DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRAInfo code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: U. S. Department of Energy - Knolls Atomic Power Laboratory

Facility Address: 2401 River Road, Niskayuna, New York 12309
Facility EPA ID #: NY6890008992

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 #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 RCRAInfo national database ONLY as long as they remain true (i.e., RCRAInfo status codes must be changed when the regulatory authorities become aware of contrary information).

Site Background, Knolls Atomic Power Laboratory

The Knolls Atomic Power Laboratory (hereafter referred to as "KAPL") is located in the Town of Niskayuna, New York, approximately two miles east of the City of Schenectady. The facility consists of 170 acres situated on the southern bank of the Mohawk River. The river serves as the main watercourse for the Mohawk River Drainage Basin, which covers an area of 3456 square miles (Reference 1). Residential areas lie to the south of the KAPL facility. A separate research and development facility lies to the west, while a town park and closed municipal landfill lie to the east. Active site operations occur on the 60 westernmost acres of the property ("secure facility area"), which is completely surrounded by security fencing and is subject to 24-hour surveillance. The remainder of the site to the east ("non-secure area") consists of undeveloped woods and fields, and is routinely patrolled by facility security.

KAPL's principal function is research and development in the design and operation of Naval nuclear power reactors. Laboratory research at the facility began in 1949. One of KAPL's original missions was to develop a pilot process for the separation of radionuclides from irradiated nuclear fuel. Research on this process, conducted at the Separations Process Research Unit ("SPRU") on-site, was completed in 1954. Since the completion of SPRU research, KAPL has been dedicated to the Naval nuclear propulsion program.

Hazardous waste and mixed waste (containing both hazardous waste and radioactive waste) is generated from laboratory research and facility renovation activities, and is stored on-site within the secure facility prior to shipment off-site. Storage of hazardous and mixed wastes is regulated via a Title 6 New York Code of Rules and Regulations ("NYCRR") Part 373 Hazardous Waste Management Permit, issued by the New York State Department of Environmental Conservation ("NYSDEC") on July 20, 1998 (Reference 2). The Part 373 Permit requires RCRA Corrective Action at specific areas where accidental contaminant release, and managed waste disposal, had occurred coincident with the early years of facility operation.

There is currently no disposal of hazardous waste or mixed waste at the facility. Furthermore, there are no production wells for service water on-site (Reference 1). No known wells are used for domestic consumption in the vicinity of the site, since area residences are all served by a municipal water system (References 3 and 4).

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.

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).

Rationale and Reference(s): Pursuant to Department of Energy Order 5400.1, KAPL initiated a hydrogeological study and sitewide groundwater monitoring program in 1987. The monitoring well network currently consists of 31 wells. These wells are sampled annually or bi-annually for various chemical parameters, including volatile organic contaminants or "VOCs" (see Figure 1). Results of this routine sampling program are summarized in the facility's annual Environmental Monitoring Reports, which are distributed to legislators and to federal, state and local officials and agency personnel.

Prior to the issuance of New York State's 6 NYCRR Part 373 Hazardous Waste Management Permit in 1998, KAPL's sitewide groundwater sampling program had identified two areas where groundwater demonstrated consistent contamination by chlorinated VOCs. The first is within an area known as the Land Disposal Area ("LDA"), in the eastern non-secure part of the facility. The second is known as the Hillside Area, which is located along the western margin of the secure facility. Contamination at the LDA has been attributed to managed waste disposal at various locations within the area during KAPL's early years. Contamination found at the Hillside Area has been traced to historical outdoor solvent drum storage and dispensing operations (Reference 4). The specific locations at which "VOC" contamination in groundwater was discovered were: monitoring well W-3 in the Land Disposal Area, and monitoring wells B-5 and B-15 within the Hillside Area (Figure 1).

A third area of groundwater contamination by VOCs was discovered at a former electrical High Yard, during a Permit-required RCRA Facility Investigation conducted from 1998-1999 (Reference 5). The High Yard is located in the center of the secure facility, just south of Commission Avenue (Figure 1). The source of VOC contamination at the High Yard is unknown.

Land Disposal Area: To expedite assessment of the Groundwater Migration Environmental Indicator for the Land Disposal Area, a phased groundwater investigation was conducted, in advance of a RCRA Facility Investigation, from April 2002 - October 2003. Sampling and analysis performed during the investigation confirmed that groundwater is contaminated by tetrachloroethylene, trichloroethylene and associated chemical breakdown products in exceedence of 6 NYCRR Part 703.5 quality standards for potable groundwaters (Reference 6). Figure 2 shows the LDA monitoring well locations, and identifies individual areas within the LDA either known or suspected of having received wastes. Table 1 below compares maximum contaminant levels for various chemical parameters found within LDA groundwater to the corresponding groundwater standard. Complete information on where contamination was detected, and at what concentrations, can be found in Reference 6.

Table 1
Land Disposal Area Groundwater Monitoring Results

Contaminant	Maximum Concentration - parts per billion (ppb)	Location of Sample (Figure 2)	Part 703.5 Groundwater Standard (ppb)
benzene	1.1	LMW-37	1
cis-1,2-dichloroethylene	97.4	LMW-12	5
1,2-dichloroethane	36.3	LMW-15A	0.6

Contaminant	Maximum Concentration - parts per billion (ppb)	Location of Sample (Figure 2)	Part 703.5 Groundwater Standard (ppb)
trichloroethylene	641	LMW-24	5
toluene	7.6	LMW-37	5
tetrachloroethylene	5740	LMW-14	5
vinyl chloride	14.2	LMW-37	2

Hillside Area: Pursuant to the Part 373 Permit, a phased RCRA Facility Investigation ("RFI") was conducted at the Hillside Area from July 2001 - September 2003. Sampling and analysis performed during the RFI confirmed levels of trichoroethylene and additional breakdown products in groundwater in exceedence of Part 703.5 groundwater quality standards (Reference 6). In addition, a separate area of groundwater contamination by tetrachloroethylene and associated chemicals was discovered in the southern portion of the Hillside Area. Table 2 below compares maximum groundwater contaminant levels for each contravening chemical parameter to the corresponding Part 703.5 groundwater standard. Hillside Area RFI monitoring well locations can be found in Figure 3. Complete information on where contamination was detected, and at what concentrations, can be found in Reference 6.

