International Business Machines Corporation

PO Box 950
Poughkeepsie, NY 12602

January 16, 1995

Mr. Steven Kaminski
Environmental Engineer III
Division of Hazardous Substances Regulation
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7252

Re: Transmittal of RCRA Facility Assessment Report, IBM Kingston Facility
Part 373 Permit No. 3-5154-67/1-0

Dear Mr. Kaminski:

Attached please find a copy of the report entitled "RCRA Facility Assessment, Four Recently Identified Solid Waste Management Units" which has been prepared in accordance with the work scope presented in Section 4.6 of the "RCRA Facility Investigation Scope of Work" for the IBM Kingston facility dated July 30, 1993. As such, this RFA report presents the results of our work performed over the past four months relative to potential releases from four Solid Waste Management Units which were newly identified in the 1993 RFI SOW.

After you have had an opportunity to review this RFA report, should you have any questions or comments, please call me at (914) 433-9395.

Very truly yours,
IBM CORPORATION

Robert J. Newhard

Robert J. Newhard
Environmental Engineer

RJN/C:jhk

Attachment

cc: Rod Aldrich, NYSDEC
with attachment
James Reidy, USEPA
with attachment
Gary Casper, NYSDEC
without attachment
Victor Valaitis, NYSDEC
without attachment

IBM

Kingston, New York

RCRA Facility Assessment
Four Recently Identified Solid Waste Management Units

Prepared for:

IBM Mid-Hudson Valley
Poughkeepsie, New York

January 16, 1995

Prepared by:

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2601 Market Place Street, Suite 310
Harrisburg, PA 17110

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1 INTRODUCTION

The subject of this report is the assessment of the four Solid Waste Management Units (SWMUs) first identified in the July 30, 1993 "Corrective Action for Solid Waste Management Units, RCRA Facility Investigation, Scope of Work" (1993 RFI SOW). This section discusses the purpose of this report and presents the organization of the remainder of the report.

1.1 Purpose

The purpose of this report is to evaluate the potential for releases from the following four SWMUs: Building 035 (B035) Former Dry Well, the Salt Barn Parking Lot Sand Disposal Area, Building 036 (B036) Construction and Debris Landfill, and the Building 031 (B031) Former Lagoon (Figure 1-1). This report presents the results of assessments of these units as discussed in subsection 4.6 of the 1993 RFI SOW.

1.2 Report Organization

Section 2, Background, addresses regional and sitewide conditions relating to geology and hydrogeology. Section 2 also addresses the history of the four SWMUs, historical occurrence of chemicals in the subsurface as it relates to the four SWMUs, and previous corrective action measures relating to the four SWMUs. This background information provides the context in which the assessment activities are discussed. Section 3 discusses field activities and sample collection, and Section 4 discusses SWMU-specific geology and hydrogeology. Section 5 presents the results of soil gas, soil and groundwater sampling. Section 6 presents conclusions regarding impacts to groundwater and recommendations for additional activities.

2 BACKGROUND

The background of the IBM Kingston site has been presented in several reports previously submitted to NYSDEC, including the 1993 RFI SOW. The background elements that are necessary in the context of the assessment of the four SWMUs are summarized in the subsections below.

The IBM Kingston facility is located approximately four miles north of the City of Kingston in the Town of Ulster, Ulster County, New York (Figure 2-1). The site consists of two parcels separated by Neighborhood Road with areas of approximately 138 acres for the eastern parcel and 120 acres for the western parcel. The site (both parcels) is bounded to the east by properties along the west side of State Route 9W, to the north by Old Neighborhood Road, to the northwest and southwest by Esopus Creek, to the west by private property, and to the south by private property and Boice Lane.

2.1 Regional Geologic Setting

The site is located in the western portion of the Hudson-Mohawk Lowland Physiographic Province. Bedrock beneath roughly the western two-thirds of the site consists of Hamilton Group fine clastic units of Middle Devonian Age (Fisher, D.W., et. al., 1970, Geologic Map of New York, New York State Museum and Science Service, Map and Chart Series No.15). The eastern third of the site is underlain by the Onondaga Limestone. These bedrock units are overlain by up to tens of feet of unconsolidated sediments resulting primarily from Wisconsinan glaciation. According to Cadwell (Cadwell, D.H., 1989, Surficial Geologic Map of New York, New York State Museum-Geological Survey, Map and Chart Series No.40), these unconsolidated units consist of:

1. Recent alluvial deposits associated with Esopus Creek and described as non-calcareous fine sand to gravel;

2. Lacustrine silt and clay, adjacent to valley alluvial deposits described as laminated silt and clay deposited in pro-glacial lakes, which is generally calcareous;

3. Lacustrine sand above lacustrine silt and clay, described as a near-shore or near-sand-source deposits of well-sorted (poorly graded), stratified, generally quartz sand.

In addition to these units, an ice contact deposit and a till deposit occur in places beneath the lacustrine deposits and directly on top of bedrock. Both the ice contact and till units occur discontinuously in depressions in the bedrock surface and usually achieve thicknesses of less than 20 feet.

The principal surface water stream in the area of the site is Esopus Creek, which flows northward and empties into the Hudson River a few miles north of the site. Drainage across the site and in the area surrounding the site is generally westward toward Esopus Creek.

2.2 Site Description

The following subsections discuss site topography, geology, and hydrogeology.

2.2.1 Topography

The surface of the site slopes generally westward toward Esopus Creek. Elevations range from approximately 180 feet above mean sea level (amsl) in the eastern portion of the site, to 175 feet amsl in the vicinity of Neighborhood Road, down to approximately 135 feet amsl along the eastern bank of Esopus Creek. The site is generally flat with the only significant break in topography occurring along the western edge of the property where the land surface drops into the Esopus Creek flood plain.

2.2.2 Geology

The following discussion of site geology is based on both literature sources (primarily Fisher and others (1970) and Cadwell and others (1989)) and numerous borings drilled on site. Most of these borings have been completed as monitoring wells. As will be discussed in section 3, 19 of these borings and wells were installed in 1994 as part of this assessment.

As shown in Fisher and others (1970), the eastern portion of the site is underlain by the Onondaga Limestone, and the western portion of the site is underlain by the Lower Hamilton Group (primarily shale).

The bedrock beneath the site is overlain in various areas by till, a sand and gravel unit, varved silt and clay, and a sand unit that generally occurs above the varved silt and clay. The varved silt and clay unit directly overlies the bedrock in the central and northwestern portions of the site, and overlies the till and the sand and gravel noted above where they are present above the bedrock. Cadwell and others (1989) assigned a lacustrine (lake) origin to the varved silt and clay unit and described it as generally laminated silt and clay with a variable thickness of up to 330 feet. Its thickness beneath the site and presence everywhere across the site (except in a small area on top of the bedrock high beneath Neighborhood Road and an area near Esopus Creek) support this interpretation of a lacustrine origin. Site well logs describe this unit generally as a gray-pink, varved silt and clay.

The surficial unit overlying the varved silt and clay consists primarily of sand. It is this uppermost unit over which the B035, B031, and Salt Barn SWMUS are located. Cadwell and others (1989) interpret this unit on a regional scale as lacustrine sand deposits associated with large bodies of water. He indicates that this unit is generally a well sorted (poorly graded), stratified, generally coarse sand with a thickness ranging from approximately 6 to 65 feet. This unit is generally described in site well logs as a clean (i.e., relatively few fines) brown sand, ranging from fine- to coarse-grained. Locally across the site, this unit is overlain by a veneer of fill typically described as a fine to medium, clean or silty sand. This lacustrine sand unit is present across most of the site except in the topographically low areas of the Esopus Creek flood plain in the extreme northwestern portion of the site, where the silt and sand deposits are likely of more recent alluvial origin. The B036 Construction and Debris (C&D) Landfill SWMU is located in part over this alluvial silt and sand unit.

2.2.3 Hydrogeology

The principal hydrogeologic units beneath the site correspond to the principal geologic units. The aquifers consist of the bedrock, the deep sand and gravel unit in the southwestern portion of the site, the shallow lacustrine sand (and fill) unit and the alluvial silt and sand unit in the northwestern portion of the site. The principal aquitards beneath the site consists of the varved silt and clay unit and the till unit where it is present..

The bedrock aquifer and the sand and gravel aquifer lie below the varved silt and clay unit under confined conditions. The shallow lacustrine and alluvial sandy aquifers present on site generally exist under water table conditions above the varved silt and clay except where local confining units are present in the northwestern portion of the site. The hydraulic conductivity of the lacustrine shallow sand (and fill) unit typically ranges from approximately 60 to 270 feet per day (ft/day).

The principal aquitard beneath the site consists of the varved silt and clay unit, and where the till is present, the combined varved silt and clay and till units. As noted previously, the varved silt and clay unit is present everywhere beneath the site except for a small area beneath Neighborhood Road and beneath the northwestern portion of the site. The bulk horizontal hydraulic conductivity of the varved silt and clay unit was determined by Dames & Moore (D&M) in the March 1981 "Summary Report" to be one ft/day in MW-2S. The data used in making this determination were not presented in the D&M Summary Report and so this value cannot be confirmed. Based on values presented in Freeze and Cherry, 1979, for silt units, this value seems relatively high. The vertical hydraulic conductivity can be assumed to be significantly lower than this determination of one ft/day due to the strong horizontal lamination of this varved unit.

The two shallow sandy aquifers are the hydrogeologic units potentially impacted by the four SWMUs and in which hazardous constituents in groundwater have historically been detected sitewide. Figure 2-2 is a shallow sand water table contour map which shows the configuration of the water table across the site in early 1994. The data used to construct this map are posted on the map.

