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DOE/AL/62350-95
REV. 1



# UMTRA PROJECT WATER SAMPLING AND ANALYSIS PLAN

## CANONSBURG, PENNSYLVANIA

September 1995



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# UMTRA PROJECT WATER SAMPLING AND ANALYSIS PLAN
# CANONSBURG, PENNSYLVANIA

September 1995

Prepared for
U.S. Department of Energy
Environmental Restoration Division
UMTRA Project Team
Albuquerque, New Mexico

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# LIST OF ACRONYMS

| Acronym | Definition |
|---|---|
| AEC | Atomic Energy Commission |
| DOE | U.S. Department of Energy |
| DQO | data quality objectives |
| EPA | U.S. Environmental Protection Agency |
| LTSP | Long-Term Surveillance Plan |
| MCL | maximum concentration limit |
| NRC | U.S. Nuclear Regulatory Commission |
| QA | quality assurance |
| RRM | residual radioactive material |
| SOP | standard operating procedures |
| TDS | total dissolved solids |
| UMTRA | Uranium Mill Tailings Remedial Action |
| UMTRCA | Uranium Mill Tailings Radiation Control Act |
| VCA | Vitro Corporation of America |
| WSAP | water sampling and analysis plan |

# 1.0 INTRODUCTION

Surface remedial action was completed at the U.S. Department of Energy (DOE) Canonsburg and Burrell Uranium Mill Tailings Remedial Action (UMTRA) Project sites in southwestern Pennsylvania in 1985 and 1987, respectively. The Burrell disposal site, included in the UMTRA Project as a vicinity property, was remediated in conjunction with the remedial action at Canonsburg. On 27 May 1994, the Nuclear Regulatory Commission (NRC) accepted the DOE final Long-Term Surveillance Plan (LTSP) (DOE, 1993) for Burrell, thus establishing the site under the general license in 10 CFR §40.27 (1994). In accordance with the DOE guidance document for long-term surveillance (DOE, 1995), all NRC/DOE interaction on the Burrell site's long-term care now is conducted with the DOE Grand Junction Projects Office in Grand Junction, Colorado, and is no longer the responsibility of the DOE UMTRA Project Team in Albuquerque, New Mexico. Therefore, the planned sampling activities described in this water sampling and analysis plan (WSAP) are limited to the Canonsburg site.

## 1.1 PURPOSE

This WSAP identifies and justifies the sampling locations, analytical parameters, detection limits, and sampling frequencies for routine monitoring at the Canonsburg site for calender years 1995 and 1996. Currently, the analytical data further the site characterization and demonstrate that the disposal cell's initial performance is in accordance with design requirements.

The regulatory basis for routine ground water monitoring at UMTRA Project sites is derived from the U.S. Environmental Protection Agency (EPA) regulations in 40 CFR Part 192 (1994) and the final EPA ground water protection standards (60 FR 2854 (1995)). UMTRA Project standard operating procedures (SOPs) (JEG, n.d.) and the Technical Approach Document (DOE, 1989) provide most sampling procedures. When these documents provide no specific procedures, industry-accepted approaches are employed.

## 1.2 SITE LOCATION

The Canonsburg site is near the southwestern corner of the borough of Canonsburg, Washington County, Pennsylvania, approximately 20 miles (mi) (32 kilometers [km]) southwest of downtown Pittsburgh (Figure 1.1). The 30-acre (12-hectare) site is bounded on the north, east, and west by Chartiers Creek and on the south by the Conrail railroad tracks (Figure 1.2). The site is located in a mixed residential/commercial area. The disposal site, comprising Areas A and B, is fenced and not accessible to the public (Figure 1.2). Area C, southeast of the disposal cell, across Strabane Avenue, is outside the fenced area and is being evaluated for potential public use (Figure 1.2).

site in accordance with the cooperative agreement (Licensing Implementation Plan, 1992).

## 1.4 SITE STATUS

Surface remediation at the Canonsburg site began in October 1983 and was completed in December 1985. Remediation consisted of stabilizing contaminated materials in an on-site disposal cell. Because the Canonsburg disposal cell's design and construction were based on the EPA standards remanded in part on 3 September 1985, the EPA tentatively concluded that modifying the existing disposal cell to meet the proposed standards of 24 September 1987 (52 FR 36000 (1987)), Subpart A, was not warranted. The ground water protection standards of 11 January 1995 (60 FR 2854) are applicable for compliance under Subpart B.

The Canonsburg site will remain in poststabilization, prelicensing status until the NRC licenses the site for long-term surveillance and maintenance under the provisions of 10 CFR Part 40 (1994). The general license becomes effective after the NRC concurs with the completion of the surface remedial action and approves the LTSP. Upon licensing, ownership of the Canonsburg site, with the exception of Area C, will transfer from the commonwealth of Pennsylvania to the U.S. Government under the DOE's oversight. The state will retain ownership of Area C.

## 1.5 SAMPLING PLAN

The primary monitor well network used to monitor postclosure ground water conditions at the Canonsburg site consists of four wells completed in the unconsolidated materials (monitor wells CAN-01-0410, -0412, -0413, and -0414) and three wells completed in the underlying shallow bedrock (monitor wells CAN-01-0504, -0505, and -0506), as shown in Figure 1.3. In August and November 1986, the monitor wells were sampled to define background and baseline ground water conditions at the site. The monitor wells were sampled semiannually for 7 years (through 1992) thereafter and currently are sampled annually.

Eight new monitor wells were installed in October 1993 to evaluate further the ground water conditions at the site. Four of these wells (CAN-01-0422, -0423, -0424, and -0425) are completed in the unconsolidated materials; the other four wells (CAN-01-0507, -0508, -0509, and -0510) are completed in the underlying shallow bedrock (Figure 1.3). The wells were sampled once in 1993 and once in 1994 in support of the baseline risk assessment to characterize further the background ground water quality and the nature and extent of ground water contamination at the site.

Six surface water sampling locations (CAN-01-0601 through -0606) are along Chartiers Creek (Figure 1.3). Locations CAN-01-0601 (upstream from the site) and -0602 (adjacent to Area C) were sampled semiannually from 1989 through