Table 2
Hillside Area Groundwater Monitoring Results

Contaminant	Maximum Concentration (ppb)	Location of Sample (Figure 3)	Part 703.5 Groundwater Standard (ppb)
carbon tetrachloride	5620	MW-24	5
chloroform	4690	MW-24	7
cis-1,2-dichloroethylene	648	MW-02	5
trans-1,2-dichloroethylene	46.7	MW-20	5
1,1-dichloroethane	7.6	MW-24	5
1,1-dichloroethylene	9.8	MW-45	5
methylene chloride	120 (estimated)	MW-24	5
tetrachloroethylene	22500 (estimated)	MW-35A	5
trichloroethylene	21600	MW-24	5
vinyl chloride	50.3	MW-06	2

High Yard Area: Four monitoring wells installed during the High Yard Area RCRA Facility Investigation ("RFI") revealed cis/trans-dichloroethylene and tetrachloroethylene in groundwater. Maximum exceedences of Part 703.5 groundwater standards for these parameters are listed in Table 3 below. Figure 4 shows the High Yard Area well locations, plus the location of five additional perimeter wells installed in October 2003 to define the boundaries of the contamination. Complete information on where contamination was detected, and at what concentrations, can be found in References 5 and 7.

Table 3
High Yard Area Groundwater Monitoring Results

Contaminant	Maximum Concentration (ppb)	Location of Sample (Figure 4)	Part 703.5 Groundwater Standard (ppb)
cis-1,2-dichloroethylene	22	MW-4	5
trans-1,2-dichloroethylene	9.8	MW-4	5
tetrachloroethylene	7.7	MW-2	5

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): Activities resulting in groundwater contamination are likely to have occurred

[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.

during KAPL's early years (circa early 1950's). Therefore, current observations regarding the limits of groundwater contamination are likely to represent long-term and largely static conditions. Data generated by the investigations performed at each of the contaminated areas (Land Disposal Area, Hillside Area, and High Yard Area) suggest that the current extent of groundwater contamination in each area is relatively limited and has been defined. This appears to be due to restricted groundwater movement within geologic units of very low permeability, plus attenuation of contaminants to below groundwater quality standards well within site property boundaries. As such, there is no off-site migration of contaminated groundwater.

The natural geologic materials underlying the KAPL site display poor aquifer properties, with low porosities and permeabilities due to a high degree of consolidation and small grain size (Reference 4). Hence, these materials do not transmit water readily, and groundwater movement is slow. The predominant geologic feature influencing groundwater flow patterns at much of the KAPL site is the low-permeability glacial lodgement "till," which directly overlies shale and sandstone bedrock. The till is dense, tough and compact, as a result of being pressed down by the weight of glacial ice. The till layer ranges from approximately 20-60 feet in thickness, and generally transitions into a weathered, less dense till layer within 10 feet or less of its upper surface. Previous testing of groundwater flow through the till at KAPL has resulted in estimated hydraulic conductivities averaging 10^{-8} centimeters per second (cm/sec) (Reference 8). For perspective, Title 6 NYCRR Part 373 standards for hazardous waste landfills allow natural cap and liner materials to be an order of magnitude more permeable (Reference 9). While discontinuous sand seams within the till may result in localized zones of higher permeability, these have been found to be limited in extent. The underlying bedrock also exhibits poor aquifer characteristics (Reference 10).

Land Disposal Area: The scope of the LDA groundwater study is shown on Figure 2. Historical contamination of monitoring well W-3 by VOCs prompted further investigation of this area in 2002-2003. Based on groundwater monitoring conducted since 1987, the constituents of concern at monitoring well W-3 were the VOCs tetrachloroethylene, trichloroethylene, and 1,2-dichloroethylene. Total VOCs at this well have typically been found at 100 parts per billion (ppb) or less.

Within the LDA, about 25-55 feet of dense glacial till, with a 5-10 foot weathered layer, overlies shale and sandstone bedrock. On top of the till, about 20-30 feet of low-permeability clayey silt thins northward to monitoring well W-4, where it is absent (Figure 2). Groundwater flow is controlled by topography. An east-west topographic divide runs from well W-1 in the west through Building Q12 (salt storage shed). This approximates a divide between northerly groundwater flow toward Midline Stream and southerly flow toward the East Boundary Stream (Reference 11).

Data from the 2002-2003 LDA groundwater study have indicated that a shallow, north-south trending VOC plume has formed in a narrow band of sand and gravel deposits found above the till, and is controlled to the east and west by less permeable till and clayey silt deposits. The analytical data, as summarized below, indicate that the plume's dimensions are approximately 450 feet in length and 150 feet in width at its widest point just northwest of Building Q12. The plume narrows considerably at both its northern terminus near monitoring well LMW-21, and at its southern terminus near sitewide monitoring well W-8 (Figure 2). Overdrilling of monitoring well W-3 to isolate the well screen within the bedrock resulted in a dry well, indicating that groundwater contamination in this area consists of a surficial plume perched within the overburden sand and gravel deposits (Reference 12).

As mentioned above, the limits of the VOC plume have been effectively defined. Wells installed as part of the 2002-2003 groundwater study (LMW-22, LMW-23, LMW-17 and LMW-18) have demonstrated no contamination, indicating the plume's limits to the west (Figure 2). The highest total VOC concentrations were found at LMW-14 (5794 ppb) and at LMW-09 (3723 ppb). To the north, total VOC contamination attenuates at LMW-21 to 17 ppb/31 ppb in two separate sampling episodes. No contamination was discovered at LMW-2, LMW-3, or LMW-6 to the east, while LMW-1 contained less than 1 ppb of tetrachloroethylene. In addition, soil borings SB-7, SB-11 and SB-13 installed in shallow till to the east were dry, and hence could not be completed as monitoring wells. These borings were installed in an area where it is thought that a hillock of weathered till had previously been removed as borrow material, thus exposing the dense till in the near-surface. Contamination attenuates to below groundwater standards at LMW-27 and LMW-29, just north of the divide (Reference 6).