As shown on Figure 2-2, the general direction of groundwater flow is westward. One striking feature shown on this figure is a relatively large area where perennially saturated conditions do not exist in the shallow sand aquifer. This area of generally unsaturated shallow sand, located in the central and southwestern portion of the site, is generally coincident with the highest elevations of the top of the varved silt and clay unit and the bedrock ridge. The boundaries of the area where saturated shallow sand is absent were established by reviewing the logs for wells located within this area, cross-contouring the water table elevations with the top of the varved silt and clay unit, and determining the area where the water table contours are lower than the top of varved silt and clay unit contours. A second smaller area where there is no saturated sand is shown in the northeast corner of the site.

Another major feature of groundwater flow conditions beneath the site is the east-west trending groundwater divide found at a location more-or-less coincident with the center of the main site buildings

(Building 001 (B001) through Building 005 (B005)). Groundwater to the south of the divide flows generally westward, then southwest in the vicinity of Neighborhood Road. Groundwater flow to the north of the divide flows generally westward and then northwestward around the northern end of the area in which the saturated sand unit is absent.

Also shown on Figure 2-2 is the location of buried storm sewers that extend below the water table. The storm sewer system has a significant influence on groundwater flow. A "valley" in the water table located along the north central portion of the site is caused by a 60-inch storm drain which runs through the center of this "valley" and acts as a groundwater collector. The 42-inch sewer system also acts as a groundwater collector as shown by the corresponding "valley" in groundwater elevation contours on Figure 2-2.

In 1985, long-term corrective action groundwater collection and withdrawal was started at the Groundwater Collection System (GWCS). The location of the GWCS is shown on Figure 2-2. This interceptor trench extends downward from the surface and is keyed into the top of the varved silt and clay unit such that it intercepts the entire saturated thickness of the shallow lacustrine sand aquifer. An average of approximately 30 gallons per minute (gpm) are pumped continuously from this unit and this pumping has the effect of locally steepening gradients adjacent to the trench and eliminating a significant source of recharge for the area previously downgradient (i.e., to the west and northwest) from the GWCS. As discussed in detail in the RFI SOW, this reduction in recharge to the area downgradient from the GWCS has had the effect of expanding the area over which there is no perennially saturated shallow sand aquifer.

The shallow alluvial sandy aquifer at the B036 area was, as a result of this loss of recharge, separated from the main portion of the sand aquifer. The B036 area, which until the start up of the GWCS in mid-1985 appears to have received a significant amount of recharge from the North Parking Lot Area, no longer receives a substantial portion of this recharge as a result of diversion by the GWCS. However, sewers which flow by gravity from the North Parking Lot Area to the area of the B036 area are conveying some impacted groundwater through what would otherwise be a barrier to groundwater flow.

2.2.4 SWMU Background

The following subsections present historical information regarding location, past use, and chemical occurrence associated with each of the four SWMUs.

2.2.4.1 Building 035 Former Dry Well SWMU

B035 (Figure 1-1) was constructed in 1955 and was originally occupied by electrical and mechanical equipment. It has been added to several times. Several years after it was constructed a dry well with an associated drain field was reportedly installed (Figure 2-3). This building, at one time, housed the forklift maintenance and repair operation. The effluent from forklift steam cleaning associated with the maintenance activities in this building was reportedly discharged to the dry well located in the northwest corner of the B001/B035 alcove. The dry well was reportedly used at least in the 1970s and 1980s. The dry well and associated distribution pipes were reportedly closed by removal when the maintenance activities were contracted to vendors.

Additional uses of this building included general maintenance operations, material handling and housing of electrical equipment. Chemicals used in B035 included oils, grease, paint, solvents, and sulfuric acid.

According to a 1990 letter from D&M to IBM, three informal soil samples were collected from locations near the distribution field pipes and a sample was also obtained from inside a distribution field pipe. All three soil samples were analyzed for VOCs by Method 8240 and no VOCs were reportedly detected. The soil TPH results reportedly ranged from 48 to 69 mg/kg. The TPH concentration from the sample collected in the pipe was 850 mg/kg. This SWMU lies over the B005 groundwater VOC plume.

2.2.4.2 Salt Barn Parking Lot Sand Disposal Area SWMU

The Salt Barn (or Building 070 (B070)) Parking Lot Sand Disposal Area SWMU is located in the southwestern portion of the site (Figure 1-1). This unit received primarily parking lot sweepings consisting almost entirely of sand as observed at the surface. Small amounts of construction debris and landscaping waste (brush) also have been noted in the filled area of this unit. There is no known placement of hazardous waste into this unit. The dimensions of this area are approximately 300 by 500 feet (Figure 2-4). Aerial photographs taken in 1980 indicate that this fill area was still in use as cultivated land at that time. IBM purchased this parcel in 1981 and filling presumably started after 1981.

2.2.4.3 Building 036 Construction and Debris Landfill SWMU

The B036 C&D Landfill is located to the north and northwest of B036 (Figure 2-5). This unit has also been identified in the past (RFI SOW) as the C&D Landfill north of the IWSL (Industrial Waste Sludge Lagoon). This SWMU consists of a filled area approximately 100 to 300 feet wide and 800 feet long and up to approximately 20 feet thick. It appears to contain predominantly construction debris in the form of soil, concrete, and bituminous asphalt. The southern portion of the unit is covered with mature trees and has apparently been inactive for many years. The northern portion was graded and planted with grass and crown vetch a few years ago. Aerial photographs show that filling may have started as early as 1959 and was active in the northern portion of the unit in 1980. Interviews indicate that filling operations had been occurring in this area for many years. Sheet metal, galvanized pipe, ceramic, brick, and three empty drums were also found in this unit. There is no known placement of hazardous waste in this landfill.

In March 1990, D&M collected five soil samples from test trenches for analysis. This work is documented in a brief April 16, 1990 letter report (Appendix A). Several trenches were dug and these trenches uncovered landscaping debris, empty paint cans, asphalt, concrete, wood, and construction debris. The trenches were 10-12 feet deep. All of the soil samples collected from the trenches were analyzed for pesticides and three samples were analyzed for TCLP pesticides, total base neutral compounds, and total metals. Chlordane was detected at concentrations of up to 1.35 mg/kg in the soil samples and was detected in the leachate from the TCLP analyses at concentrations up to 0.46 μg/l. The base neutral compounds fluoranthene, pyrene, and benzo(a)anthracene were detected in one sample at concentrations of 1.2, 0.9, and 0.8 mg/kg, respectively. Arsenic, beryllium, cadmium, chromium, copper, lead, nickel, selenium, and zinc were detected at concentrations of up to 5.4, 1.9, 1.6, 88, 320, 280, 200, 13, and 820 mg/kg, respectively.

2.2.4.4 Building 031 Former Lagoon SWMU

B031 was constructed in 1954 and is the site's utility plant. It is the primary location of space heating boilers and process water cooling facilities.

From 1954 to 1958, B031 used a lagoon for handling boiler blowdown and cooling tower water (Figure 2-6). The lagoon was drained and backfilled around 1958. During the time period from 1958 to 1972, the lagoon's function was replaced by a subsurface separator, which discharged to the 42-inch storm sewer system. This separator has also been identified as a SWMU. In subsequent years, from 1972 to the present, the boiler blowdown and other B031 discharges were redirected into the site IW sewer system.

Chemicals reportedly associated with B031, but not known to have been discharged to the lagoon or the separator, include caustics, oil, paint, solvents, biocides, and CFCs. Although no chemicals are known to have been discharged to the separator, the presence of the separator suggests that its designers may have planned for, or anticipated, the potential release of materials which would require a separator to keep them from entering the storm sewer system.

3 ASSESSMENT FIELD ACTIVITIES

Activities conducted in the field during the course of the assessment included a soil gas survey, digging test pits, drilling soil borings, and installing monitoring wells. Soil gas samples were collected, field headspace analysis of soil samples was conducted, soil samples for laboratory analysis were collected, and three rounds of groundwater samples were collected. The following subsections describe these activities in detail for each of the four SWMUs.

3.1 Building 035 Former Dry Well Activities

As shown on Figure 2-3, the former dry well was located in the northwest corner of the alcove between B001 and B035. The associated drainage field was not very large and was also probably limited in area to the northwestern portion of the alcove. A soil gas survey, consisting of nine points, was conducted to determine if any anomalously high concentrations existed in the subsurface soil vapor (Figure 2-3). If any hot spots were detected, then the presence of these hot spots would have guided additional assessment activities.

The soil gas survey consisted of nine locations designated AA through AI, as shown on Figure 2-3. These points form a regularly spaced grid with nodes approximately 20 feet apart. The rectangle formed by locations AA, AF, AE, and AB is estimated to be the approximate extent of the former distribution field associated with the former dry well. All of the soil gas samples were collected on October 17, 1994, along with four quality assurance samples consisting of an equipment blank at location AF, a field blank, a trip blank, and an ambient air blank collected at location AE. These samples were collected and preserved using methods described in Appendix K of the 1993 RFI SOW and were analyzed by the contract laboratory for VOCs by Methods 8010 and 8020, plus Freon®113 and acetone.

As will be discussed in subsection 5.1, no hot spots were found as a result of this soil gas survey, and so the next stage of assessment activities in this area focussed on the former dry well and drainage field. Monitoring wells MW-232S and MW-232M were installed as close as practical to the former dry well location. As shown on the well logs presented in Appendix B, the boring for this well was advanced to the varved silt and clay unit and has a total depth of 36 feet. Monitoring well MW-232M was screened from 34 feet to 24 feet in the lower part of the shallow sand aquifer. MW-232S is located adjacent to

MW-232M and was drilled to a depth of 15 feet. This well was screened from 15 feet to five feet in the upper part of the shallow sand (and fill) aquifer straddling the water table. Soil boring B-233 was advanced to the top of a laminated silt and clay unit within the shallow sand (and fill) unit and had a total depth of 26 feet. Borings B-234 and B-235 were both advanced to the top of the varved silt and clay unit and had total depths of 38 and 36 feet, respectively.