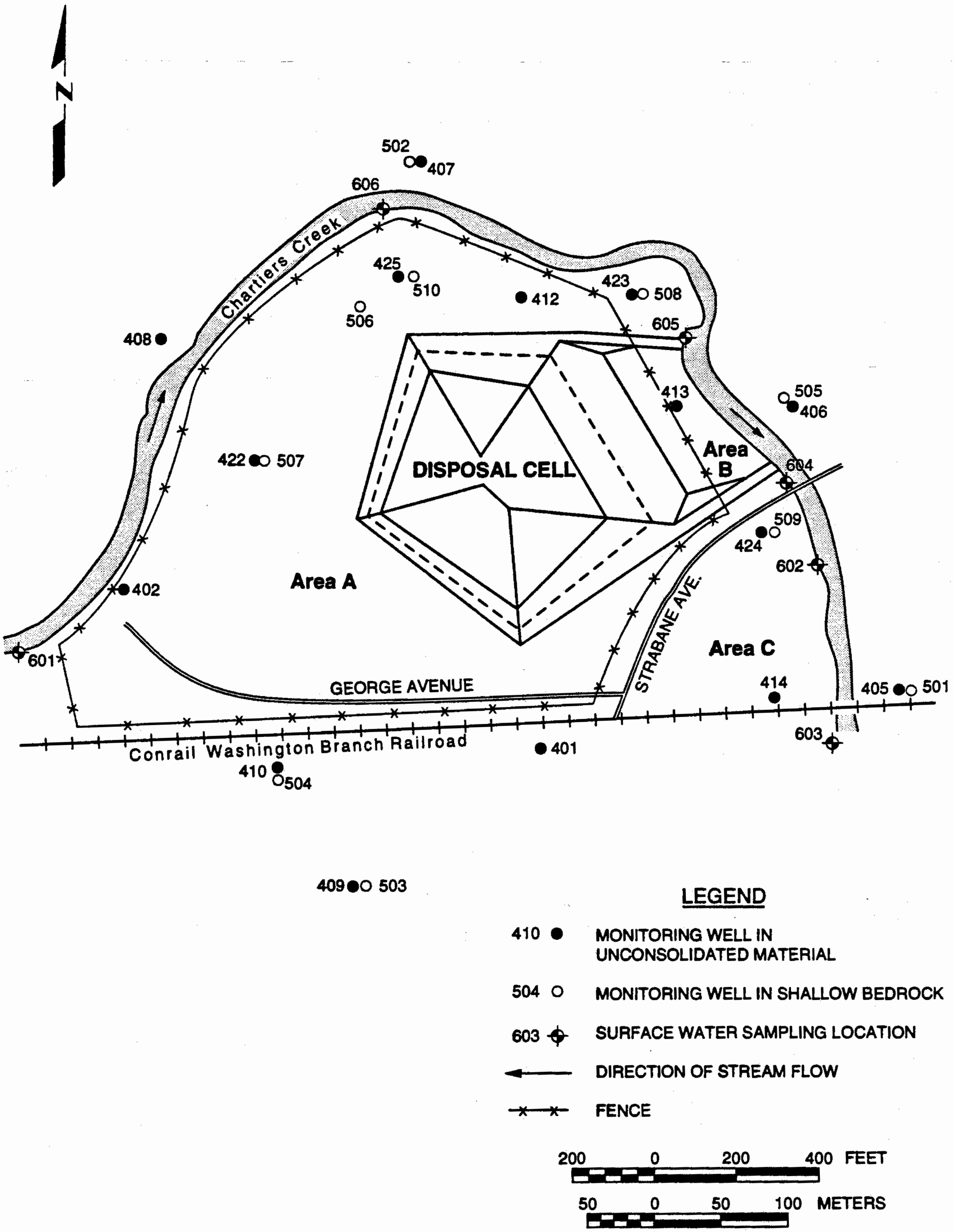


**FIGURE 1.3**
**GROUND WATER MONITORING WELL AND SURFACE WATER SAMPLING LOCATIONS CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

MAC: SITE/CAN/WSAP/BASE:CANSWSAMPLOCS

1992 and annually thereafter. Surface water samples were collected from CAN-01-0601 through -0606 in 1993 and 1994 to support baseline risk assessment recommendations.

The water quality sampling program proposed during calendar years 1995 and 1996 includes collecting water samples from selected monitor wells and from selected surface water sampling locations along Chartiers Creek. The monitoring network includes six wells (CAN-01-0406, -0410, -0412, -0413, -0414, and -0424), all completed in the unconsolidated materials and three surface water sampling locations along Chartiers Creek (CAN-01-0601, -0602, and -0603), as shown in Figure 1.3.

The DOE will continue annual ground water monitoring at the Canonsburg site for the next 2 years as a best management practice. This sampling frequency will evaluate potential contaminant trends in ground water from specific monitor wells completed in the unconsolidated materials underlying the site and will demonstrate that the disposal cell's performance is in accordance with design requirements. In addition, continued surface water monitoring will evaluate the potential effects of ground water discharging from the site to Chartiers Creek.

The sampling will be conducted from late-October to early-November of 1995 and 1996, when low-flow conditions in Chartiers Creek facilitate evaluating water quality and potential ground water/surface water interactions. The annual sampling frequency will assess long-term trends in ground water flow conditions and quality.

# 2.0 SITE CONDITIONS

## 2.1 SITE BACKGROUND INFORMATION

### 2.1.1 Surrounding land use

Four municipalities are within a 1-mi (1.6-km) radius of the Canonsburg site. Based on 1990 data (Washington County Planning Commission, 1993), the populations of these municipalities in the site vicinity are as follows:

- Borough of Canonsburg - 9200
- Borough of Houston - 1445
- Chartiers Township - 7603
- North Strabane Township - 8157.

The Canonsburg residential community is north and east of the site and the North Strabane Township is south of the site and the railroad tracks. Several industrial and commercial centers are in Canonsburg and Houston.

### 2.1.2 Surrounding water use

Most residents of Canonsburg, Houston, North Strabane, and Chartiers, in the site vicinity, are connected to a municipal water supply system operated by the Pennsylvania-American Water Company. The Monongahela River, east of the site, supplies the water for the system.

Shallow ground water in the units beneath the site is not used for drinking, agricultural, commercial, or other purposes and is not considered a water resource. Institutional controls (e.g., signs and fencing) protect human health and the environment from any potential impact of contaminated ground water resulting from uranium processing activities at the site.

Surface water sources provide most of the water for domestic purposes in the site vicinity.

Ground water from deeper aquifers more than 1 mi (1.6 km) south of the site is used for domestic purposes, but is not impacted by site activities due to the upgradient location of the pumping wells.

### 2.1.3 Contaminant source

The source of contamination at the Canonsburg site was the RRM generated by extracting, concentrating, and processing radioactive materials (radium and uranium) from carnotite ore between the early 1900s and 1957. When operations ceased, the site was used to store radioactive materials until 1967 under an AEC contract.

## 2.2 GEOLOGY AND HYDROLOGY

### 2.2.1 Physical setting

The Canonsburg site lies in the Chartiers Creek basin along the creek's southern bank, approximately 15 mi (24 km) upstream from its confluence with the Ohio River. The site is 930 to 970 feet (ft) (280 to 300 meters [m]) above mean sea level. Landfilling and earth-moving activities associated with former mill processing and disposal cell construction have altered the topography of the Canonsburg site, originally a low-lying flood plain. Slopes are gentle across the site except for one steep slope along the western and northwestern portions of the site, which drops about 30 ft (10 m) to the creek bed. Surface water from the site drains into Chartiers Creek.

### 2.2.2 Geology

The geological structure surrounding the Canonsburg site consists of subparallel folds with northeastern axis orientation. The site is located on a sequence of unconsolidated materials overlying bedrock of the Pennsylvanian Casselman Formation (Figures 2.1, 2.2, and 2.3).

The unconsolidated materials are heterogeneous in nature beneath the site and do not form discrete, continuous units. Generally, they consist of up to 30 ft (9 m) of sandy loam to silty clay loam, clay, alluvium, and fill material (cinders mixed with soil, stones/cobbles, and building rubble).

Based on geologists' logs completed prior to the installation of monitor wells CAN-01-0504 through -0506, the bedrock lithology to a depth of 95 ft (29 m) predominantly consists of gray shale, with some interbedded limestone, and sparse coal seams (Figure 2.3). The bedrock surface generally dips northeast at less than 1 degree. Shale near the bedrock surface is broken and weathered to thin brittle plates. Fracturing was observed in core samples in the upper 5 to 20 ft (1.5 to 6.1 m) of the bedrock beneath the site. The interval of concern in the bedrock is the upper 25 ft (7 m) beneath the contact with the unconsolidated material, which is referred to as the "shallow bedrock."

### 2.2.3 Ground water hydrology

Although ground water is present in the unconsolidated materials and shallow bedrock beneath the site, neither is sufficiently permeable to provide enough water to be classified as an aquifer. Water for domestic purposes in the site vicinity generally is derived from surface water sources or from ground water at greater depths below the ground surface, where more permeable materials are present.

Ground water occurs in the unconsolidated materials under unconfined (water table) conditions. Depth to ground water in the unconsolidated materials ranges from 3 to 14 ft (0.9 to 4.3 m). During the period of observation, water levels