South of the divide, monitoring wells LMW-34 and LMW-36 were free of contamination. Wells LMW-35 and LMW-37 displayed contamination above Part 703.5 groundwater standards, to a maximum concentration of 532 ppb total VOCs at the latter well. The East Boundary Stream, to the south and downslope of the latter two wells, is expected to intercept shallow groundwater flowing from the vicinity of these wells. Seep water samples taken at the base of an old landfill just north of the East Boundary Stream also displayed VOC contamination, to a maximum level of just under 50 ppb total VOCs at Seep 2. However, surface water samples SW-01 and SW-02 taken within the stream were free of contamination (Figure 2 and Reference 6). These data suggest that the southern extent of the VOC plume has been defined.

Hillside Area: The Hillside Area consists of the land areas adjacent to Buildings D3, D4, D6, G1, G2 and H2, extending west down the slope to the Lower Level Road. These buildings, and the locations of monitoring wells installed during the RFI, are indicated on Figure 3. Contaminants at historically elevated levels at sitewide monitoring wells B-5 and B-15 have included trichloroethylene, 1,1-dichloroethylene, trans-1,2-dichloroethylene, cis-1,2-dichloroethylene, vinyl chloride, chloroform, and carbon tetrachloride (well B-15). Since 1996, total VOC concentrations at well B-5 have been less than 2000 ppb in annual sampling, while total VOCs at well B-15 have been typically less than 150 ppb.

While groundwater flow within the secure part of the KAPL facility flows generally northward toward the Mohawk River, terrain at the Hillside might be expected to influence groundwater flow. Specifically, along the area’s western margin, the ground surface slopes approximately 30 feet in elevation down to the Lower Level Road (Figure 3), implying a westward groundwater flow component. However, data collected during the RFI indicate that manmade features within the Hillside Area, namely a north-south running storm sewer and building foundation drains, have altered natural groundwater flow patterns (Figure 3). The RFI data suggest that the low permeability of the glacial till at the Hillside Area may result in preferential groundwater flow within the more porous backfill materials of the storm sewer trench and building foundation drain tenches.

The clayey silts and sands found within the LDA were not observed at the Hillside. Instead, fill material, consisting largely of re-emplaced till, overlies undisturbed till to depths ranging from 6.5 to 20 feet below ground surface. Subsurface utility trenches and building footers are cut into the undisturbed till.

Limited amounts of groundwater were encountered during drilling at a number of locations at the Hillside. Several dry borings could not be completed as monitoring wells, suggesting that shallow undisturbed till is largely retarding lateral groundwater migration, resulting in the lack of a distinct contaminant “plume.” This is also indicated by discontinuous contaminant patterns in both soil and groundwater, particularly at areas of abrupt rather than gradual contaminant attenuation. Vertical groundwater flow appears to also be restricted by the till. This is demonstrated by the fact that groundwater at the Hillside occurs as perched water on top of the till, within the weathered till layer or the looser fill material. Below the perched water level, the till becomes hard and dry.

The RFI performed from 2001-2003 revealed that VOC contamination within Hillside groundwater occurs within three distinct and relatively small areas: 1) west of Building D3/D6; 2) within the G1/D4 alleyway, and; 3) between Buildings G2 and H2 (Figure 3). An even smaller area of contamination has also been discovered near the southwest corner of Building G2 (Reference 6).

For the area west of Building D3/D6, current data indicate that contaminated groundwater is limited to a 10-foot by 20-foot area (Figure 3). Within this area, total VOC contamination peaks at MW-35A (24243 ppb). Groundwater at MW-8 and DW-9 (both within the storm sewer trench, to the west of MW-35A) was found to be contaminated above Part 703.5 groundwater standards to a maximum of 122 ppb total VOCs in the latter well. However, attenuation of VOC concentrations to below standards at well MW-40 (1.4 ppb tetrachloroethylene) and SW-10 (0.23 ppb toluene - estimated, and non-detect during a second sampling episode) indicate the limits of groundwater contamination within the storm sewer backfill. Soil borings SB-33 and SB-34 to the west of the storm sewer revealed shallow till conditions, and could not be completed as wells (Reference 13). It is therefore likely that the till forming the storm sewer trench walls to the east of these borings is inhibiting groundwater flow beyond the trench.

VOC contamination within groundwater at the Building G1/D4 alleyway peaks at monitoring well B-5 (2154 ppb total VOCs). Additional wells installed on either side of the alleyway indicate a contaminated area of approximately 45 feet by 65 feet in dimension. The contaminated area is bounded to the west by well SW-10, which was installed within the storm sewer trench backfill. Sampling of SW-10 has indicated no westward VOC migration from the alleyway via the backfill within either the storm sewer trench or the Building G1 foundation drain trench (Figure 3).

Total VOCs of 142 ppb were found at monitoring well MW-7, to the east of the storm sewer and southwest of Building G2. However, no contamination was found at MW-30 to the west of the sewer or at MW-31 east of MW-7. Lack of groundwater at the till contact at both soil borings SB-29 and SB-32 (Reference 13) suggests that the area of contaminated groundwater is limited to the vicinity of MW-7.

Between Buildings G2 and H2, total VOC contamination peaks at monitoring well MW-24 (32539 ppb), and additional wells indicate that contaminated groundwater is limited to an approximate 60 foot by 80 foot area. This area is bounded to the west by MW-26 and MW-27, and to the north by MW-25, where no contamination was found. No contamination was found at downslope wellpoint WP-2, while wellpoint WP-1 was dry. Contamination was not found at MW-22 to the south, nor at MW-SV2 and MW-SV8 to the east. The latter two wells were installed and sampled during 2001 in a separate investigation of units associated with former “SPRU” operations (Reference 14).