Jar headspace analyses were performed for samples collected from each 2-foot split-spoon sampler. Soil samples for laboratory VOC analysis were collected at a depth of 24 inches in MW-232M and each of the three soil borings, and at depths of eight feet in GW-232M, B-234, and B-235. A soil sample for laboratory analysis was collected at 6.5 feet in B-233. Jar headspace screening indicated that elevated PID readings were encountered from a depth of approximately 24 feet to a depth of approximately 32 feet at MW-232M, B-234, and B-235. Soil samples collected from the 24- to 26-foot and 26- to 28-foot split-spoon samples from B-235 were collected for laboratory VOC analysis.

Following well development, groundwater samples were collected from wells MW-232M and MW-232S for Appendix 33 VOCs on November 4, 1994. Results of these groundwater sample analyses, as discussed later in subsection 5.1, indicated that it was appropriate to analyze the groundwater samples collected in the second and third characterization sampling rounds for Method 8010 and 8020 parameters plus Freon®113 and acetone in MW-232M and for 8010 plus Freon®113 in MW-232S. The second round of samples was collected on November 22, 1994, and the third round on December 8, 1994.

3.2 Salt Barn Area Activities

Before starting test pit and drilling activities in the Parking Lot Sand Disposal Area SWMU, a recent aerial photograph and detailed topographic map with one-foot elevation contours, based on November 23, 1993 aerial photography, were reviewed. The limits of filling can easily be discerned from the aerial photograph and the topographic map (Figure 2-4). The limit of fill was verified in the field by a GSC geologist examining both topography and surficial soils. Immediately following the test pit activities within the fill area described below, test pits were dug adjacent to the filled area and the soil encountered was examined to further confirm the limits of fill. Four of these test pits outside the filled area were dug to the east of the filled area, three to the south, and one to the west.

After a grid with 100-foot spacing for test pit locations was laid out over the filled area, test pits were dug to the base of the fill or to a depth of four feet, whichever was greater. In several locations, test pits were extended to the maximum depth reachable by the backhoe (10 feet). Soil samples were collected for jar headspace measurements within the fill at 2-foot intervals, as described in Appendix K of the RFI SOW. The depth of the fill in each test pit and the results of jar headspace analyses are shown on Figure 3-1. Soil samples were chosen for laboratory VOC analysis from various locations and depths within the filled area in order to obtain analytical results which were representative of the entire area. As discussed in subsection 5.2, soil samples for laboratory analysis were also chosen at each of the three test pit locations where a response above background was observed in jar headspace measurements (test pits TP-E, TP-F, and TP-J).

Based on stratigraphic information gathered during the digging of test pits (discussed in subsection 4.2), the western portion of the Parking Lot Sand Disposal Area appeared to be the only area where saturated sand conditions would be encountered. Six monitoring wells were installed in the western portion of this unit (MW-240S through MW-245S). Monitoring well MW-243S was installed at a location where less than one-half foot of saturated sand was present and so was not serviceable as a monitoring point. During the construction of well MW-245S, the well was damaged such that approximately 1.5 feet of sand was present in the well. When this well was sounded during well development activities in November it was dry. An attempt was made in December to remove the sand within this well using a specially fabricated hand auger with a diameter slightly smaller than the 2-inch inside diameter of this well. This attempt to remove the sand was unsuccessful and indicated that the bottom cap was separated from the well screen. This being the case, the well is not salvageable and is scheduled for abandonment. As will be discussed in subsection 4.2, based on data obtained from other monitoring wells in this area, this well was installed at a location where less than two feet of saturated sand would have been encountered. This well is located within 50 feet of the eastern limit of saturated sand in this area, and in a position which is upgradient from MW-241S. This well would have, therefore, under the best of conditions, had approximately 1.5 feet or less of monitorable water column and is redundant with respect to MW-241S. This being the case, there are no plans for the replacement of this well.

Soil samples were collected from each of the split-spoon samples recovered from these monitoring wells. Jar headspace measurements indicate that only the 8- to 10-foot sample collected from MW-245S had a response greater than background. This response was low (0.2 ppm) and a soil sample had been collected in the fill at this location (TP-F).

Groundwater samples were collected from MW-240S, MW-241S, MW-242S, and MW-244S on three occasions. The initial samples were collected on November 2, 1994 and analyzed for Appendix 33 parameters except dioxins. Based on the results of the first round of samples, as will be discussed in detail in subsection 5.2, the second and third rounds of samples collected from these wells were analyzed for a more limited set of parameters. VOCs were analyzed for by Method 8010 plus Freon®113 in all four monitoring wells. Base neutral compounds were analyzed for in MW-244S, pesticides were analyzed for in MW-241S and MW-244S, and six Appendix 33 metals were analyzed for in all four wells. The second and third round of characterization samples were collected from these wells on November 21 and December 7, 1994.

3.3 Building 036 Construction and Debris Landfill Area Activities

The limits of this unit are shown on Figure 2-5. These limits were determined by field examination of the area and by a comparison of historical topography from the mid-1950s to current topography determined from a set of November 23, 1993 aerial photographs. Six groundwater monitoring wells (MW-220S through MW-225S) were installed along the downgradient edge of the filled area. As shown on the well logs in Appendix B and on the cross-section presented as Figure 3-2, the borings drilled for these monitoring wells ranged in depth from 17 feet to 29 feet. These wells were installed with continuous split-spoon samples collected from the ground surface to total depth. These split-spoon samples were placed in jars and the headspace gases analyzed for VOC response. There were no soil sample headspace responses greater than background and no soil samples were stained or had a chemical odor. Therefore, headspace analysis, presence or absence of staining, and presence or absence of odor were not considered in choosing screened intervals. Appropriate screened intervals were chosen for each well based on stratigraphy, and soil saturation.

The first round of groundwater samples was collected from these wells on November 2 and 3, 1994 and was analyzed for Appendix 33 parameters less dioxins. The second round of samples was collected on November 22, 1994 and the third round on December 7, 1994. The second and third rounds of samples were analyzed for a more limited set of parameters based on the results of the first round of samples, as discussed in subsection 5.3. Groundwater samples from these later rounds were analyzed as follows: MW-220S, Method 8010 parameters plus Freon®113; MW-221S, Method 8010 parameters plus Freon®113, semi-volatiles, pesticides and six metals; MW-222S, MW-224S, and MW-225S, Method 8010 parameters plus Freon®113 and six metals; and MW-223S, Method 8010 parameters plus Freon®113, Method 8020 parameters plus acetone, and six metals. A second sample for analysis of six metals was collected from MW-220S in January 1995.

3.4 Building 031 Former Lagoon Activities

The limits of this SWMU are shown on Figure 2-4 and were determined from historical building plans. Two monitoring wells were installed at the downgradient edge of this unit. As shown on the well logs presented in Appendix B, the boring for the deeper of these two wells, MW-236M, was advanced to the varved silt and clay unit, which was encountered at a depth of 18.5 feet. This well was screened from 19 feet to 14 feet in the lower portion of the shallow sand (and fill) aquifer. MW-236S is located adjacent to MW-236M and was drilled to a depth of nine feet. This well was screened from nine feet to four feet in the upper portion of the shallow sand (and fill) aquifer and straddles the water table.

Jar headspace analyses were performed for samples collected from each 2-foot split-spoon sampler in MW-236M. As shown on the well log for this well, there were no responses above background in the headspace analyses.

Following well development, MW-236M and MW-236S were sampled for Appendix 33 VOCs on November 4, 1994. Results of these groundwater sample analyses, as discussed in subsection 5.4 indicated that it was appropriate to analyze the groundwater samples collected from MW-236M in the second and third characterization sampling rounds for Method 8010 and 8020 parameters, plus acetone and Freon®113. Second and third round samples from MW-236S were analyzed for Method 8010 parameters plus Freon®113. The second round of samples was collected from these wells on November 22, 1994 and the third round on December 8, 1994.

4 GEOLOGY AND HYDROGEOLOGY

Regional and general sitewide geology and hydrogeology were discussed previously in Section 2. The following subsections present local geologic and hydrogeologic conditions in the areas of the four SWMUs which are the subject of this report.

4.1 Building 035 Former Dry Well Area

The stratigraphic units encountered in the B035 dry well area are much as expected, based on previous investigations at the site. The shallow sand (and fill) unit extends from the surface to a depth of approximately 33 feet. The unit encountered beneath the shallow sand (and fill) unit is the lacustrine varved silt and clay unit. The shallow sand (and fill) unit consisted primarily of very fine- to medium-grained sand. However, a thinly laminated (2 to 5 mm) silt, sand, and clay unit was encountered in boring B-233 at a depth of approximately 24 feet. Two thin, laminated silt and clay units were in MW-232M, one thin silt unit (3 to 5 cm) was encountered in B-235, and an interlayered silt and sand unit was encountered in B-234. All of these thin silty units were encountered at a depth of approximately 24 feet.

The elevation of the top of the varved silt and clay unit, as determined in MW-232M, B-234, and B-235, are within one foot of each other in elevation. The data from MW-232M was chosen to represent this area of closely spaced data on the revised sitewide top of silt and clay unit structure contour map (Figure 4-1). As shown on this map, the previous interpretation of a north-south trending valley on the varved silt and clay unit surface, lying a short distance to the west of the B001/B035 alcove is supported by the most recent data collected in the B035 area.

Groundwater elevation contours in the B035 area are shown on Figure 4-2. This figure shows groundwater flow to the west-northwest in the B035 area which agrees with previous site groundwater elevation contour map interpretations (Figure 2-2). Figure 4-2 also shows that the groundwater elevation in MW-232S is greater than the potentiometric surface in the deeper part of this aquifer in MW-232M. This expected result indicates a slight downward gradient within the shallow sand aquifer.

4.2 Salt Barn Area

Stratigraphic information obtained from test pits is presented on test pit logs in Appendix C. Stratigraphic information from monitoring wells are presented in well logs in Appendix B. The logs presented in these appendices indicate that the fill in this area consists largely of the sand which was spread on site roads and parking lots in the winter and swept up in the spring and deposited at this unit. Pieces of asphalt and concrete were also found in the fill material, as well as lumber and brush from landscaping activities. No waste containers, stained soil, or soil with odors were encountered during test pit and drilling activities.