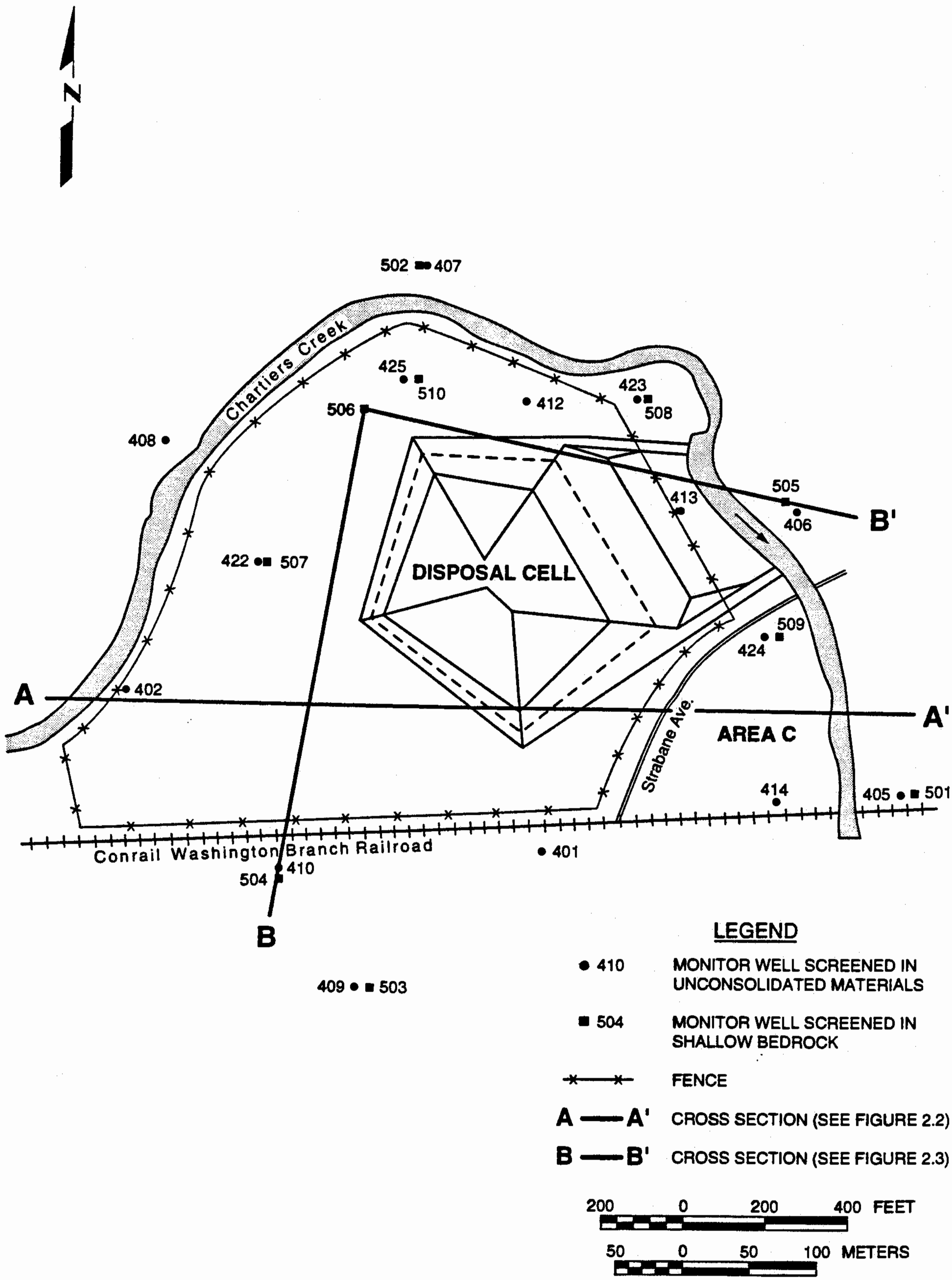


**FIGURE 2.1**
**SITE MAP SHOWING LOCATIONS OF MONITOR WELLS AND CROSS SECTION TRACE LINES CANONSBURG, PENNSYLVANIA, SITE**

MAC: SITE/CAN/WSAP/GWSAMPLOCSNEW

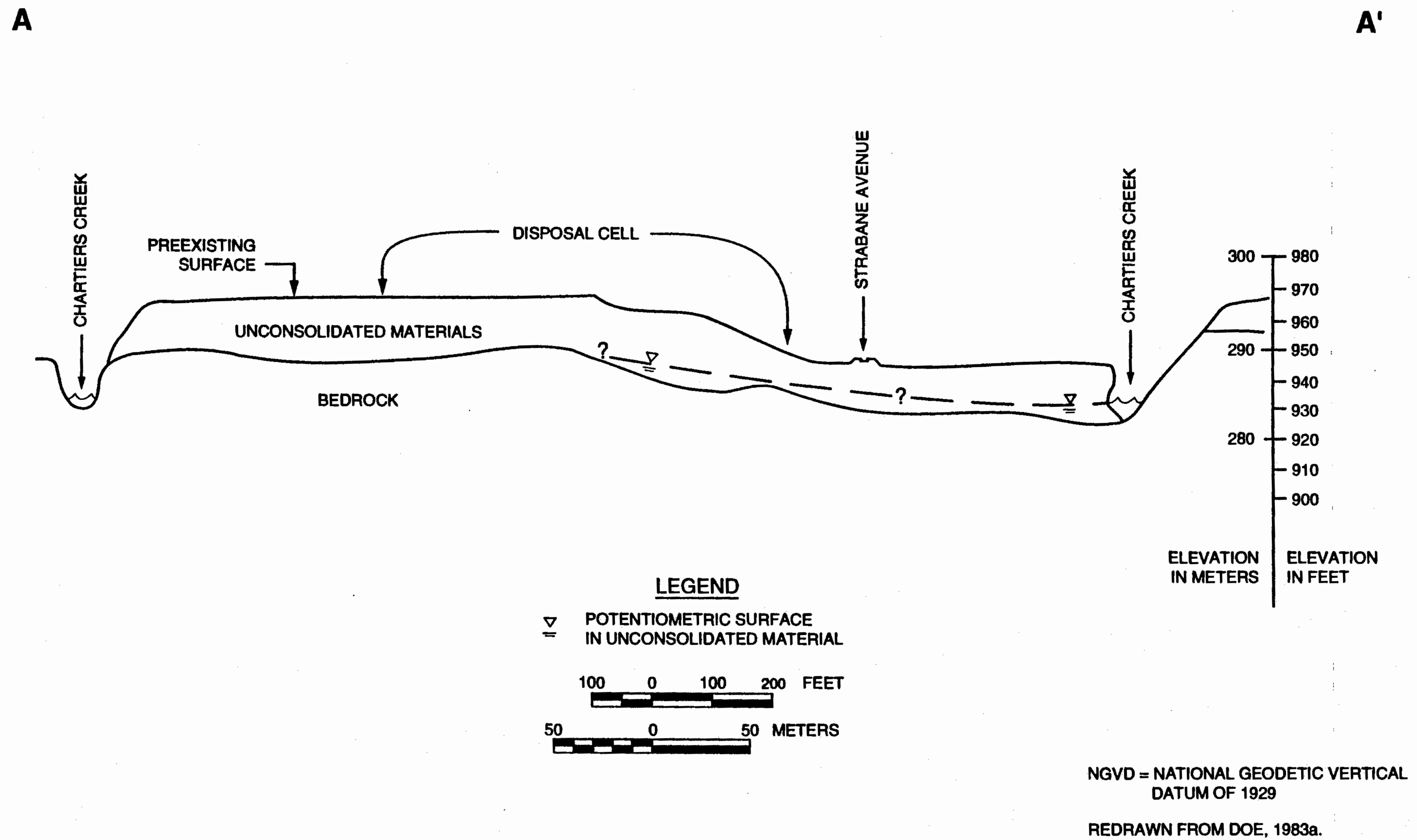


**FIGURE 2.2**
**HYDROGEOLOGIC CROSS SECTION A-A'**
**CANONSBURG, PENNSYLVANIA, SITE**

MAC: SITE/CAN/WSAP/HYDROCAN(A-A')