Low hydraulic gradients toward the east (Reference 15), plus lack of recharge via precipitation to areas overtopped by buildings of the E, D and G complexes, result in little potential for contaminant migration in this direction from the Hillside Area, especially when coupled with the low permeability soils of the area. Thus, the Hillside RFI data suggest that VOC contamination is neither moving off-site, nor migrating within groundwater beyond the original contaminant source zones.

High Yard Area: The High Yard Area is located in the central portion of the KAPL site within the secure facility, just south of Commission Avenue. In addition to KAPL’s perimeter security fence, access to the High Yard Area is further restricted by a separate locked chain link fence. Nearly ninety percent of the ground surface of the Yard is covered by asphalt and/or non-occupied buildings/switchgear equipment.

The High Yard Area is underlain by low-permeability silty clay deposits overlying approximately 60 feet of glacial till. Much of the Yard was excavated during its construction, which likely created a “bathtub” of fill within the less permeable native deposits (Reference 5). Vertical groundwater flow is controlled by the low permeabilities of the silty clay and till underlying the High Yard Area. Similarly, horizontal flow is limited by the low permeability of the native materials making up the walls of the original excavation. Locally higher groundwater velocities may occur along utilities; however, the movement of groundwater into these local areas is controlled by limited groundwater flow from the contaminant source areas through the native deposits. Groundwater elevation measurements indicate local radial to sub-radial flow from the High Yard (Reference 7).

During the RFI, concentrations of VOCs ranging from 7.4 ppb to 22 ppb were detected in MW-1, MW-2 and MW-4 (Figure 4). These wells occur within an approximate 60-foot by 20-foot area within the High Yard. Water data for Electrical Manhole No.1, a potential downgradient location, shows no detectable VOCs, indicating that VOC migration has not occurred along the subsurface conduit into Electrical Manhole No 1. Subsequent groundwater data generated from five supplemental perimeter wells (MW-5 through MW-9, Figure 4) installed in October 2003 demonstrate attenuation of contaminant levels to a maximum of 1 ppb, indicating that the extent of contaminated groundwater at the High Yard Area has been defined (Reference 7).

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

______ If yes - continue after identifying potentially affected surface water bodies.

__X__ 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.

<u>Rationale and Reference(s)</u>: Surface water from the KAPL site drains to the Mohawk River via three streams: the East Boundary Stream, the Midline Stream, and the West Boundary Stream (Figure 1). In addition to the undeveloped areas along the southern part of the LDA, the drainage area for the East Boundary Stream includes off-site areas upgradient of the KAPL site. The Midline Stream primarily drains the central undeveloped area of the site, including the LDA, although it receives some runoff from parking lots and roadways in the developed part of the site to the west. The West Boundary Stream receives some surface water runoff from KAPL, although most of its drainage is derived from off-site surrounding land areas, in particular from the General Electric Corporate Research and Development Center to the west of KAPL.

These streams are perennial, though flow becomes extremely low during dry summer weather. The streams are not readily accessible to the public except at the point where they discharge to the Mohawk River. All three streams are routinely monitored for water quality as part of KAPL's New York State Pollutant Discharge Elimination System ("SPDES") program (Reference 11). In addition, KAPL has voluntarily monitored both the streams and the Mohawk River since 2000 for volatile organic contaminants ("VOCs") via EPA Method 601.

As part of the Hillside Area RFI, manhole catch basins were sampled to assess the potential for VOC-contaminated groundwater to infiltrate building foundation drains and storm sewers. Water samples collected from catch basins MCB-8, MCB-9, MCB-29 and MCB-31 (Figure 3) revealed minor VOC and trihalomethane concentrations. The concentrations were all below Part 703.5 groundwater and surface water standards with the exception of chloroform which, at 8.2 ppb, slightly exceeded the standard of 7 ppb within MCB-29 (Reference 6). The basins are part of sewer/drain systems that ultimately discharge to the Mohawk River at Outfall 002 (Figure 1). However, due to the distance to the outfall and the low contaminant levels found within the catch basins, it is unlikely that the river is being impacted via this route.

Groundwater contamination has been shown to attenuate to below the applicable quality standards upgradient of the above-mentioned site-related surface water bodies, with the exception of the Midline Stream just north of the LDA, and the East Boundary Stream to the south of the LDA (Figure 2).

While there is no evidence of VOC contamination of the Midline Stream, total VOC concentrations were found at monitoring well LMW-21 to a maximum of 31 ppb (Reference 6). Shallow groundwater flows north from LMW-21 through a low, marshy area before converging upon the stream. Were any contamination entering the stream, it would most likely be insignificant, given the attenuation criterion of Question # 5 below. The only contaminant exceeding groundwater quality standards at LMW-21 was tetrachloroethylene, which was detected at a maximum of 25 ppb. This concentration is less than 10 times the corresponding Part 703.5 standard of 5 ppb. Attenuation is made more likely by the possibility that contamination is diffusing within the natural organic material of the marshy area prior to reaching the stream.

Three water samples taken at Seeps 1 through 3 on Figure 2 displayed contamination by trichloroethylene, cis-1,2-dichloroethylene and vinyl chloride, to a maximum level of <50 ppb total VOCs at Seep 2 (Reference 6). A sample taken at seep 4 was free of contamination, as was surface water sample SW-01 taken within the East Boundary Stream. The seeps most likely re-infiltrate the ground at their point of outbreak. Surface water sample SW-01 suggests no impact within the stream approximately 20 feet downstream of the nearest contaminated seep. Furthermore, although the contaminant concentrations within the seeps may be representative of deteriorated groundwater quality at these locations, contaminant levels here are also less than 10 times their respective groundwater quality standards. Thus, the levels are not expected to significantly impact the stream. This is borne out by the results of surface water sample SW-01.

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)? **NA**

_____ 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

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

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 - enter "IN" status code in #8.

Rationale and Reference(s):____
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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])? **NA**

_____ 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

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[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.

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):____

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.