As shown on Figure 3-1, the thickness of the fill placed into this SWMU ranges up to seven feet in the western portion of the unit. Sand fill thicknesses are 4.5 feet or less beneath the central and eastern portions of the unit. The fill in this SWMU was placed on a shallow natural sand unit, which in this area consists of silt and very fine to coarse-grained sand. This unit occupies the same stratigraphic position as the shallow sand (and fill) unit beneath B035 and B031. Beneath the fill, this silt and sand unit is thinnest beneath the central portion of the filled area and thickest beneath the eastern and western portions. The thickness beneath the central portion is approximately five feet and is greater than 10 feet beneath the northwestern portion of the filled area.

The shallow silt and sand unit lies on top of the varved silt and clay unit. The varved silt and clay unit was encountered in all six monitoring wells, as well as TP-H and a test pit outside the fill area located approximately 50 feet to the southwest of TP-P. The local structure on top of the varved silt and clay unit is shown on Figure 4-3. This figure indicates a north-south trending structural high beneath the central portion of the filled area with elevations on top of the varved silt and clay unit decreasing to the west, east, and south.

Saturated soil conditions were not encountered within the fill. The shallow silt and sand unit beneath the fill is saturated beneath the western portion of the filled area, to the west of the north-south trending varved silt and clay ridge. The water table map in this shallow silt and sand aquifer is shown as Figure 4-4. This map indicates a generally northward direction of groundwater flow in the saturated sand beneath the western portion of the filled area with a gradient of approximately 0.003. The silt and sand beneath the eastern portion of the filled area does not appear to be perennially saturated, as indicated by TP-H, TP-N, TP-Q, and the test pit to the southwest of TP-P. Water was observed entering TP-H at a depth of 9.5 feet, which is coincident with the top of the varved silt and clay unit. Water was observed entering TP-N and TP-Q at a depth of 10 feet, which based on the mapping shown on Figure 4-3 is very near the top of the varved silt and clay unit. No water was observed entering the test pit to the southwest of TP-P. This test pit to the south of TP-P reached the top of the varved silt and clay unit at an elevation of approximately 151 feet. This is approximately 2.5 feet below the elevation of the water table in nearby MW-243S. Based on the groundwater gradient observed in the shallow silt and sand beneath the western portion of the filled area, groundwater should have been encountered more than two feet above the top of the varved silt and clay unit in the test pit to the south of TP-P. Therefore, based on the observations in these four test pits, it does not appear that the sand beneath the eastern portion of the filled area is perennially saturated. The thickness of the saturated sand beneath the western portion of the site is shown on Figure 4-5.

4.3 Building 036 Construction and Debris Landfill Area

The eastern limit of the C&D Landfill area is approximately coincident with the original eastern bank of the Esopus Creek flood plain. There was originally a sharp break in topography according to site mapping done in the mid-1950s such that there was a steeply sloping bank approximately 15 feet high, and then the ground surface sloped more gently toward the creek losing another 15 feet in elevation over a distance of approximately 150 feet. As shown on Figure 2-5, fill in the western and southern portion of the landfill area was placed in a swamp and fill in the northern and eastern portion of the landfill was placed on land between the steep bank of the flood plain and the edge of the swamp.

The stratigraphy beneath this portion of the site is relatively complex compared to other portions of the site. A cross-section through the six monitoring wells installed to assess this unit is presented as Figure 3-2. As shown on this figure, shale bedrock was encountered in two monitoring wells and is overlain by numerous stratigraphic units ranging in grain size from the varved silt and clay unit (which is present in the two northernmost wells), to sandy units.

Groundwater elevations are shown on the cross-section (Figure 3-1) and on a groundwater elevation contour map presented as Figure 4-6. The groundwater elevation contour map shows that groundwater flows from east to west beneath the landfill. This direction of groundwater flow can be demonstrated in the three northernmost monitoring wells (MW-223S through MW-225S) and monitoring wells MW-103S, MW-106S, and MW-205S to the south of the filled area. Groundwater elevation contours are shown schematically beneath the central and southern portions of the landfill.

4.4 Building 031 Former Lagoon Area

The stratigraphic units encountered in the B031 Former Lagoon Area are as would be expected, based on previous investigations at this facility. The shallow sand (and fill) unit extends from the surface to a depth of approximately 19 feet. The unit encountered beneath the shallow sand (and fill) unit is the lacustrine varved silt and clay unit.

The elevation of the top of the varved silt and clay unit was used to update the sitewide varved silt and clay structure contour map (Figure 4-1). This surface, which represents the base of the shallow sand unit, slopes gently in a westwardly direction beneath the Former Lagoon Area.

Groundwater elevation contours in the B031 area are shown on Figure 4-7. This contour map indicates that the direction of groundwater flow is generally northwestward, which agrees with previous site groundwater flow interpretations (Figure 2-2). Figure 4-7 also shows that the groundwater elevation in MW-236S is greater than the potentiometric surface in the deeper part of this aquifer as measured in MW-232M. This expected result indicates a slight downward flow component within the shallow sand (and fill) aquifer.

5 CHEMICAL OCCURRENCE

Results of the soil gas survey, soil sample jar headspace measurements, laboratory soil analyses, and groundwater analyses are presented in this section.

5.1 Building 035 Former Dry Well Area

As discussed in previous sections, the first assessment activity in this area was a soil gas survey. Results of this survey are summarized on Table 5-1 and shown on Figure 5-1. Complete data are presented in Appendix D. Table 5-1 indicates that four VOCs were detected in soil gas samples. These VOCs were all detected at relatively low concentrations, with the highest concentration detected equal to ten times the detection limit. Trichloroethene (TCE) was detected in four samples and the equipment blank, 1,1,1-trichloroethane (TCA) was detected in one sample, Freon®11 in one sample, and Freon®12 in one sample. As shown on Figure 5-1, there does not appear to be a pattern to the distribution of detected VOCs. The soil gas sample collected at the approximate location of the former dry well (location AA shown on Figure 5-1) did not detect any VOCs.

Table 5-1
B035 Former Dry Well Area Soil Gas Survey Detections
(µg/l)

Location	TCE	TCA	Freon®11	Freon®12
AA	--	--	--	--
AB	0.7J	--	--	--
AC	1.1	--	--	--
AD	--	--	--	--
AE	1.2	--	--	--
AF	--/--	--/0.5J	--	--/1
AG	--	--	--	--
AH	--	--	--	--
AI	0.6J	--	10	--
Equipment Blank at AF	0.8J	--	--	--
Field Blank	--	--	--	--
Trip Blank	--	--	--	--
Ambient Air at AE	--	--	--	--

-- <1 µg/l
--/-- Field replicated sample (split sample)
TCE Trichloroethylene
TCA 1,1,1-Trichloroethane
J Estimated value

Two shallow soil samples were collected from each of four borings (MW-232M, B-233, B-234, and B-235) at depths of two feet and 6.5 to eight feet. In addition to these eight relatively shallow soil samples, two deeper soil samples were collected in B-235. As noted previously in subsection 3.1, soil sample jar headspace readings were elevated in the approximate 24- to 30-foot depth range, with respect to other soil sample jar headspace readings in each respective boring. Therefore, two soil samples from this interval were selected for laboratory analysis.

As shown on Table 5-2, the only two VOCs detected in these soil samples were acetone and methylene chloride. (Complete soil sampling data are presented in Appendix E.) These VOCs were detected in the two shallow soil samples collected from B-233 at concentrations near the detection limit, and acetone was detected in the shallowest sample from B-235. None of these concentrations exceeds the New York State Soil Cleanup Levels as revised on January 24, 1994. No VOCs were detected in the 24- to 26-foot and 26- to 28-foot samples collected from B-235.

Table 5-2
B035 Dry Well Area Soil Sampling Detections
(µg/kg)

Location	Sample Depth	Acetone	Dichloromethane (Methylene Chloride)
GW-232M	2' 8'	ND ND/ND	ND ND/ND
B-233	2' 6.5'	2J 16	6J 20
B-234	2' 8'	ND ND	ND ND
B-235	2' 8' 24-26' 26-28'	4J ND ND ND	ND ND ND ND

ND Not Detected
ND/ND Indicates split sample results
J Estimated value

Groundwater samples were collected on November 4, November 26, and December 8, 1994 from wells MW-232S and MW-232M. Samples from the first round were analyzed for Appendix 33 VOCs by Method 8240. The only VOCs detected in the first round are constituents of either the Method 8010 or 8020 parameter lists, and so the two subsequent sampling rounds were analyzed by Method 8010 plus Freon®113 and 8020 plus acetone in MW-232M and Method 8010 plus Freon®113 in MW-232S.

Results of the three groundwater sampling rounds in well MW-232M are summarized on Table 5-3. Groundwater data are presented in Appendix F. This table indicates that trichloromethane (chloroform (TCM)), acetone, and TCE were detected in one of two duplicate samples in the first round collected from MW-232M. In the two subsequent sampling rounds, TCM and acetone were not detected. This table also indicates that TCE was detected at low concentrations in all three sampling rounds and that TCA was detected at low concentrations in two sampling rounds. All of the VOC detections in well MW-232M are below New York State Groundwater Quality Standards (NYSGQS).

As shown on Table 5-3, no VOCs were detected in the first and third sampling rounds collected from MW-232S. In the second sampling round, TCA and TCE were detected at concentrations of less than 1 µg/l, which is well below the NYSGQS.