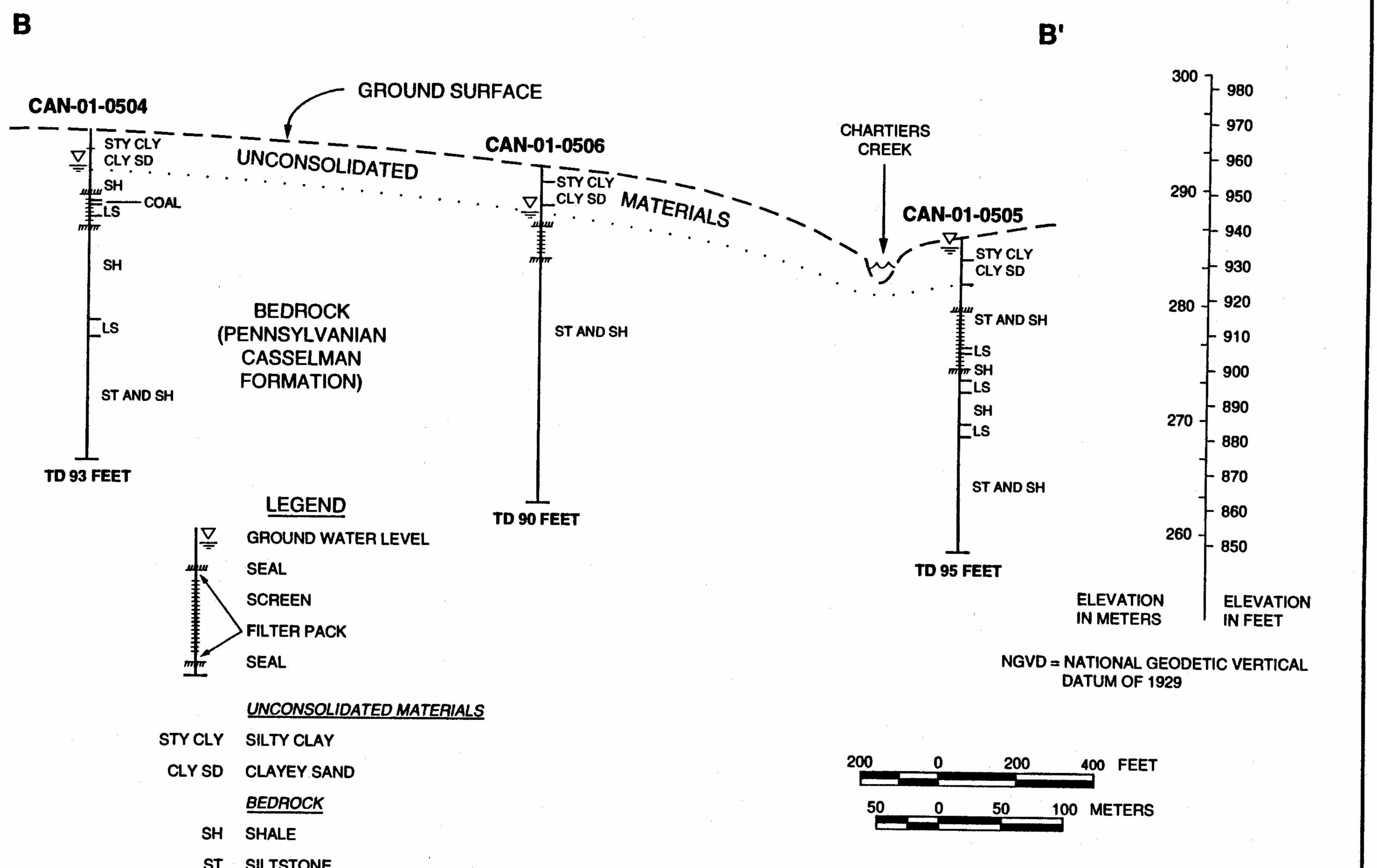


**FIGURE 2.3**
**HYDROGEOLOGIC CROSS SECTION B-B'**
**CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

MAC: SITE/CAN/WSAP/HYDROCAN(B-B')

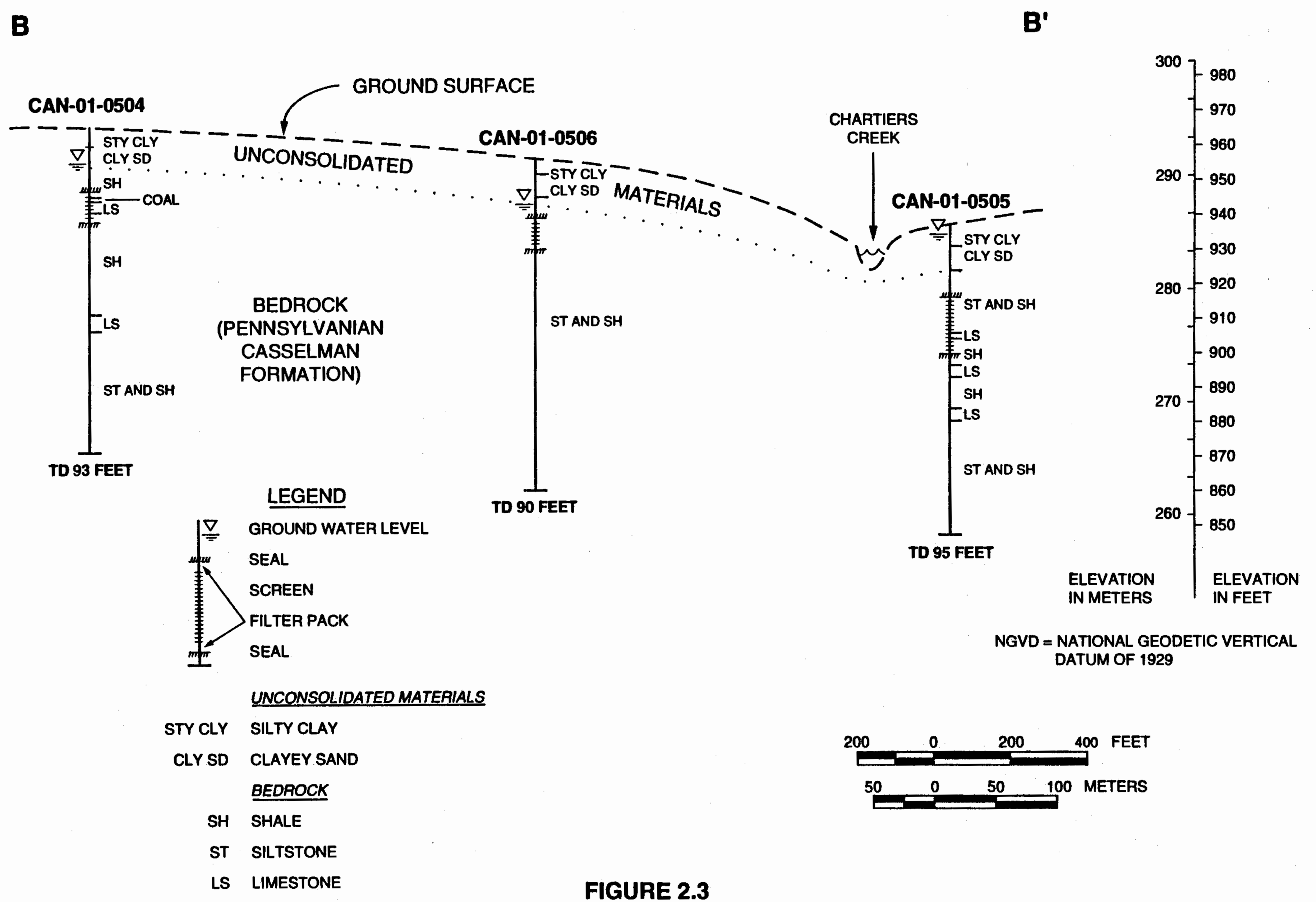


**FIGURE 2.3**
**HYDROGEOLOGIC CROSS SECTION B-B'**
**CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

MAC: SITE/CAN/WSAP/HYDROCAN(B-B')

varied slightly over time while the configuration of the potentiometric surface remained generally the same. The potentiometric surface configuration generally defines the relative ground water flow direction in this unit; however, due to material discontinuities and heterogeneities, the hydraulic interconnection between areas beneath the site may vary (Figure 2.4). Ground water in the unconsolidated materials is a result of upgradient flow and water infiltrating the unit from above. Away from the creek, some ground water apparently flows downward into the shallow bedrock; near the creek, ground water apparently flows upward from the shallow bedrock to the unconsolidated materials. Water may perch on clay layers within the unit or on the shallow bedrock. Lateral continuity of ground water quality and hydraulic conductivity in this unit has not been well established.

Ground water occurs in the underlying shallow bedrock under semiconfined conditions. The potentiometric surface configuration generally defines ground water flow direction in the shallow bedrock unit; however, due to discontinuities and ground water accumulation in fractured and weathered zones, the hydraulic interconnection between areas beneath the site may vary (Figure 2.5). Ground water in the shallow bedrock would result from water infiltrating from above into zones of secondary porosity, where the shale bedrock is weathered or fractured. Lateral continuity of ground water in this unit has not been well established. Ground water occurs in deeper zones of the bedrock and is associated with limestone or more porous zones. This ground water probably is not related to surface infiltration near the site due to intervening shale layers acting as aquitards, but is a result of ground water underflow.