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

Rationale and Reference(s): The remedy for groundwater contamination at KAPL has not yet been selected. Ongoing studies are being performed pursuant to the RCRA Corrective Action Module of KAPL's Part 373 Permit (Reference 2). The goal of these studies is to select and impose measures to remedy both soil and groundwater contamination. As part of this, additional data will be collected, as appropriate, to verify conditions and/or further refine current knowledge regarding the limits of groundwater contamination.

Post-remedial monitoring will be conducted to confirm the effectiveness of remediation. Furthermore, the sitewide monitoring wells shown on Figure 1 will continue to be monitored by KAPL, to confirm historical data indicating that VOCs are not migrating beyond the areas previously described.

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 **U.S. Department of Energy, Schenectady Naval Reactors, Knolls Atomic Power Laboratory** facility , EPA ID # **NY6890008992** , located at **2401 River Road, Niskayuna, New York**. 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 represents the best understanding of conditions at the afore-mentioned facility by the Agency, given the most current data. 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 ______________________________ Date _____________
(print) Margaret Rogers
(title) Engineering Geologist II

Supervisor ______________________________ Date _____________
(print) Clifton J. Van Guilder, P.E.
(title) Regional Solid & Hazardous Materials Engineer
(EPA Region or State) NYSDEC Region 4

NYSDEC
Central Office ______________________________ Date _____________
(print) Edwin Dassatti, P.E.
(title) Director, Bureau of Hazardous Waste & Radiation Management
(EPA Region or State) NYSDEC Central Office

References:

1) Knolls Atomic Power Laboratory, 2002. *Environmental Monitoring Report, Calendar Year 2002.* KAPL-4849.

2) New York State Department of Environmental Conservation, 1998. *NYSDEC 6 NYCRR Part 373 Hazardous Waste Management Facility Permit for the U.S. Department of Energy Knolls Atomic Power Laboratory, Knolls Site, Niskayuna, New York.* EPA I.D. Number: NY6890008992, NYSDEC Permit Number: 4-4224-00024/00001.

3) General Electric Company, Knolls Atomic Power Laboratory, Schenectady, New York, 1991. *Memo to File, R. Curley (GE) to J. Verbige (Niskayuna Water Department)*, September 23, 1991.

4) Knolls Atomic Power Laboratory, 2002. *Knolls Site Environmental Summary Report*, August 2002, KAPL-4847.

5) Knolls Atomic Power Laboratory, 2000. *RCRA Facility Investigation Report for the High Yard Area, Knolls Atomic Power Laboratory, Niskayuna, New York.* August 2000. (Approved by NYSDEC 4/01).

6) Knolls Atomic Power Laboratory, 2004. *Knolls Atomic Power Laboratory, Knolls Site - Environmental Indicator Migration of Contaminated Groundwater Under Control (CA750), Supporting Information.* July 16, 2004.

7) Knolls Atomic Power Laboratory, 2004. *Supplemental Groundwater Characterization Report for the High Yard Area (SWMU-023), Knolls Atomic Power Laboratory, Niskayuna, New York.* February 2004. (Accepted by NYSDEC 5/04).

8) Knolls Atomic Power Laboratory, 2004. *Corrective Action Status for Environmental Indicators*, April 29, 2004.

9) New York State Department of Environmental Conservation, 2002. *6 NYCRR Subpart 373-2, Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities*, March 15, 2002.

10) Winslow, J.D., Et Al, 1965. *Groundwater Resources of Eastern Schenectady County, New York.* United States Department of the Interior Geological Survey, Bulletin 57.

11) Knolls Atomic Power Laboratory, 2002. *RCRA Facility Assessment Sampling Visit Work Plan for the Land Disposal Areas SWMUs 003, 004, 006 and 007 and Groundwater Investigation, Knolls Atomic Power Laboratory, Niskayuna, New York*, April 2002. (Approved by NYSDEC 5/02).

12) Knolls Atomic Power Laboratory, 2003. *Land Disposal Area (LDA) Sampling Visit Groundwater Investigation Summary*, June 26, 2003.

13) Knolls Atomic Power Laboratory, 2003. *RCRA Facility Investigation, Knolls Atomic Power Laboratory, Niskayuna, New York, Progress Report #33*, July 2003.

14) Knolls Atomic Power Laboratory, 2002. *RCRA Facility Assessment Sampling Visit Report for the Separations Process Research Unit SWMUs/AOC, Knolls Atomic Power Laboratory, Niskayuna, New York*. February 2003. (Draft).

15) ERM-Northeast, Inc., 1992. *Hydrogeologic Evaluation of the Knolls Atomic Power Laboratory, Knolls Site, Project No. 380.004.* July 8, 1992.

Locations where References may be found:

<u>New York State Department of Environmental Conservation</u>
<u>Region 4</u>
<u>Division of Solid & Hazardous Materials</u>
<u>1150 North Westcott Road</u>
<u>Schenectady, NY 12306</u>