Table 5-3
B035 Dry Well Area Groundwater Sampling Detections
(µg/l)

Well	Sample Date	TCM	TCE	TCA	Acetone
MW-232M	11/4/94 11/22/94 12/8/94	6J/ND ND ND	ND/1J 2.8 1.9	ND/ND 1 0.6J	10J/ND ND ND
MW-232S	11/4/94 11/22/94 12/8/94	ND ND ND	ND 0.3J ND	ND 0.6J ND	ND

J Estimated Value
ND Not Detected
TCM Trichloromethane (Chloroform)
TCE Trichloroethylene
TCA 1,1,1-Trichloroethane
ND/ND Indicates split sample results

5.2 Salt Barn Parking Lot Sand Fill Area

As shown on Figure 2-4, 45 soil samples were collected from sixteen test pits and measured for headspace concentrations. In TP-E and TP-F, concentrations ranged from background to 0.2 ppm above background. In TP-J, concentrations ranged from 0.2 to 1.3 ppm above background. No measurements above background were detected in the other 13 test pits.

As shown on Figure 5-2, 11 soil samples were collected for laboratory analysis from seven test pits. These seven test pits included the three test pits in which headspace concentrations were greater than background concentrations. In TP-E, no VOCs were detected in the 2- to 4-foot and 4- to 6-foot samples. No VOCs were detected in the soil sample collected from TP-F at a depth of 2- to 4-feet. Four soil samples were collected at TP-J at depths of 0-2, 2-4, 4-6, and 6-8 feet and the sample collected at 6-8 feet had an intralaboratory duplicate. Acetone was detected at the three deepest TP-J soil samples at concentrations ranging up to 210 μg/kg. Methyl ethyl ketone was also detected in the three deepest samples at concentrations ranging up to 58 μg/kg. Toluene and ethyl benzene were detected in the 4- to 6-foot sample at concentrations of 1J μg/kg and 3J μg/kg, respectively. No VOCs were detected in the soil samples collected from TP-H, TP-L, and TP-N, which are all located in the central and eastern portion of the filled area. Acetone was reported to be present in the 2- to 4-foot sample from TP-Q at a concentration of 12B μg/l, which is approximately equal to the detection limit. As the "B" qualifier indicates, acetone was also present in the method blank associated with this sample. With the exception of the acetone concentration at TP-J in the 2- to 4-foot sample, none of these soil concentrations exceed the New York State Soil Cleanup Levels.

The first round of groundwater samples was collected from wells in this unit on November 2, 1994. These samples were analyzed for Appendix 33 constituents (except dioxins). VOCs were not detected in any of these first round samples. The base neutral compound bis(2-ethylhexyl)phthalate (BEHP) was detected at a concentration of 2J μg/l in MW-242S and pyridine was detected at a concentration of 2J μg/l in MW-244S. The pesticide Endosulfan II was detected at a concentration of 0.05J μg/l in the sample collected from MW-241S. Organic compound groundwater detections are summarized in Table 5-4.

Parameters analyzed for in the second and third rounds were selected based on the first round sampling results. The second and third round samples were analyzed for Method 8010 plus Freon®113 VOCs based on facility historical conditions. Because of the presence of pyridine in the first round sample from MW-244S, subsequent samples from this monitoring well were analyzed for base neutral compounds and pesticides. The presence of Endosulfan II in the first round sample from MW-241S prompted the analysis for pesticides in subsequent samples from this well.

Table 5-4 shows that BEHP was detected at low concentrations in the second and third sampling rounds at MW-244S and that pyridine and Endosulfan II were not detected in any second or third round samples. This table also shows that TCA and TCE were detected at concentrations of less than 1 μg/l in the November 21 samples collected at MW-240S and MW-244S and the December 7 sample collected at MW-241S. None of the organic compound detections in groundwater samples collected from beneath this unit are greater than their respective NYSGQS. Therefore, the groundwater data shows that the acetone concentration in soil at TP-J, which was above the soil cleanup level, is not indicative of an impact to groundwater.

Table 5-4
Parking Lot Sand Disposal Area Organic Compound Detections
(μg/l)

Well	Sample Date	BEHP	Pyridine	Endosulfan II	TCA	TCE
MW-240S	11/2/94 11/21/94 12/7/94	ND	ND	ND	ND ND ND	ND 0.45J ND
MW-241S	11/2/94 11/21/94 12/7/94	ND	ND	0.05J ND ND	ND ND 0.6J	ND ND ND
MW-242S	11/2/94 11/21/94 12/7/94	2J	ND	ND	ND ND ND	ND ND ND
MW-244S	11/2/94 11/21/94 12/7/94	ND 4J 1J	2J ND/ND ND/ND	ND ND ND	ND 0.6J/ND ND/ND	ND ND/ND ND/ND

BEHP bis(2-ethylhexyl)phthalate; TCA 1,1,1-Trichloroethane; TCE Trichloroethylene
ND Not Detected; 2J/ND Indicates split sample result; J Estimated Value

Table 5-5 shows the inorganic compound detections in the groundwater samples collected from monitoring wells installed in this unit. As shown on this table, barium, beryllium, chromium, copper, lead, thallium, vanadium, and zinc were detected in one or more well samples in the first round of sampling. The concentrations of each of these compounds detected in the first round of sampling were all below the respective NYSGQS or, where there is no NYSGQS, the USEPA Maximum Contaminant Level (MCL).

Table 5-5
Parking Lot Sand Disposal Area Inorganic Detections
(µg/l)

Well	Date	Barium	Beryllium	Chromium	Copper	Lead	Thallium	Vanadium	Zinc
MW-240S	11/2/94 11/21/94 12/7/94	36B	1.7B ND ND	ND ND ND	11B	3.4 3.0WJ 2.3BWJ	ND ND ND	ND ND ND	29*J
MW-241S	11/2/94 11/21/94 12/7/94	88B	ND ND ND	15 ND ND	13B	8.4WJ 6.0WJ 2.2BWJ	0.67B 0.75BWJ 0.99BWJ	ND 16B ND	14*BJ
MW-242S	11/2/94 11/21/94 12/7/94	21B	ND ND ND	ND ND 12NJ	8.3B	2.6B 2.7B ND	ND 0.82BWJ 0.88BWJ	ND ND ND	40*J
MW-244S	11/2/94 11/21/94 12/7/94	16B	ND ND ND	ND ND ND	12B	3.7WJ ND 2.0BWJ	0.81B ND ND	ND ND ND	43*J
NYSGQS		1000		50	200	25			300
USEPA MCL			4				2		

NYSGQS	New York State Class GA Groundwater Standard	N	Spiked sample recovery not within control limits
USEPA MCL	USEPA Maximum Contaminant Level	*	Duplicate analysis not within control limits
B	The reported inorganic value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL).	ND	Not detected
J	Estimated Value	W	Post digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

The presence of beryllium, chromium, lead, thallium, and vanadium in samples collected from this unit and the B036 C&D Landfill unit prompted the analysis for these five parameters, as well as arsenic (which was detected in the B036 C&D Landfill unit, but not in any groundwater samples from this unit) in the second and third sampling rounds.

As shown on Table 5-5, concentrations of metals detected in the second and third rounds are also below the NYSGQS or USEPA MCL. Vanadium was detected at a concentration of 16B µg/l in the December 7 sample collected from MW-241S. There is no NYSGQS or USEPA MCL for this parameter.

5.3 Building 036 Construction and Debris Landfill Area

The first round of groundwater samples was collected from wells in this unit on November 2 and 3, 1994. These samples were analyzed for Appendix 33 constituents (except dioxins). As shown on

Table 5-6, two VOCs were detected in the first round of sampling. 1,1-Dichloroethane (1,1-DCA) was detected in the sample collected from MW-121S at a concentration of 3J µg/l. Acetone was detected at a concentration of 13 µg/l in the sample collected from MW-223S. One base neutral compound was detected in first round groundwater samples at a low concentration. Pyridine was detected in the sample collected from MW-221S at a concentration of 1J µg/l. No pesticides were detected in any of the groundwater samples collected at the downgradient edge of this unit.

Table 5-6
B036 C&D Landfill Area Groundwater Organic Compound Detections
(µg/l)

Well	Sample Date	Pyridine	1,1-Dichloroethane	Acetone	Tetrachloroethylene
MW-220S	11/2/94 11/22/94 12/7/94	ND	ND ND ND	ND	ND 0.4J ND
MW-221S	11/3/94 11/22/94 12/7/94	1J ND ND	3J 2.5 2.5	ND	ND ND ND
MW-222S	11/3/94 11/22/94 12/7/94	ND	ND ND ND	ND	ND ND ND
MW-223S	11/3/94 11/22/94 12/7/94	ND	ND ND/ND ND/ND	13 ND/ND ND/ND	ND ND/ND ND/ND
MW-224S	11/3/94 11/22/94 12/7/94	ND	ND ND ND	ND	ND ND ND
MW-225S	11/3/94 11/22/94 12/7/94	ND	ND ND ND	ND	ND ND ND

ND Not Detected
J Estimated Concentration
ND/ND Indicates split sample result

Parameters analyzed for in the second and third rounds were selected based on the first round of sampling results and on general facility historical conditions. Method 8010 VOCs were analyzed for in all six monitoring wells. Method 8020 VOCs were analyzed for in MW-223S, in which acetone was detected in the first sampling round. Base neutral compounds and pesticides were analyzed for in MW-221S. Table 5-6 indicates that the initial detection of 1,1-DCA in well MW-221S was confirmed in the two subsequent samples at concentrations of 2.5 µg/l in each sample. Four subsequent analyses in two sampling rounds at MW-223S did not confirm the presence of acetone in samples collected from this monitoring well in the first sampling round. Tetrachloroethylene (PCE) was detected at a concentration of 0.4J µg/l in the second round sample collected from MW-220S. Subsequent base neutral compound analyses from second and third round samples collected at MW-221S did not confirm the presence of pyridine at a low concentration in the first round of sampling. All of the organic compounds detected in samples collected from these monitoring wells were present at concentrations which are below the NYSGQS for each parameter.