Hydraulic interconnection appears to exist between the two lithologic units with a generally downward vertical gradient from the unconsolidated materials to the shallow bedrock, except near Chartiers Creek where the vertical gradient appears to flow upward. Ground water recharge to the unconsolidated materials and the shallow bedrock principally is from precipitation infiltration and surface runoff. The dominant boundary condition for ground water movement in the unconsolidated materials and shallow bedrock is Chartiers Creek. The creek surrounds the site on the west, north, and east and is the discharge zone for the water table and shallow bedrock ground water systems. Transmissivity, based on aquifer pumping tests, ranges from 1.3 to 3.8 square centimeters ($cm^2$) per second in the unconsolidated materials and 0.2 to 3.9 $cm^2$ per second in the shallow bedrock (DOE, 1983a).

### 2.2.4 Surface water hydrology

The Canonsburg site lies along the southern bank of Chartiers Creek (Figure 2.1). Chartiers Creek is a meandering stream with a channel width of 75 to 100 ft (23 to 30 m) and a normal channel depth of about 5 ft (1.5 m). Chartiers Creek drains an approximate 80-square-mile (207-square-kilometer) area upstream from the site and drains into the Ohio River 15 mi (24 km) downstream from the site (DOE, 1994a). Chartiers Creek averages 90 to 130 cubic feet per second (27 to 40 cubic meters per second) (DOE, 1994a).

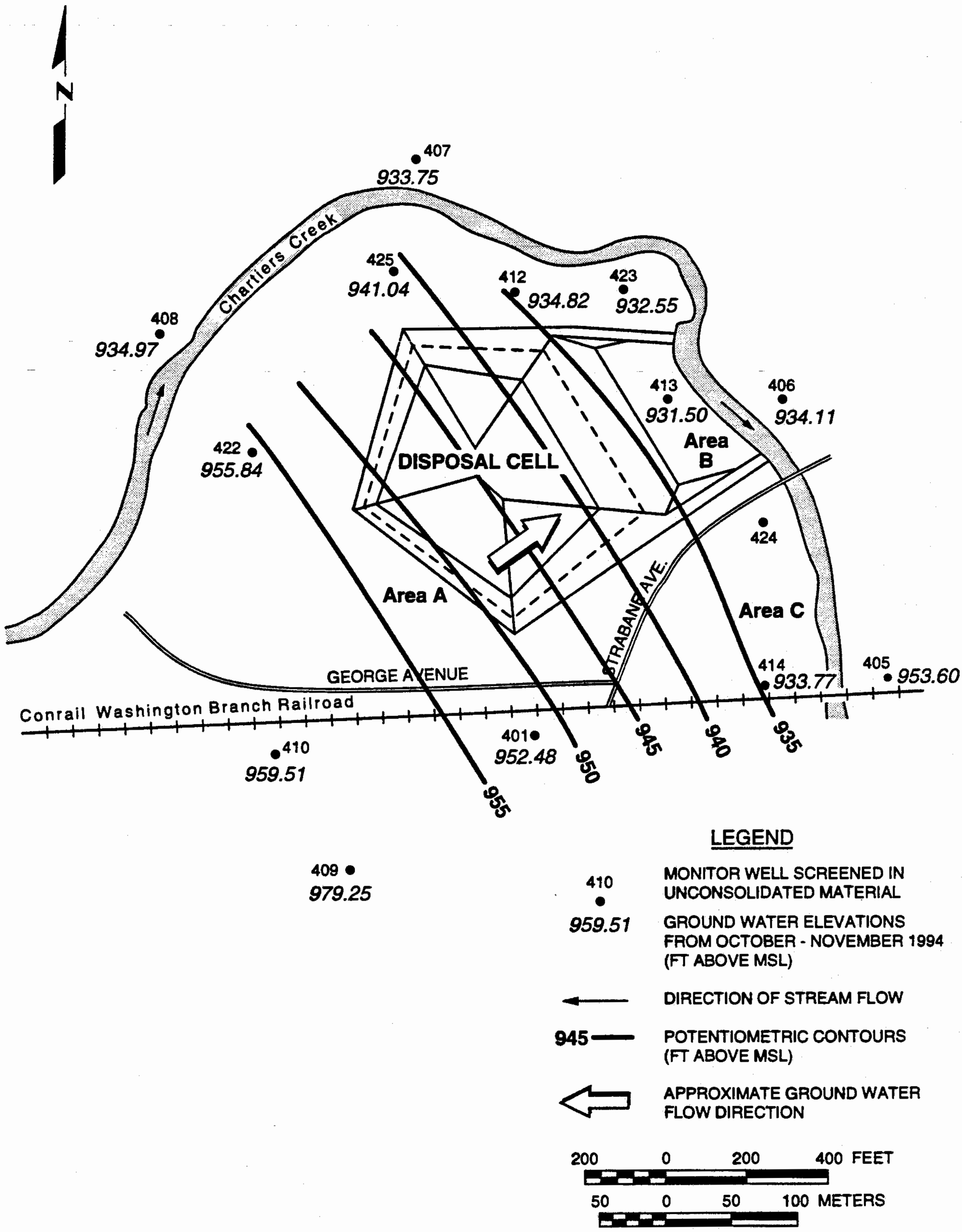


**FIGURE 2.4**
**POTENTIOMETRIC SURFACE OF THE UNCONSOLIDATED MATERIALS AT THE CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

MAC: SITE/CAN/WSAP/BASE:CAN-POTENURNCON

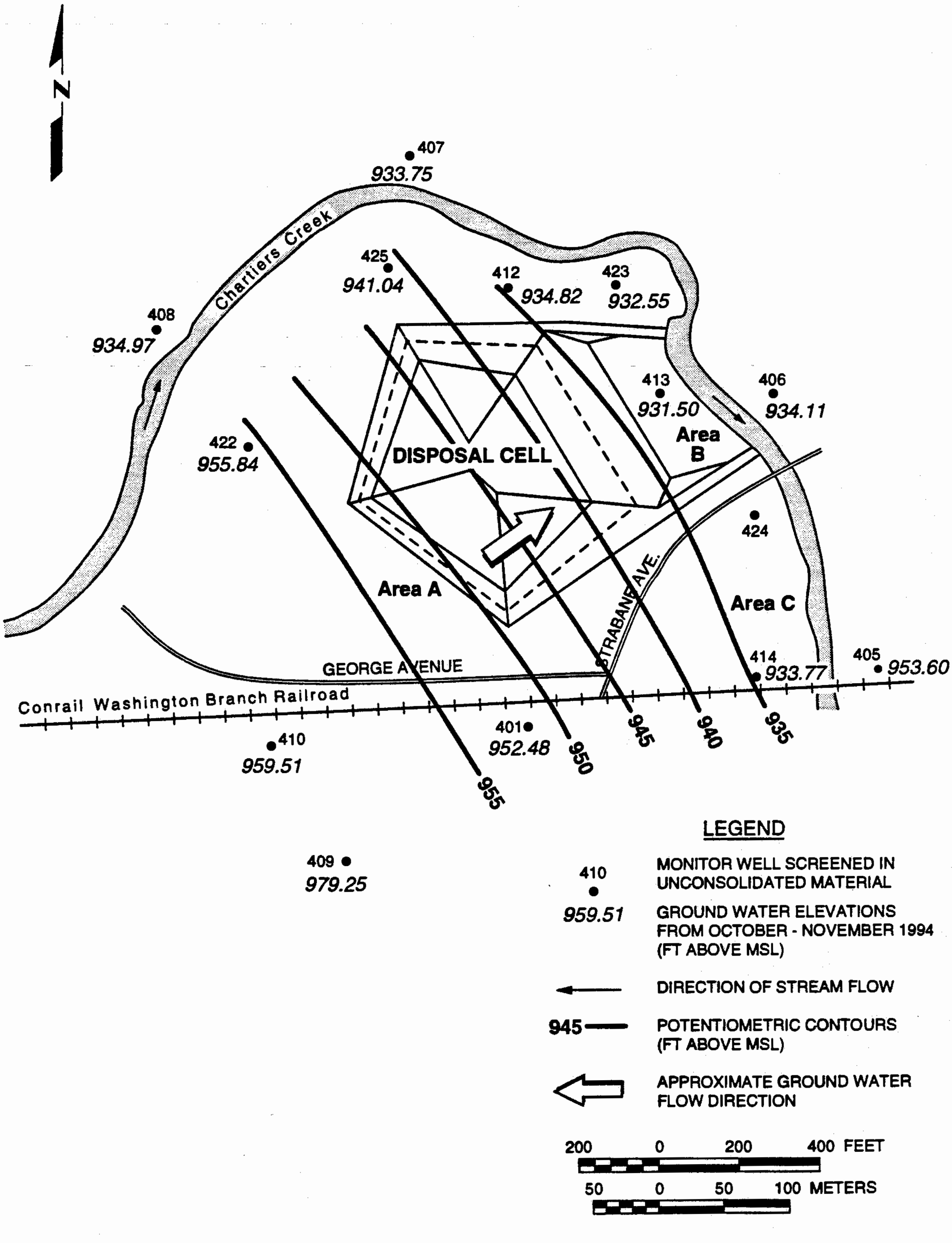


**FIGURE 2.4**
**POTENTIOMETRIC SURFACE OF THE UNCONSOLIDATED MATERIALS AT THE CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