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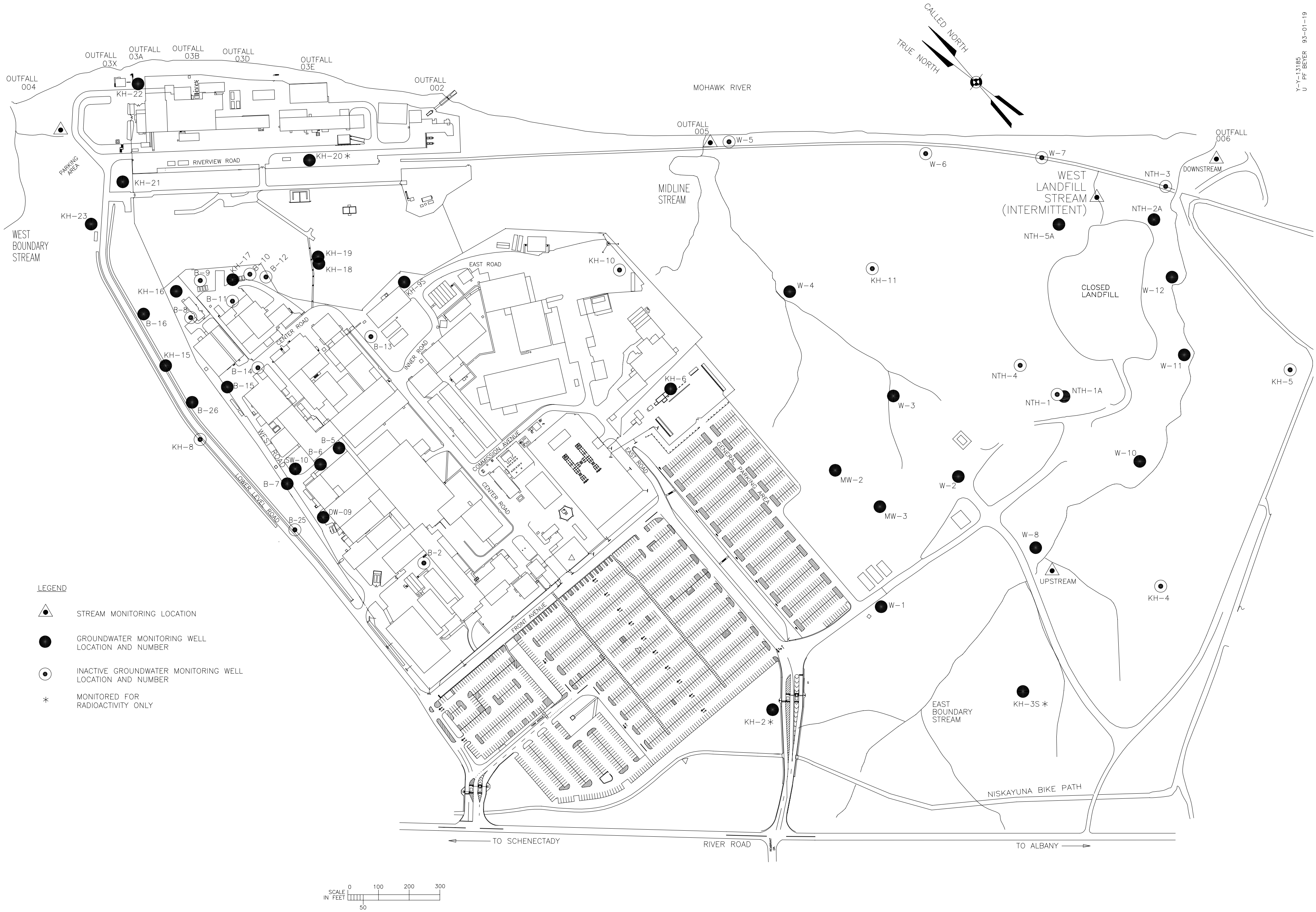
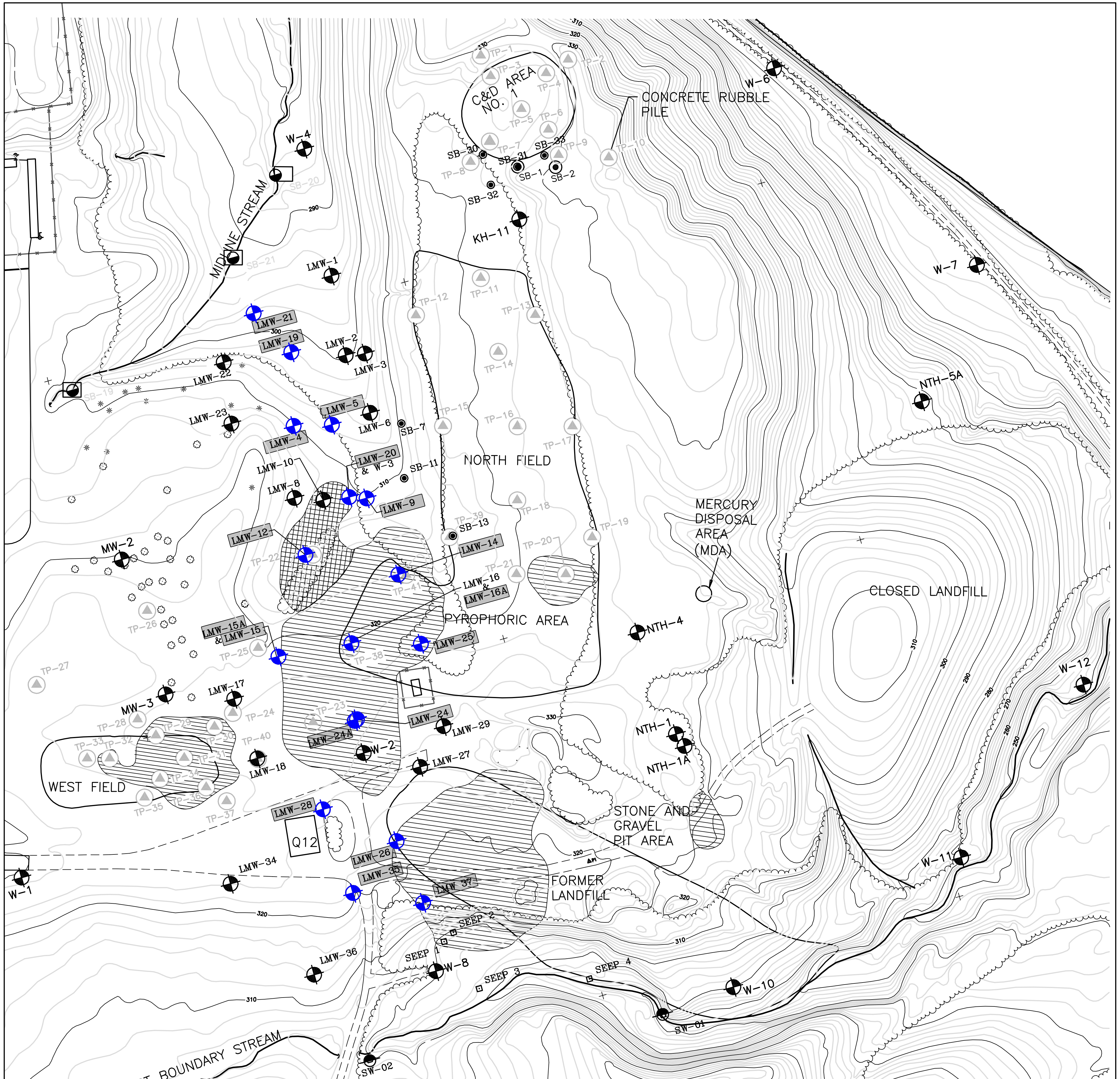


