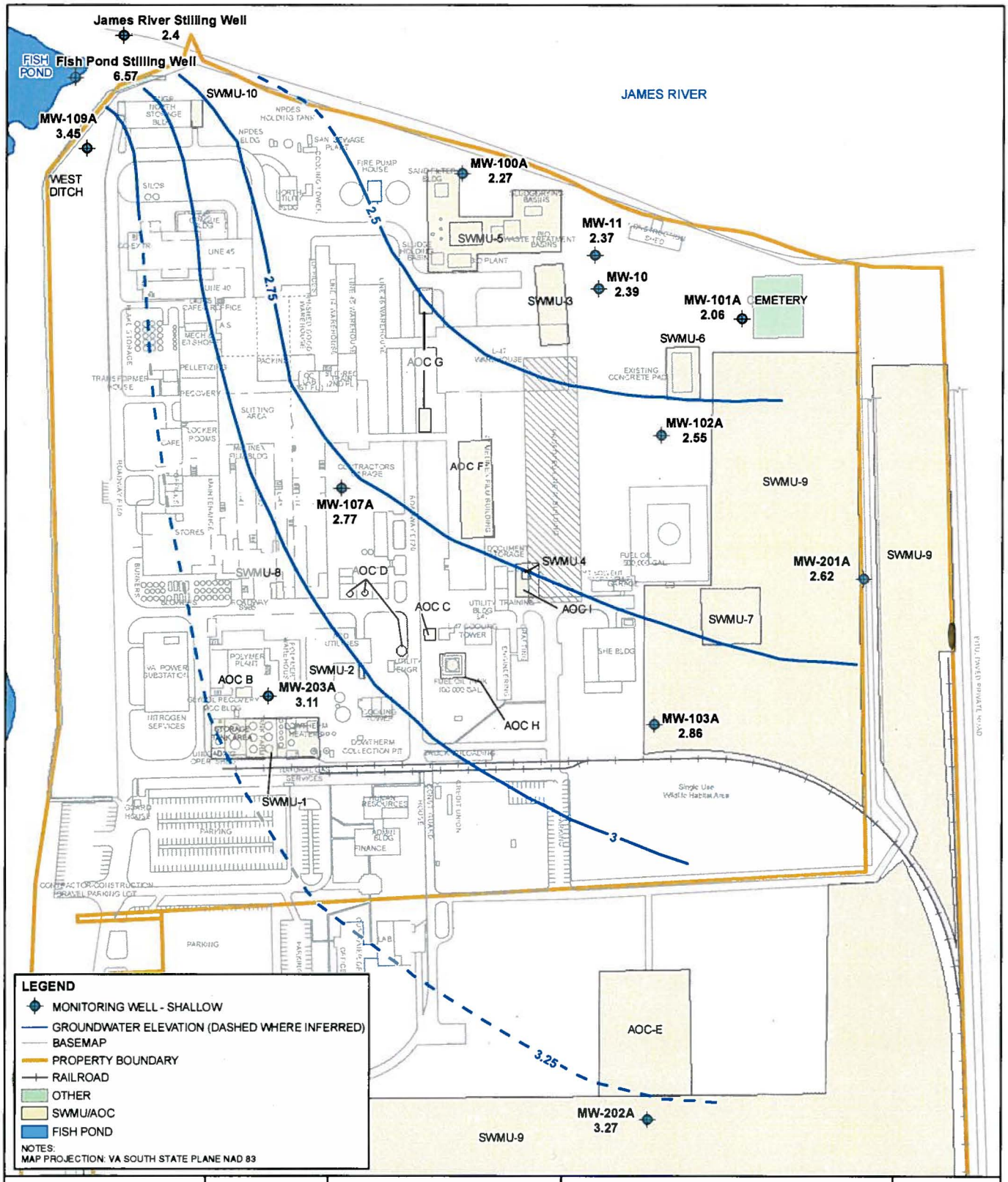
URS Corporation
Iron Hill Corporate Center
4051 Ogletown Road, Suite 300
Newark, DE 19713

MONITORING WELL LOCATION MAP

EI CA750
DUPONT TEIJIN FILMS
HOPEWELL, VIRGINIA

PROJECT NUMBER:	18985575
DATE:	12/14/2010
FIGURE NUMBER:	2

Printed: Tuesday, December 14, 2010 5:49:28 PM By: matt.layton
U:\Hopewell_GIS\Projects\18985575_RFI_Phase_II\Hope_MW_Locations_A3.mxd



0 150 300

Feet

MAP FORMATTED FOR "A" (8.5" X 11") SIZE SHEET. SCALE NOT VALID FOR DIFFERENT PAGE SIZE.