MAC: SITE/CAN/WSAP/BASE:CAN-POTENURNCON

## 2.3 WATER QUALITY

This section presents water quality results from previous ground water and surface water sampling events at the Canonsburg site. Figure 1.3 shows monitor well and surface water sampling locations. Table 2.1 presents monitor well completion data including well specifications, formation of completion, and the relationship of each monitor well to the ground water flow direction.

### 2.3.1 Background water quality

Background ground water quality was determined by analyzing samples from monitor well CAN-01-0410, completed in the unconsolidated materials, and monitor well CAN-01-0504, completed in the shallow bedrock upgradient from the site (Figure 1.3 and Table 2.1). These monitor wells evaluate ground water conditions in specific zones just above and below the contact between the two units and are not open to the entire unit thickness. Background ground water in the unconsolidated materials is sulfate type containing slightly less bicarbonate and chloride anions (DOE, 1994a). Sodium, calcium, and magnesium are the dominant cations. Iron and manganese levels in background ground water exceed the EPA secondary drinking water standards. A 360-milligram-per-liter (mg/L) total dissolved solids (TDS) content and a 5.6 pH were measured in October 1994. Background ground water in the shallow bedrock is sulfate, chloride, and bicarbonate type. Calcium is the dominant cation. An 860-mg/L TDS and 6.7 pH were measured in October 1994. No concentrations of any constituents of concern in background ground water at the Canonsburg site exceeded the EPA maximum concentration limits (MCL) in either unit.

### 2.3.2 Point of compliance

The EPA *Groundwater Standards for Remedial Actions at Inactive Uranium Processing Sites* (40 CFR Part 192 --- Final Rule of 11 January 1995 in 60 FR 2854) regulates ground water protection at the Canonsburg site. Because the Canonsburg disposal cell's design and construction were based on standards remanded in part on 3 September 1985, the EPA considered this site separately and tentatively concluded that modifying the existing disposal cell to meet the final standards is not warranted. As stated in 60 FR 2854: *"The disposal site at Canonsburg, PA, is located above the banks of Chartiers Creek. Contamination that might seep from the encapsulated tailings will reach the surface within the site boundary, and is then diluted by water in the creek to insignificant levels. Under these circumstances, this site qualifies for an ACL under 192.02(c)(3)(ii), and modification of the existing disposal cell is not warranted".* For all practical purposes, the point of compliance would be Chartiers Creek; consequently, no point-of-compliance monitor wells exist.

### 2.3.3 Contaminant delineation

The disposal site monitor well network to assess postclosure ground water conditions beneath and downgradient from the Canonsburg site consists of three

wells completed in the unconsolidated materials (CAN-01-0412, -0413, and -0414) and two wells completed in the shallow bedrock (CAN-01-0505 and -0506) (Figure 1.3 and Table 2.1). Several other recently installed monitor wells in the unconsolidated materials (CAN-01-0422, -0423, -0424, and -0425) and shallow bedrock (CAN-01-0507, -0508, -0509, and -0510) have been sampled to support previous results and assess less-defined areas of the site (Figure 1.3 and Table 2.1).

Ground water and surface water samples initially were evaluated for the presence of hazardous constituents generally expected to be in or derived from the RRM related to the uranium processing activities. The following constituents and parameters were analyzed during the screening monitoring to determine background and baseline ground water quality in the unconsolidated materials and the shallow bedrock: aluminum, ammonium, antimony, arsenic, barium, beryllium, boron, bromium, cadmium, calcium, chloride, chromium, cobalt, copper, cyanide, fluoride, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, nitrate, pH, phosphate, potassium, selenium, silica, silver, sodium, strontium, sulfate, sulfur, thallium, tin, total alkalinity, TDS, total kjeldahl nitrogen, total organic carbon, uranium, vanadium, and zinc. The following radionuclides were analyzed: lead-210, polonium-210, radium (Ra)-226 and -228, and thorium-230, as well as gross alpha/beta. This list was modified during subsequent sampling events to focus on the following hazardous constituents determined to be related to uranium processing activities: ammonium, boron, calcium, manganese, molybdenum, potassium, strontium, and uranium (DOE, 1994a). In addition, arsenic, chloride, iron, magnesium, selenium, sodium, sulfate, TDS, gross alpha, and Ra-226 and -228 were included to characterize ground water beneath the site further.

Characterization of ground water quality beneath and downgradient from the Canonsburg site indicates that uranium is the only constituent of concern exceeding the EPA MCL. Consequently, uranium is considered the key indicator of site-related contaminant migration in ground water beneath the site.

Sample data collected in October 1994 show the distribution of uranium concentrations in the ground water of the uncontaminated materials and shallow bedrock at the Canonsburg site (Figure 2.6). Uranium concentrations in ground water in monitor well CAN-01-0506 have been consistently above the MCL since sampling began in 1986. This monitor well was installed in a separate covered area containing contaminated material not put into the disposal cell. These elevated uranium concentrations probably are a result of this source. Two additional monitor wells (CAN-01-0425 and -0510) were installed in 1993 just downgradient from monitor well CAN-01-0506 to verify a possible local source of contamination. The uranium concentration was low (0.002 mg/L) in monitor well CAN-01-0425 and was not detected in monitor well CAN-01-0510, which is consistent with this assumption. Also, these results may substantiate the apparent lack of lateral hydraulic continuity of ground water in the shallow bedrock, indicating minimal contaminant migration in ground water in the shallow bedrock even with an elevated source area. No