FIGURE 1
KNOLLS SITE
GROUNDWATER, STREAM, AND OUTFALL MONITORING LOCATIONS

FIGURE 2



LEGEND

AREA CONTAINING POSSIBLE BURIED METAL OBJECTS

AREA CONTAINING POSSIBLE CONDUCTIVE SOIL OR GROUNDWATER

MW-3 OLD MONITORING WELL LOCATION

LMW-1 NEW MONITORING WELL LOCATION

SB-1 SOIL BORING LOCATION

TP-38 TEST PIT LOCATION

SB-20 SEDIMENT SAMPLE LOCATION

SEEP 1 SEEP SAMPLE LOCATION

SW-02 SURFACE WATER SAMPLE LOCATION

LMW-24 VOC CONCENTRATION GREATER THAN GROUNDWATER STANDARD

KNOLLS ATOMIC POWER LABORATORY
NISKAYUNA, NEW YORK

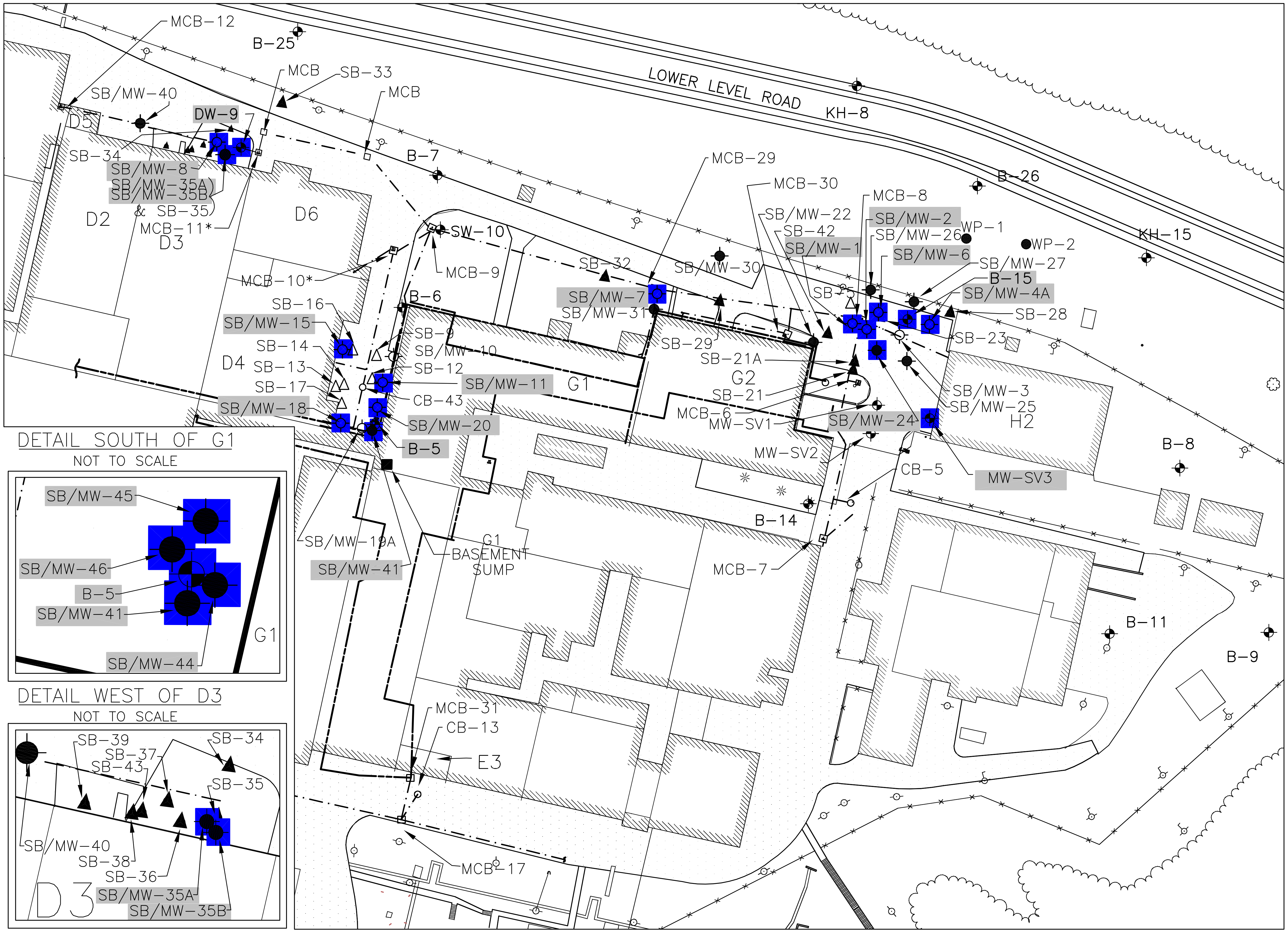
LAND DISPOSAL AREA
SAMPLING VISIT
MONITORING WELL
LOCATIONS

150 0 150

1"=150'

10350.29274

FIGURE 3



LEGEND

- EXISTING MONITORING WELL LOCATION
- STORM SEWER SYSTEM
- BUILDING
- PAVED AREA
- TREE LOCATION
- SB/MW-2 — PHASE I RFI BORING & TEMPORARY WELL LOCATION
- SB-5 — PHASE I RFI BORING LOCATION
- MCB-8 — MANHOLE CATCH BASIN
- CB-5 — CATCH BASIN
- SB/MW-22 — PHASE II RFI SOIL BORING & TEMPORARY WELL LOCATION
- SB-21 — PHASE II RFI SOIL BORING LOCATION
- WP-1 — PHASE II WELL POINT LOCATION
- FOUNDATION DRAINS
- SUMP
- MW-2 — VOC CONCENTRATION GREATER THAN GROUNDWATER STANDARD