Table 5-7 shows inorganic compound detections in the groundwater samples collected from the wells installed downgradient from this unit. As shown on this table, arsenic, barium, beryllium, copper, nickel, thallium, vanadium, and zinc were detected in samples collected in the first round. Concentrations of each of these first round detections were all below the respective NYSGQS or, where there is no NYSGQS, the USEPA MCL. As discussed in subsection 5.2, the presence of arsenic, beryllium, chromium, lead, thallium, and vanadium in samples collected from this unit prompted the analysis for these six parameters in subsequent sampling rounds. As shown on Table 5-7, concentrations of these six inorganic parameters in the subsequent sampling rounds are below the NYSGQS or USEPA MCL. Vanadium was detected at concentrations of up to 25B µg/l in groundwater samples collected from this unit. There is no NYSGQS or USEPA MCL for this parameter.

Table 5-7
B036 C&D Landfill Area Groundwater Inorganic Sample Results
(µg/l)

Well	Sample Date	Arsenic	Barium	Beryllium	Copper	Lead	Nickel	Thallium	Vanadium	Zinc
MW-220S	11/2/94 1/6/95	ND 4.7 BW	107B	1.8B ND	9.0B	ND ND	ND	ND ND	ND ND	29*
MW-221S	11/3/94 11/22/94 12/7/94	ND/3.3BWJ ND 2.5B	131B/128B	ND ND ND	ND	ND ND 1.8BWJ	ND	1.0B*N/ND ND 0.97B	ND ND 18B	60/18B
MW-222S	11/3/94 11/22/94 12/7/94	ND ND 4.8B	123B	ND ND ND	ND	ND ND 2.2B	ND	0.79W*N ND ND	ND 14B ND	28
MW-223S	11/3/94 11/22/94 12/7/97	ND ND ND	324	ND ND ND	12B	ND 3.2WJ 1.8B	ND	ND 0.68BWJ 1.1BWJ	23B 21B 21B	40
MW-224S	11/3/94 11/22/94 12/7/94	8.1BWJ 8.5 ND	33B	ND ND ND	8.9B	ND ND 2.1B	27B	ND ND ND	16B 18B ND	26
MW-225S	11/3/94 11/22/94 12/7/94	ND ND ND	83B	ND ND ND	7.7B	ND ND 2.1B	ND	ND ND ND	ND 25B ND	19B
NYSGQS		25	1000		200	25				300
MCL				4			100	2		

NYSGQS — New York State Class GA Groundwater Standard
USEPA MCL — USEPA Maximum Contaminant Level
B — The reported inorganic value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL).
131B/128B — Indicates split sample results
J — Estimated value
N — Spiked sample recovery not within control limits
* — Duplicate analysis not within control limits
ND — Not detected
W — Post digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

5.4 Building 031 Former Lagoon Area

The first round of groundwater samples collected from the two monitoring wells installed adjacent to this unit were analyzed for Appendix 33 VOCs. No VOCs were detected in the shallower of these two wells (MW-236S), and acetone and 1,2-DCE were detected in MW-236M at concentrations of 11/8J and 2J µg/l, respectively. Based on these results, the second and third round of VOC samples collected from these wells were analyzed for Method 8010 parameters plus Freon®113 in the case of MW-232S, and Method 8010 and 8020 parameters plus Freon®113 and acetone in the case of MW-232M. As shown on Table 5-8, 1,2-DCE was detected in the second and third round samples collected from MW-236M and in the second round sample from MW-236S. These detections range in concentration up to 1 µg/l. TCE, which was not detected in the first round in either of the two wells, was detected in the second and third round samples collected from MW-236M at a concentrations of 0.5J µg/l each time. TCA was detected in the second round sample from MW-236M at 0.5J µg/l. Acetone was not detected in the second or third round samples collected from MW-236M. All of the detections of VOCs in MW-236M and MW-236S are well below the NYSGQS for these parameters.

Table 5-8
B031 Former Lagoon Area Groundwater Sampling Detections
(µg/l)

Well	Sample Date	1,2-Dichloroethylene	Acetone	Trichloroethylene	1,1,1-Trichloroethane
MW-236M	11/4/94 11/22/94 12/8/94	2J/1J 1 0.8J	11/8J ND ND	ND/ND 0.5J 0.5J	ND/ND 0.5J ND
MW-236S	11/4/94 11/22/94 12/8/94	ND 0.8J ND	ND	ND ND ND	ND ND ND

J Estimated Value
ND Not Detected
ND/ND Indicates split sample result

6 CONCLUSIONS AND RECOMMENDATIONS

The following subsections present conclusions and recommendations for each of the four SWMUs.

6.1 Building 035 Former Dry Well SWMU

The B035 Former Dry Well Area lies within the area affected by the B005 VOC groundwater plume. It is, therefore, expected that groundwater beneath this unit may contain TCA-series and TCE-series VOCs independent of the presence and use of the former dry well. TCA and TCE were each present in slightly less than half of the samples from the Former Dry Well Area wells at concentrations near the detection limit (and below the NYSGQS). Therefore, there has not been a significant impact to site groundwater resulting from the former dry well with respect to TCA- and TCE-series parameters.

Chloroform and acetone were each detected in one of the two intralaboratory duplicate samples collected from MW-232M in the first round. These compounds were detected at concentrations less than the detection limit. Chloroform and acetone were not detected in the second and third sampling rounds. They were also not detected in groundwater samples collected from MW-232S. Since the detections of chloroform and acetone were not confirmed and were detected at concentrations less than the NYSGQS, there has not been a significant impact to groundwater in the former Dry Well Area with respect to these two VOCs.

The soil gas survey results and results of laboratory analysis of soil samples did not indicate the presence of a hot spot or areas of elevated soil VOC concentrations. The low level erratic detections of VOCs in soil gas samples and soil samples support the conclusion that there has been no significant impact to groundwater quality resulting from releases from this unit. Since there has been no significant impact to groundwater or soil, no additional assessment or investigation activities are recommended.

6.2 Salt Barn Parking Lot Sand Fill Area SWMU

TCA, TCE, pyridine, BEHP, and Endosulfan II were detected erratically and at concentrations near the detection limit in groundwater samples collected from the wells at the Salt Barn Parking Lot Sand Disposal Area. All of the detections of these organic compounds are well below the NYSGQS. Several metals were detected in groundwater samples collected from monitoring wells in this unit, but all of these detections were at concentrations less than the NYSGQS, or in the case where an NYSGQS has not been established, the USEPA MCL where an MCL has been established. Although acetone and methyl ethyl ketone were detected in soil samples collected above the water table (as well as other VOCs at concentrations near the detection limit), these compounds were not detected in groundwater samples collected from beneath this unit. Therefore, there has not been a significant impact to site groundwater resulting from releases from this unit and no additional assessment or investigation activities are recommended.

6.3 Building 036 Construction and Debris Landfill SWMU

Only one VOC was detected consistently in groundwater samples (in one well) at the B036 C&D Landfill Unit. 1,1-DCA was detected in all three sampling rounds at concentrations ranging from 2.5 µg/l to 3J µg/l in MW-221S. This VOC was not detected in any other groundwater samples collected from wells at this SWMU. The detection of this VOC in groundwater samples at concentrations which are consistently below the NYSGQS indicates that groundwater quality immediately downgradient from this unit has not been significantly impacted with respect to this compound.

Unconfirmed low concentration detections of acetone, PCE, and pyridine, as well as low concentration detections of BEHP, do not indicate a significant impact to groundwater at the downgradient edge of this unit because of the erratic nature of the detections and their concentrations being well below the NYSGQS. Although chlordane, fluoranthene, pyrene, and benzo(a) anthracene were detected in soil samples collected by D&M, as discussed in subsection 2.2.4.3, these compounds were not detected in groundwater samples.

Several metals were detected in D&M soil samples (subsection 2.2.4.3) and in groundwater samples collected from the monitoring wells at the downgradient edge of this unit. All of these groundwater detections were at concentrations less than the NYSGQS or USEPA MCL (where established) and so there has not been a significant impact to groundwater downgradient from this unit based on these inorganic analyses results.

Based on the above discussion, there has been no significant impact to site groundwater or soil from this SWMU. Therefore, no additional assessment or investigation activities are recommended.

6.4 Building 031 Former Lagoon Area

Groundwater sampling from the two monitoring wells installed at the downgradient edge of the B031 Former Lagoon SWMU indicates that 1,2-DCE is present at concentrations of up to 2J µg/l. Acetone, TCA, and TCE were detected at concentrations near or below their detection limits (and below the NYSGQS). The concentrations of all of these VOCs are well below the NYSGQS and so there has not been a significant impact to groundwater quality at the downgradient edge of this unit. No additional assessment or investigation activities are recommended.