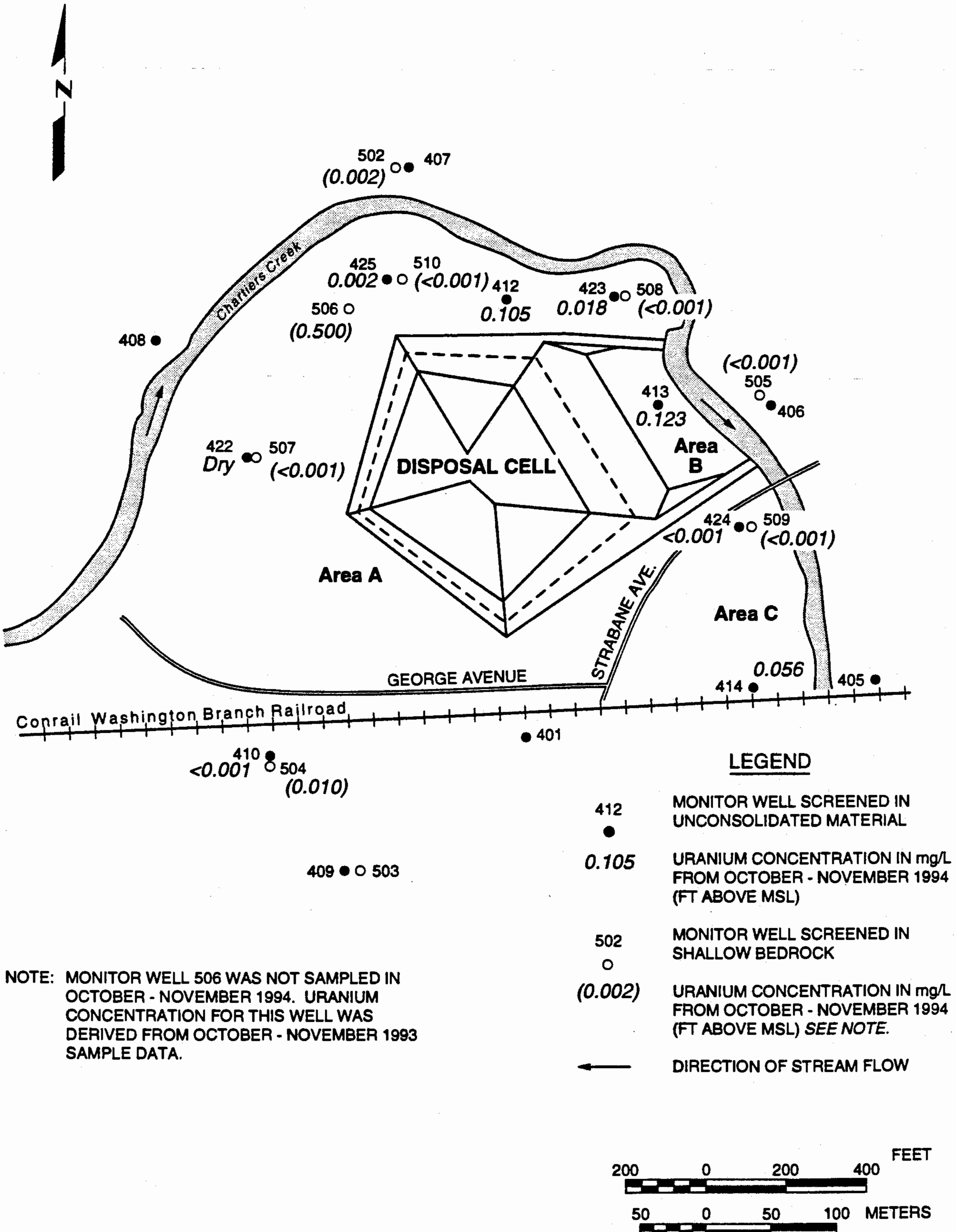


**FIGURE 2.6**
**URANIUM CONCENTRATIONS IN GROUND WATER OF THE UNCONSOLIDATED MATERIAL AND SHALLOW BEDROCK CANONSBURG, PENNSYLVANIA, DISPOSAL SITE**

# 3.0 DATA COLLECTION OBJECTIVES

Primary data collection objectives include regulatory requirements, compliance monitoring, site characterization, and risk assessment. At the Canonsburg site, data collection is performed for regulatory requirement and compliance monitoring purposes only.

## 3.1 REGULATORY REQUIREMENTS

The regulatory requirements for sampling at the Canonsburg site are specified in 40 CFR Part 192 (1994) and are described in the *Draft Guidance Document for Preparing Water Sampling and Analysis Plans for UMTRA Project Sites* (DOE 1995).

## 3.2 COMPLIANCE MONITORING

No point-of-compliance ground water monitor wells exist at the Canonsburg site. Chartiers Creek is established as the point of compliance and is monitored annually for uranium processing-related constituents.

# 4.0 DATA QUALITY OBJECTIVES

Data quality objectives (DQO) specify the quality and quantity of data required and define the manner in which ground water and surface water samples should be collected, handled, and analyzed. DQOs: 1) prescribe SOPs for water sampling and other field procedures, 2) define analytical methods and level criteria for field and laboratory analyses, 3) ensure procedures follow quality assurance (QA) and quality control protocols, and 4) provide analytical data validation. DQOs to be followed during data collection and evaluation activities are stated in the WSAP guidance document (DOE, 1995), applicable SOPs in Sections 16.1 and 16.2 (JEG, n.d.), the statement of work for general inorganic and radiochemical analyses (TAC, 1993), and the quality assurance implementation plan (DOE, 1994b).

Table 4.1 provides a summary of analytes, regulatory limits, and sampling and analysis information. Table 4.2 summarizes sampling locations, sample types, filtering requirements, sampling methods, and orders of sample collection. Ground water samples collected from DOE monitor wells will be filtered with a 0.45-micron filter, while surface water samples collected from Chartiers Creek will be both filtered and nonfiltered. QA samples will be collected as required.

**Table 4.1 Summary of analytes, regulatory limits, and sampling and analysis information**

| Analyte | MCL | MDL | Techniques[a] | Preservation | Holding time |
|---|---|---|---|---|---|
| Alkalinity | -- | -- | Field | NA | NA |
| Ammonium | -- | 0.1 | Colorimetric | 1 | 28 days |
| Arsenic | 0.05 | 0.005 | GFAA, NaBH4 | 2 | 180 days |
| Calcium | -- | 0.5 | ICP-AES | 2 | 180 days |
| Chloride | -- | 0.5 | IC, Colorimetric | 3 | 28 days |
| Iron | -- | 0.03 | ICP-AES | 2 | 180 days |
| Magnesium | -- | 0.1 | ICP-AES | 2 | 180 days |
| Manganese | -- | 0.01 | ICP-AES | 2 | 180 days |
| Molybdenum | 0.1 | 0.01 | ICP-AES | 2 | 180 days |
| Potassium | -- | 0.1 | ICP-AES, FAA | 2 | 180 days |
| Sodium | -- | 1 | ICP-AES, FAA | 2 | 180 days |
| Sulfate | -- | 1 | IC | 3 | 28 days |
| Total dissolved solids | -- | 10 | Gravimetric | 3 | 7 days |
| Uranium | 0.044 | 0.001 | ICP-MS, Fluorimetric | 2 | 180 days |

[a]Where more than one technique is specified, the first technique listed is preferred. Technique acronyms and abbreviations are defined below.

| | |
|---|---|
| AS | Alpha spectrometry |
| ASc | Alpha scintillation |
| CVAA | Cold vapor atomic absorption spectroscopy |
| FAA | Flame atomic absorption spectroscopy |
| GFAA | Graphite furnace atomic absorption spectroscopy |
| IC | Ion chromatography |
| ICP-AES | Inductively coupled plasma-atomic emission spectroscopy |
| ICP-MS | Inductively coupled plasma-mass spectrometry |
| IR | Infrared |
| ISE | Ion specific electrode |
| LSc | Liquid scintillation |
| $NaBH_4$ | Sodium borohydride reduction atomic absorption spectroscopy |
| PC | Proportional counter |
| UV | Ultraviolet |

Notes: 1. All concentrations in mg/L.
2. Preservation : (1) H2SO4, pH less than 2, 4 degrees C; (2) HNO3, pH less than 2; (3) 4 degrees C.
3. Source: DOE, 1993.

-- no established limit.

NA – not applicable.

MDL – method detection limit.

**Table 4.2 Summary of sampling locations and methods**

| Location | Type | Filtered | Method | Order |
|---|---|---|---|---|
| CAN-01-0406 | Monitor well - ground water | Yes | Submersible pump | 2 |
| CAN-01-0410 | Monitor well - ground water | Yes | Submersible pump | 1 |
| CAN-01-0412 | Monitor well - ground water | Yes | Submersible pump | 3 |
| CAN-01-0413 | Monitor well - ground water | Yes | Submersible pump | 3 |
| CAN-01-0414 | Monitor well - ground water | Yes | Submersible pump | 3 |
| CAN-01-0424 | Monitor well - ground water | Yes | Submersible pump | 2 |
| CAN-01-0601 | Surface water | Yes/No | Grab sample | 4 |
| CAN-01-0602 | Surface water | Yes/No | Grab sample | 4 |
| CAN-01-0603 | Surface water | Yes/No | Grab sample | 4 |

# 5.0 SAMPLING PLAN

The ground water monitoring program at the Canonsburg site evaluates the effectiveness of the remedial action and demonstrates compliance with the ground water standards and protection of public health and the environment. In addition, a surface water monitoring program evaluates the potential effects of ground water discharging from the site to Chartiers Creek.

Figure 1.3 shows the disposal cell location, the current DOE monitor well network, and the surface water sampling locations along Chartiers Creek at the Canonsburg site. Table 5.1 outlines the site's ground water and surface water quality sampling history.