KNOLLS ATOMIC POWER LABORATORY
NISKAYUNA, NEW YORK

HILLSIDE AREA MAP AND RFI INVESTIGATION LOCATIONS

80 0 80
1"=80'

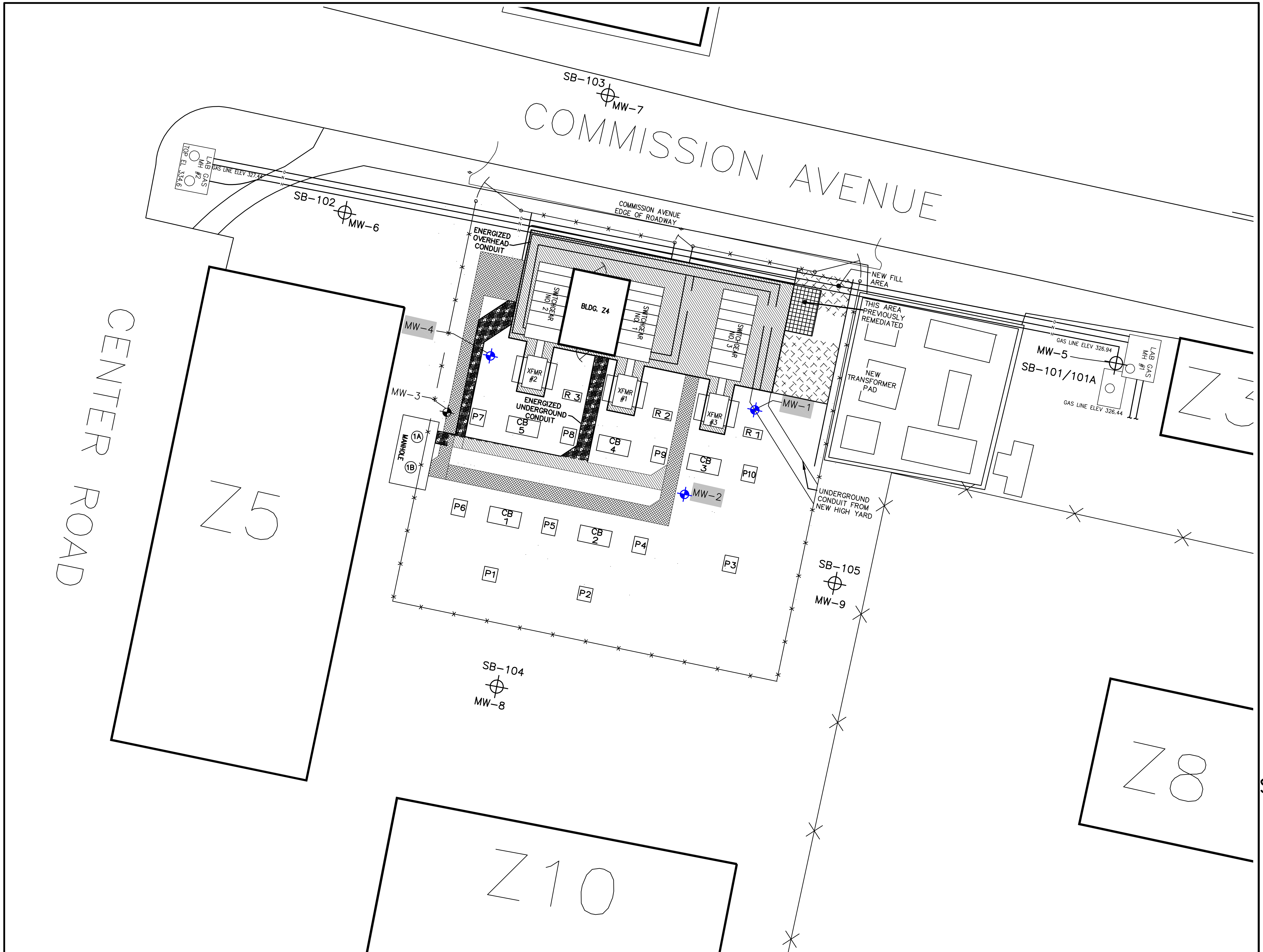
10350.29274

NOTES: 1. WELL LOCATIONS ARE BASED ON 8/19/99 AND 11/20/01 FIELD SURVEYS; MAP INFORMATION FROM: LOCKWOOD MAPPING 1999, STORM SEWER FROM WALSH MAPS, 1998. FOUNDATION DRAINS UPDATED 7/02 BASED ON TURNBULL DRAWING No. P-2 (6/8/49).
2. "*" INDICATES MANHOLE CATCH BASIN INACCESSIBLE, COVERED WITH ASPHALT PAVEMENT.

I:\ALB\PROJECT\10350\29274\DWG\HILLSIDE\New Folder\HILLSIDE-AREA RFI-Figure 3new&3

PLOT DATE: 09/15/04 (DVIEW TWIST 47.49)

FIGURE 4



NOTES: 1. ADAPTED FROM: LOCKWOOD MAP 1999.

LEGEND

MW-2	RFI PHASE II GROUNDWATER MONITORING WELL LOCATION
SB-104 / MW-8	SUPPLEMENTAL GROUNDWATER SAMPLING LOCATION AND CORRESPONDING SOIL BORING
MW-2	VOC CONCENTRATION GREATER THAN GROUNDWATER STANDARD

ADAPTED FROM: HIGH YARD AREA RCRA FACILITY INVESTIGATION REPORT, AUGUST 2000

KNOLLS ATOMIC POWER LABORATORY
NISKAYUNA, NEW YORK

SOIL BORING AND MONITORING WELL LOCATIONS HIGH YARD AREA SUPPLEMENTAL GROUNDWATER CHARACTERIZATION

1"=20' 20 0 20