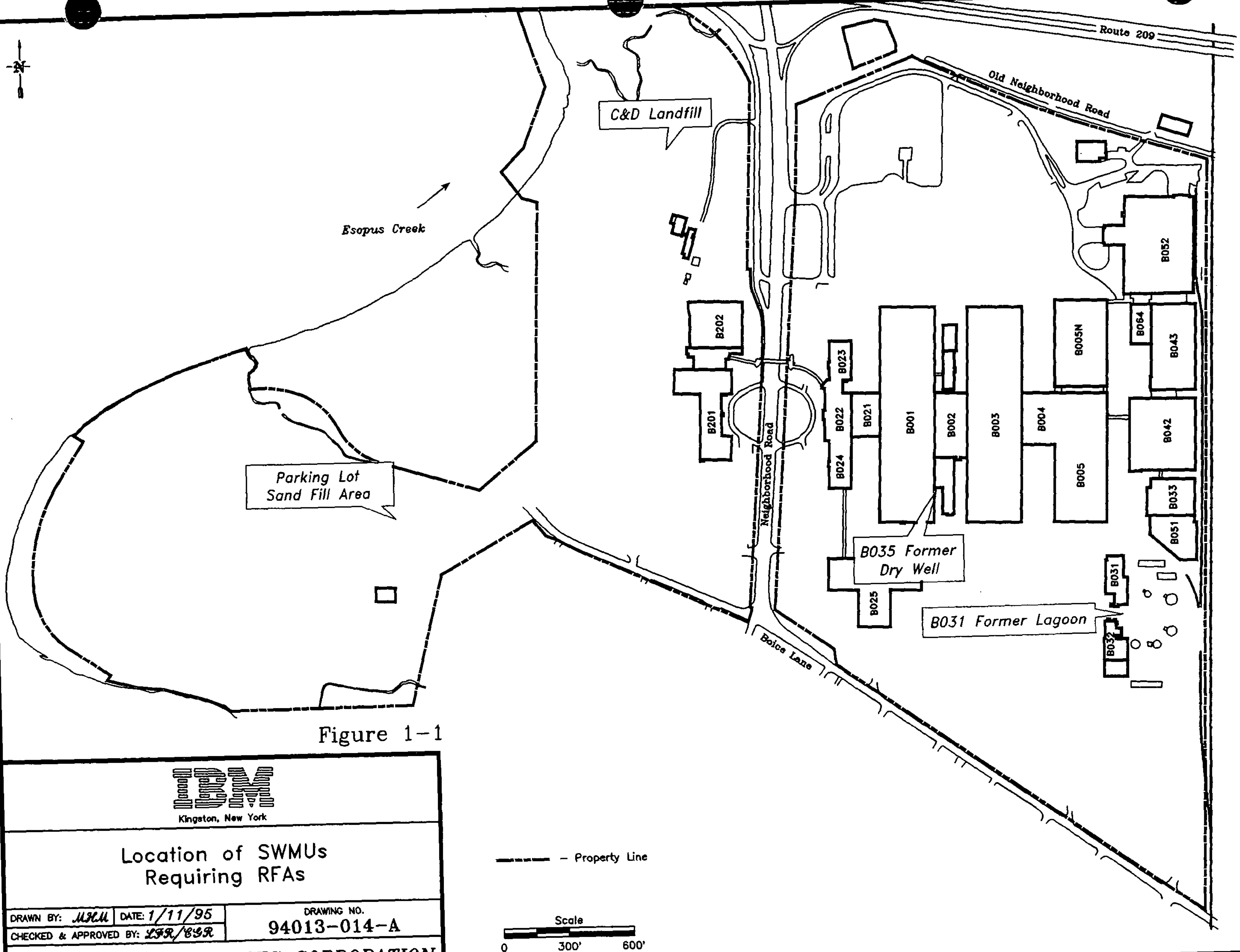

Figure 1–1

IBM
Kingston, New York

Location of SWMUs
Requiring RFAs

DRAWN BY: MHM DATE: 1/11/95
CHECKED & APPROVED BY: LFR/CGR
DRAWING NO. 94013–014–A

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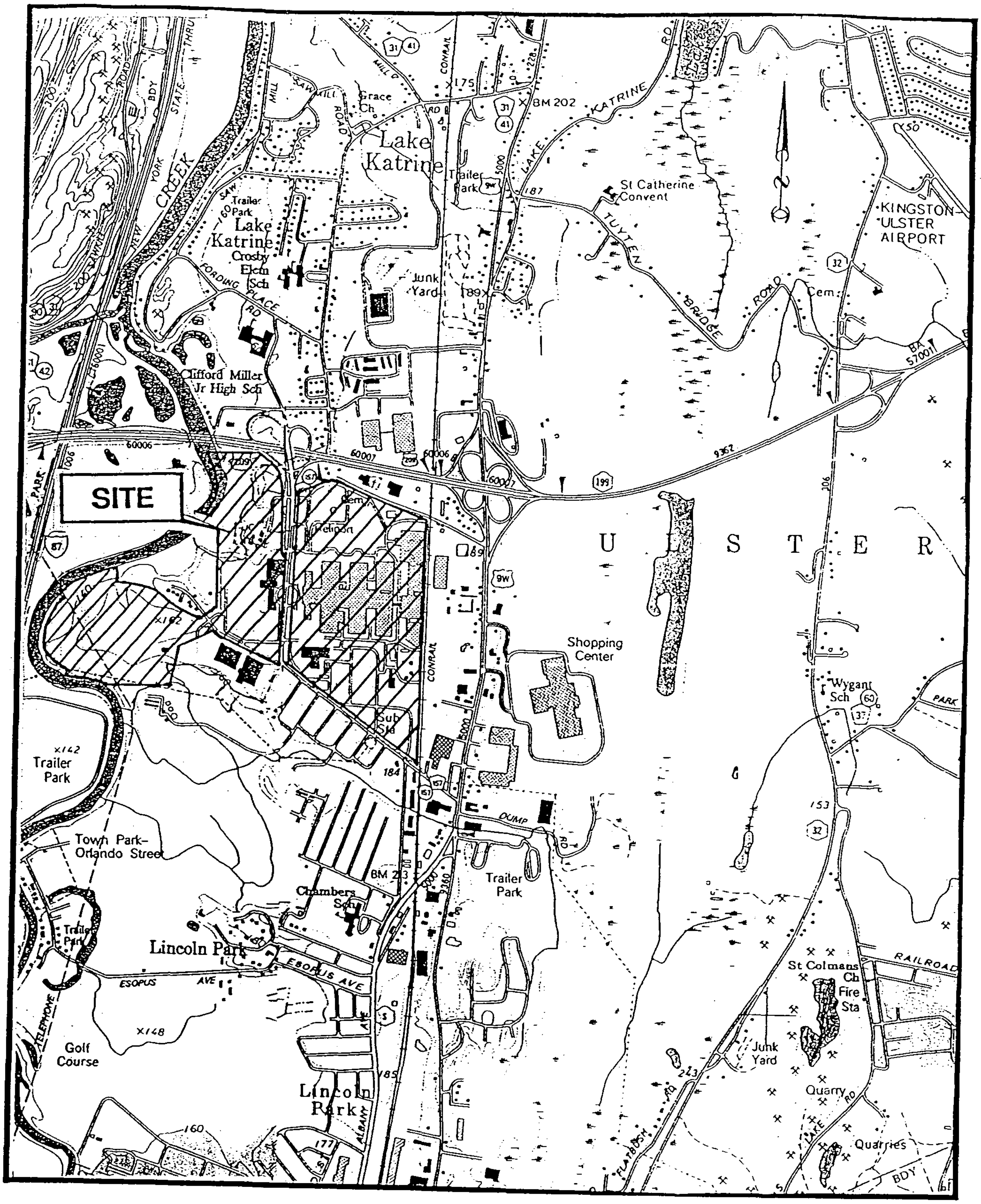
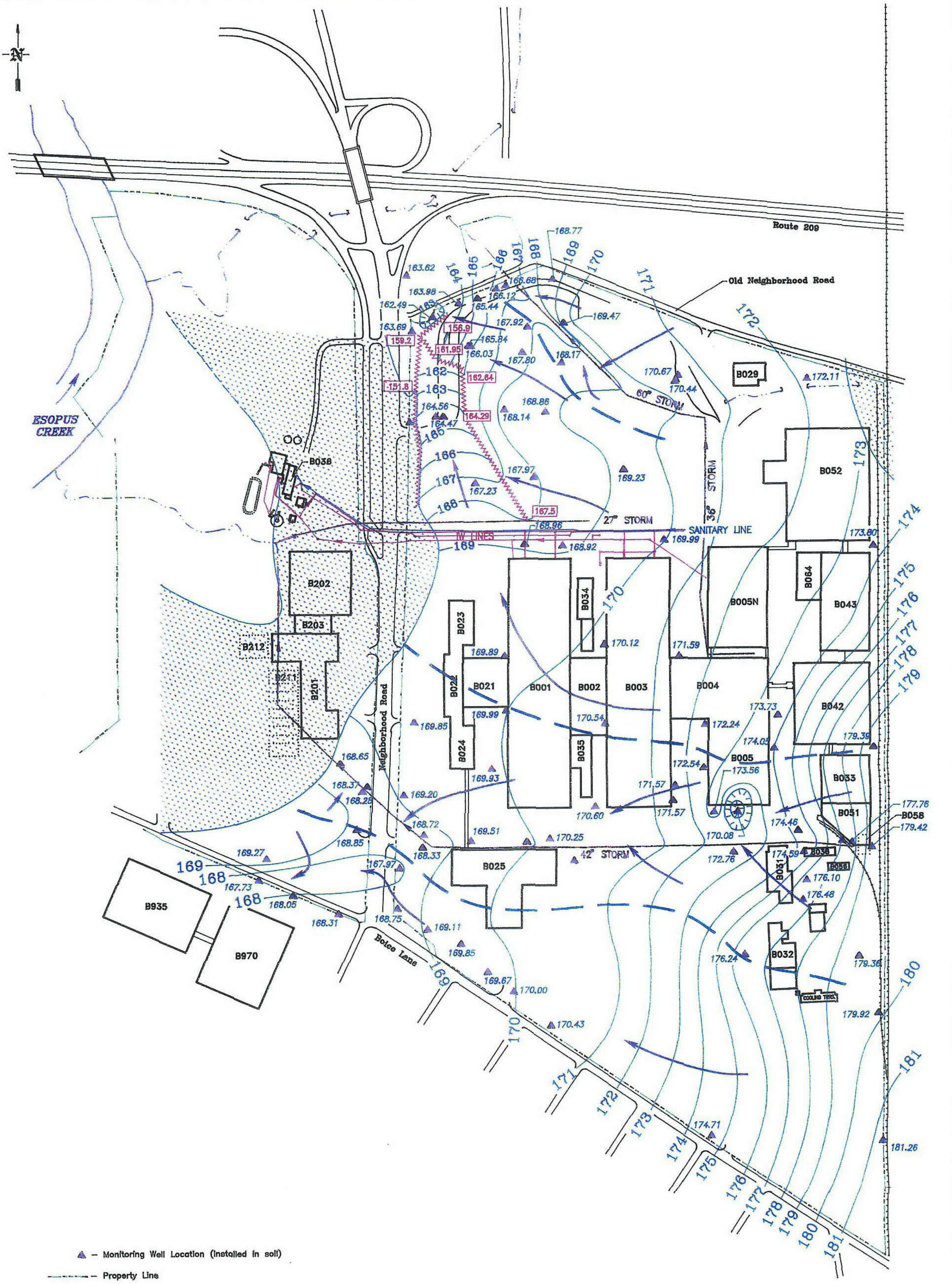