## Overview of Previous Ground Water and Surface Water Monitoring

The original monitor well network at the Canonsburg site consisted of 16 monitor wells. Seven of these wells were selected as the primary monitor well network to monitor post-closure ground water conditions at the Canonsburg site. Four wells are completed in the unconsolidated materials (monitor wells CAN-01-0410, -0412, -0413, and -0414) and three wells are completed in the underlying shallow bedrock (monitor wells CAN-01-0504, -0505, and -0506) (Table 2.1). The monitor wells evaluate ground water quality and ground water flow conditions upgradient (background) (CAN-01-0410 and -0504), crossgradient (CAN-01-0414 and -0506), and downgradient (CAN-01-0412, -0413, and -0505) from the disposal cell (Figure 1.3). Following the definition of background and baseline ground water conditions at the site in 1986, these monitor wells were sampled semiannually for 7 years (through 1992) and currently are sampled annually (Table 5.1). This sampling frequency permits evaluation of trends in ground water quality and flow conditions.

Eight new monitor wells installed in October 1993 further evaluate ground water conditions at the site. Four wells (CAN-01-0422, -0423, -0424, and -0425) were completed in the unconsolidated materials and the other four wells (CAN-01-0507, -0508, -0509, and -0510) were completed in the underlying shallow bedrock (Figure 1.3 and Table 2.1).

In 1993, all existing monitor wells at the Canonsburg site were sampled in support of the baseline risk assessment to characterize further the background ground water quality and the nature and extent of ground water contamination at the site. These included the seven monitor wells that form the primary monitor well network, the eight newly installed monitor wells, and the eight monitor wells of the original monitor well network not used to monitor postclosure conditions at the site (Table 5.1).

Routine sampling of the primary monitor well network was performed in 1994. The 1993 sample results from the newly installed monitor wells indicated no apparent impacts from uranium tailings. The new monitor wells were sampled again in 1994 to confirm the results from the previous sampling round (Table 5.1).

## Table 5.1 Water quality sampling history

| Location ID (GRN-01-) | Aug-86 | Nov-86 | Jan-87 | May-87 | Dec-87 | Jun-88 | Dec-88 | May-89 | Jan-90 | Jul/Aug-90 | Feb-91 | Aug-91 | Jan-92 | Aug-92 | Jul-93 | Oct-93 | Nov-93 | Oct-94 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0401 | X | | | | | | | | | | | | | | | X | | |
| 0405 | | | | | | | | | | | | | | | | X | | |
| 0406 | | | | | | | | | | | | | | | | | X | |
| 0407 | | | | | | | | | | | | | | | | X | | |
| 0408 | | | | | | | | | | | | | | | | | | |
| 0409 | | | | | | | | | | | | | | | | X | X | |
| 0410 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 0412 | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | X |
| 0413 | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | X |
| 0414 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X |
| 0422 | | | | | | | | | | | | | | | | | | |
| 0423 | | | | | | | | | | | | | | | | | X | X |
| 0424 | | | | | | | | | | | | | | | | | X | X |
| 0425 | | | | | | | | | | | | | | | | | X | X |
| 0502 | | | | | | | | | | | | | | | | | X | X |
| 0503 | | | | | | | | | | | | | | | | | X | |
| 0504 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X |
| 0505 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | X |
| 0506 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | X | |
| 0507 | | | | | | | | | | | | | | | | | X | X |
| 0508 | | | | | | | | | | | | | | | | | X | X |
| 0509 | | | | | | | | | | | | | | | | | X | X |
| 0510 | | | | | | | | | | | | | | | | | X | X |
| 0601 | | | | | | | | X | X | X | X | X | X | X | X | X | | X |
| 0602 | | | | | | | | X | X | X | X | X | X | X | X | X | | |
| 0603 | | | | | | | | | | | | | | | | X | | X |
| 0604 | | | | | | | | | | | | | | | | X | | X |
| 0605 | | | | | | | | | | | | | | | | X | | |
| 0606 | | | | | | | | | | | | | | | | X | | |

Six surface water sampling locations (CAN-01-0601 through -0606) are along Chartiers Creek (Figure 2.1). Locations CAN-01-0601 (upstream from the site) and -0602 (adjacent to Area C) were sampled semiannually from 1989 through 1992 and annually thereafter. Surface water samples collected from CAN-01-0601 through -0606 in 1993 and 1994 support baseline risk assessment recommendations (Table 5.1).

## 5.1 SAMPLING LOCATIONS

The primary monitor well network at the Canonsburg site has been modified. The water quality sampling program will be limited to collecting ground water samples from selected monitor wells and collecting surface water samples from selected locations along Chartier's Creek. The modified primary monitor well network will include six monitor wells (CAN-01-0406, -0410, -0412, -0413, -0414, and -0424), all completed in the unconsolidated materials (Figure 1.3 and Table 2.1). Monitor wells CAN-01-0412, and -0413, located within the restricted zone, will be sampled to verify that contamination in this area is isolated and not migrating to potentially accessible ground water areas or discharging into Chartiers Creek. Monitor wells CAN-0414 and -0424, in Area C, will be sampled to evaluate further the extent of contamination associated with well CAN-01-0414. Monitor well CAN-01-0410 will be sampled to monitor background ground water quality and monitor well CAN-01-0406 will be sampled to determine if ground water contamination is migrating across Chartiers Creek. Monitor wells completed in the bedrock unit will not be sampled because the shallow bedrock is not contaminated except for a local, immobile source of contamination in the area of monitor well CAN-01-0506. The immobility of the contaminant source has been verified by uranium concentrations lower than the detection limit observed in monitor well CAN-01-0510, located immediately downgradient from monitor well CAN-01-0506.

Surface water samples will be collected from sampling locations CAN-01-0601, -0602, and -0603 to confirm that site-contaminated ground water is not affecting the water quality of Chartiers Creek (Figure 1.3). Location CAN-01-0601 is upstream from the disposal cell and locations CAN-01-0602 and -0603 are downstream from the disposal cell.

## 5.2 ANALYTE SELECTION

The ground water monitoring program includes collecting and analyzing ground water samples from the monitor wells listed in Section 5.1. Ground water samples initially were evaluated for hazardous constituents generally expected to be in or derived from the RRM related to the uranium processing activities. Constituents listed in Section 2.3.3 were analyzed during the screening monitoring to determine background and baseline ground water and surface water quality. During subsequent sampling events, the list of constituents was modified to focus on hazardous constituents related to uranium processing activities (Section 2.3.3). A 1994 baseline risk assessment evaluated the potential impacts to human health and the environment from ground water contamination from past site activities. Based on these results, Table 4.1 presents a modified list of proposed constituents to be analyzed in ground water and surface water. Determining compliance with ground water regulations and protecting human health and the environment are based on assessing trends in ground water quality data in relation to background levels and site-specific conditions.

## 5.3 SAMPLING FREQUENCY

The DOE will continue annual ground water monitoring at the Canonsburg site for the next 2 years as a best management practice. This sampling frequency will evaluate trends of potential contaminant concentrations in specific monitor wells completed in the unconsolidated materials underlying the site and will demonstrate that the disposal cell's performance is in accordance with design requirements. In addition, continued surface water monitoring will evaluate the potential effects of ground water discharging from the site to Chartiers Creek.

The sampling will be conducted during late-October to early-November of 1995 and 1996, when low-flow conditions in Chartiers Creek facilitate evaluating water quality and potential ground water/surface water interactions. The annual sampling frequency allows assessment of trends in ground water flow conditions and quality.

## 5.4 DATA EVALUATION METHODS

Water sampling data collected during 1995 and 1996 will be analyzed and evaluated according to prescribed UMTRA Project procedures and compared with the existing data base. Trend analyses will be performed to detect any variations in ground water flow conditions and ground water and surface water quality. Variations will be evaluated and sampling plan modifications will be noted, justified, and implemented, as appropriate.

## 5.5 RESPONSE TO ANOMOLOUS DATA

If water sampling results are beyond the range of expected values, the suspect data will be evaluated to determine the cause. If the deviation cannot be related to an error in sample collection, analysis, or processes reasonably expected to occur in the hydrogeologic environment, the location will be resampled during the next scheduled sampling round. Resampling will be conducted sooner if an urgent need exists related to potential impact to human health and the environment. The WSAP guidance document (DOE, 1995) includes detailed procedures for evaluating anomalous data.

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