FILE NUMBER:	
DESIGNED BY:	CO
DRAWN BY:	DHE
DATA QUALITY CHECK BY:	MKL

URS

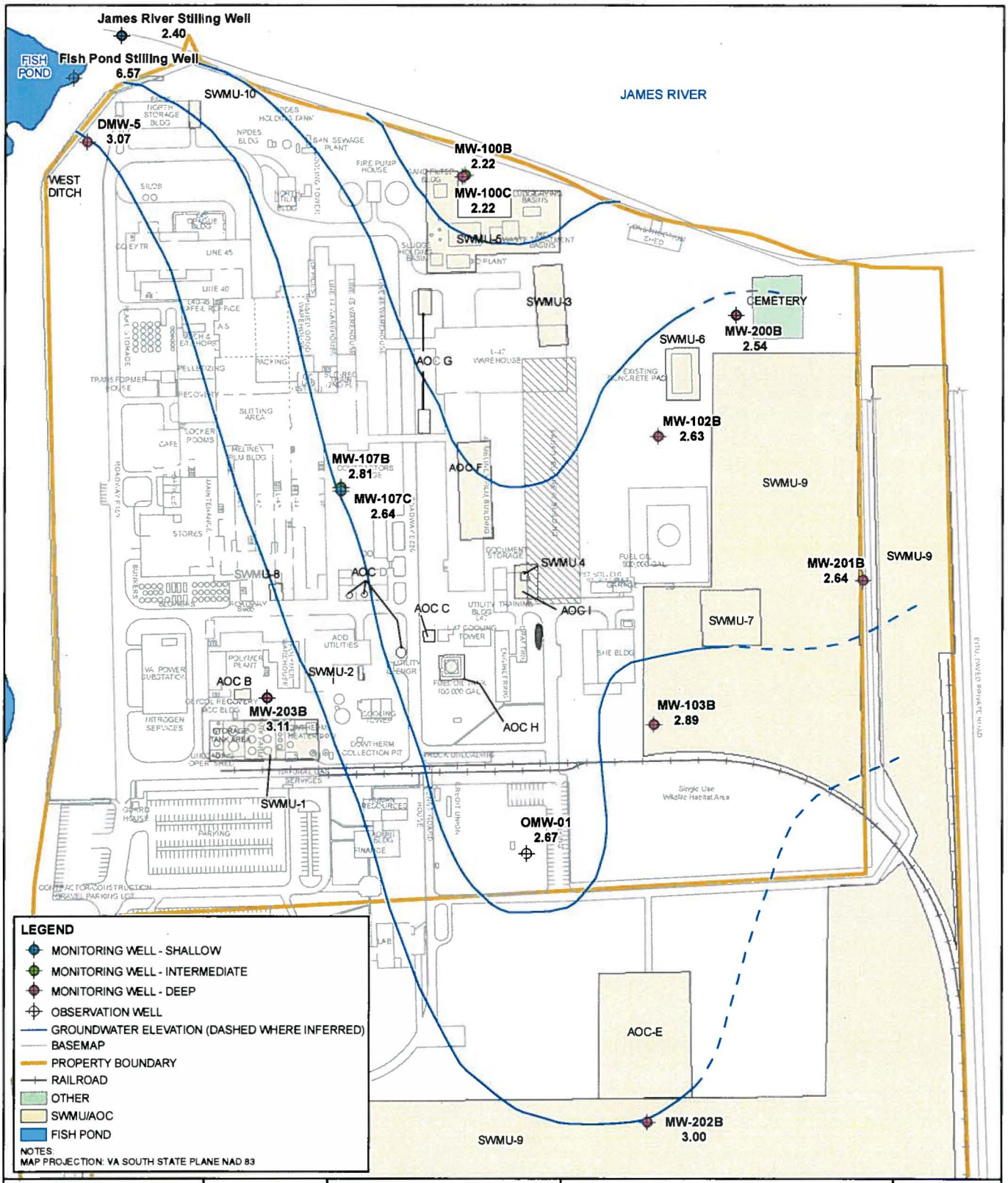
URS Corporation
Iron Hill Corporate Center
4051 Ogletown Road, Suite 300
Newark, DE 19713

HOPEWELL - UPPER AQUIFER POTENTIOMETRIC SURFACE MAP (AUG. 15 - SEPT. 2, 2010)

EI CA750
DUPONT TEIJIN FILMS
HOPEWELL, VIRGINIA

PROJECT NUMBER:	18985575
DATE:	12/14/2010
FIGURE NUMBER:	3

Printed: Tuesday, December 14, 2010 4:47:55 PM By: matt_layton
U:\Hopewell_GIS\Projects\18985575_RFI_Phase_II\Hope_Pot_Map_Upper_A8.mxd



0 150 300
Feet

MAP FORMATTED FOR "A" (8.5" X 11") SIZE SHEET. SCALE NOT VALID FOR DIFFERENT PAGE SIZE.

FILE NUMBER:	
DESIGNED BY:	CO
DRAWN BY:	DHE
DATA QUALITY CHECK BY:	MKL

URS Corporation
Iron Hill Corporate Center
4051 Ogletown Road, Suite 300
Newark, DE 19713

HOPEWELL - LOWER AQUIFER POTENTIOMETRIC SURFACE MAP (AUG. 15 - SEPT. 2, 2010)

EI CA750
DUPONT TEIJIN FILMS
HOPEWELL, VIRGINIA

PROJECT NUMBER:	18985575
DATE:	12/14/2010
FIGURE NUMBER:	4

Printed: Tuesday, December 14, 2010 4:51:54 PM By: matt.layton
U:\Hopewell_GIS\Projects\18985575_RFI_Phase_II\Hope_Pot_Map_Lower_A9.mxd