0 1000 2000

Scale 1 inch = 2,000 feet

Figure 2-1

Site Location Map
Portions of the Kingston West
and Kingston East 7.5 Minute Quadrangles



- ▲ – Monitoring Well Location (installed in soil)
- Property Line
- Railroad
- Former Building or Structure Location
- 170 – Groundwater Elevation Contour
- 168.31 – Groundwater Elevation
- Groundwater Divide
- Inferred Direction of Groundwater Flow
- Groundwater Collection System (GWCS)
- 162.64 – GWCS Invert Elevation
- Perennially Saturated Shallow Sand Absent

SCALE 0 200' 400'

Figure 2-2

IBM
Kingston, New York

Shallow Sand Water Table Contour Map
March 11 and March 15, 1994
(First Quarter 1994)

DRAWN BY: J/MM DATE: 9/7/94	DRAWING NO.
CHECKED & APPROVED BY: SMG/LGR	93002-007-H

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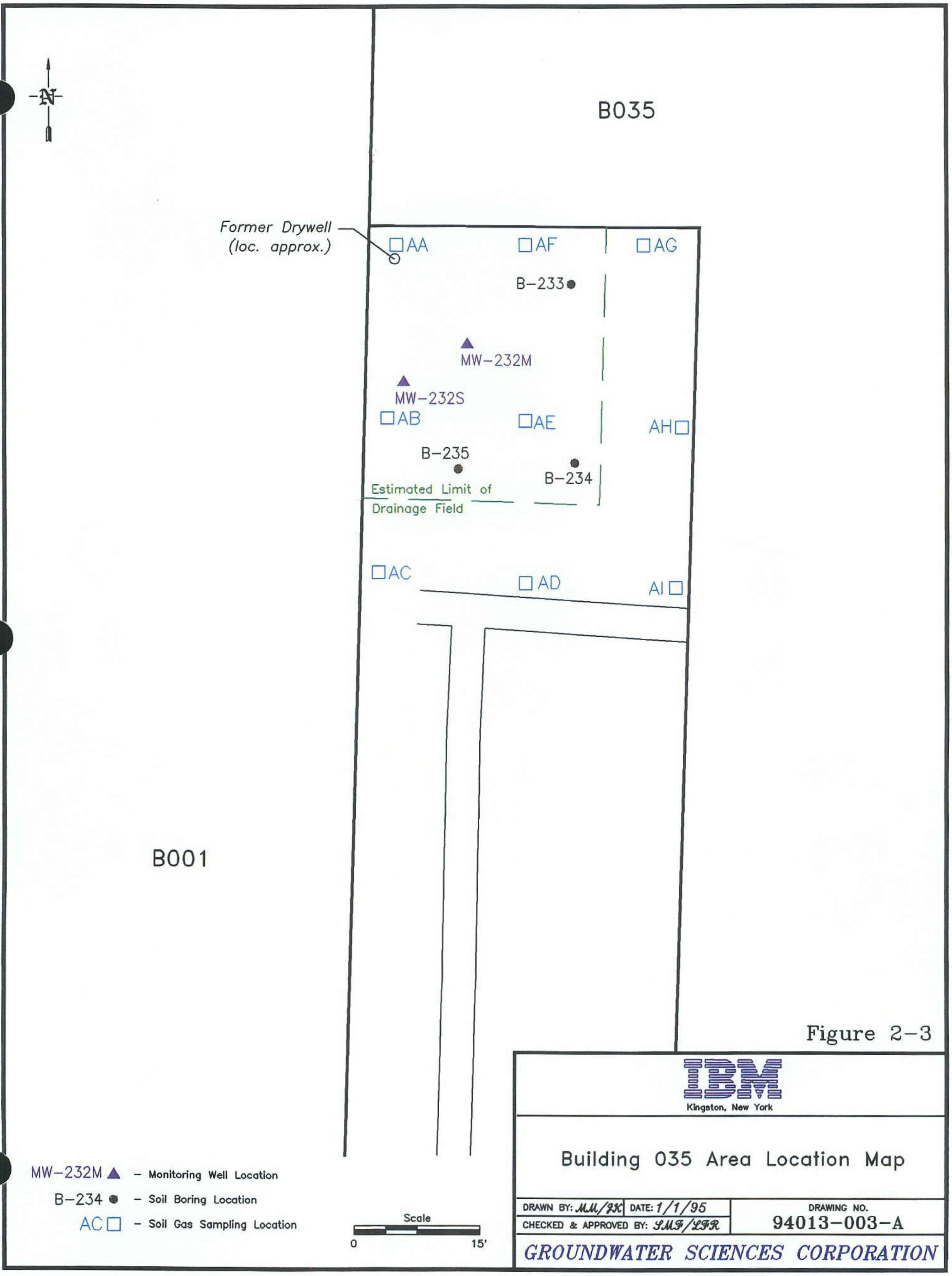

Figure 2-3

IBM
Kingston, New York

Building 035 Area Location Map

DRAWN BY: MM/JK	DATE: 1/1/95	DRAWING NO.
CHECKED & APPROVED BY: SMF/LFR		94013-003-A

GROUNDWATER SCIENCES CORPORATION

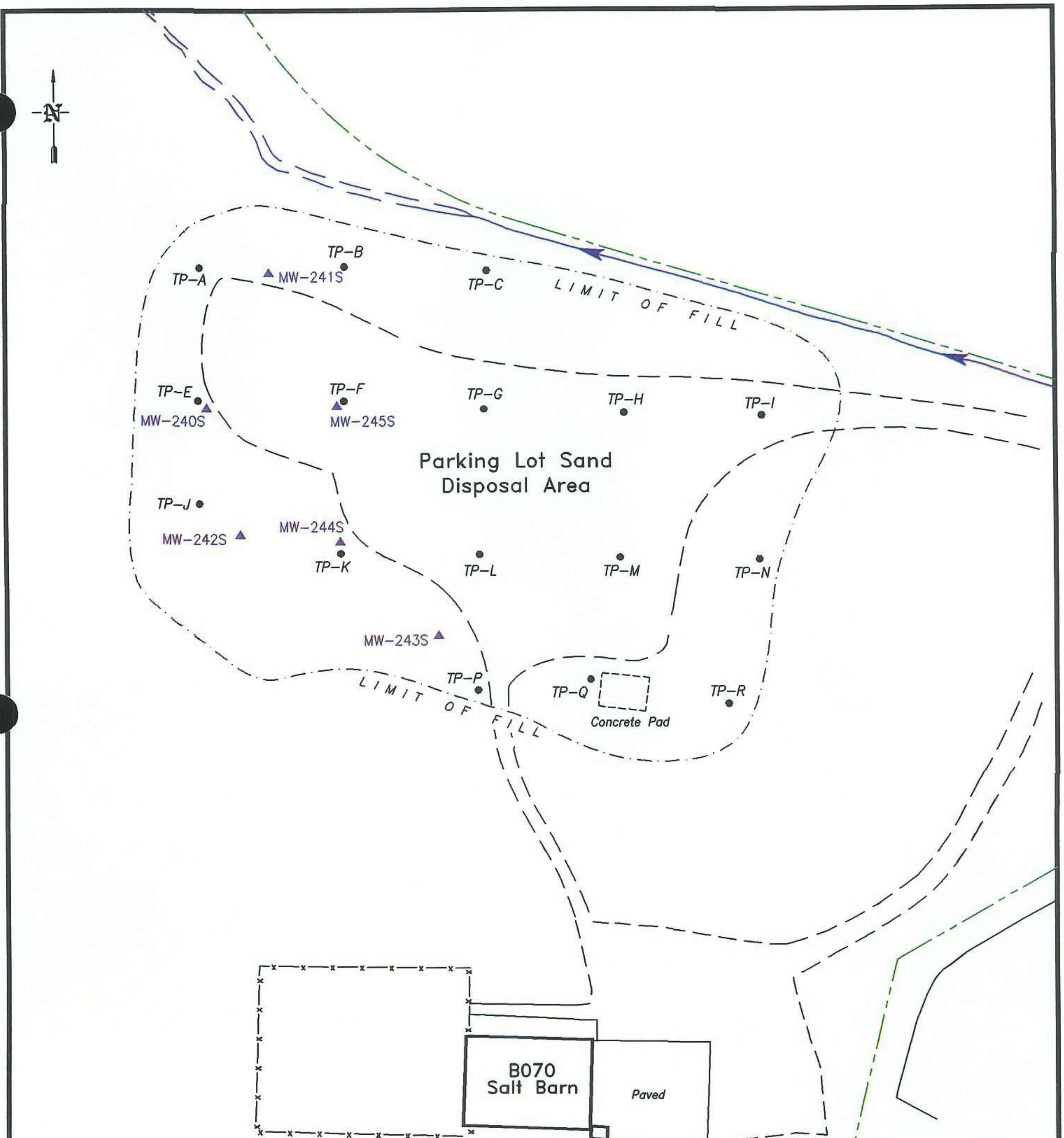

Figure 2-4

IBM
Kingston, New York

Parking Lot Sand Disposal Area
Location Map

DRAWN BY: M/J/M DATE: 1/3/95
CHECKED & APPROVED BY: SMF
DRAWING NO.
94013-001-A

GROUNDWATER SCIENCES CORPORATION

MW-244S ▲ – Monitoring Well Location
TP-K ● – Test Pit Location
– – – – Property Line
—x—x— – Fence

Scale
0 50' 100'

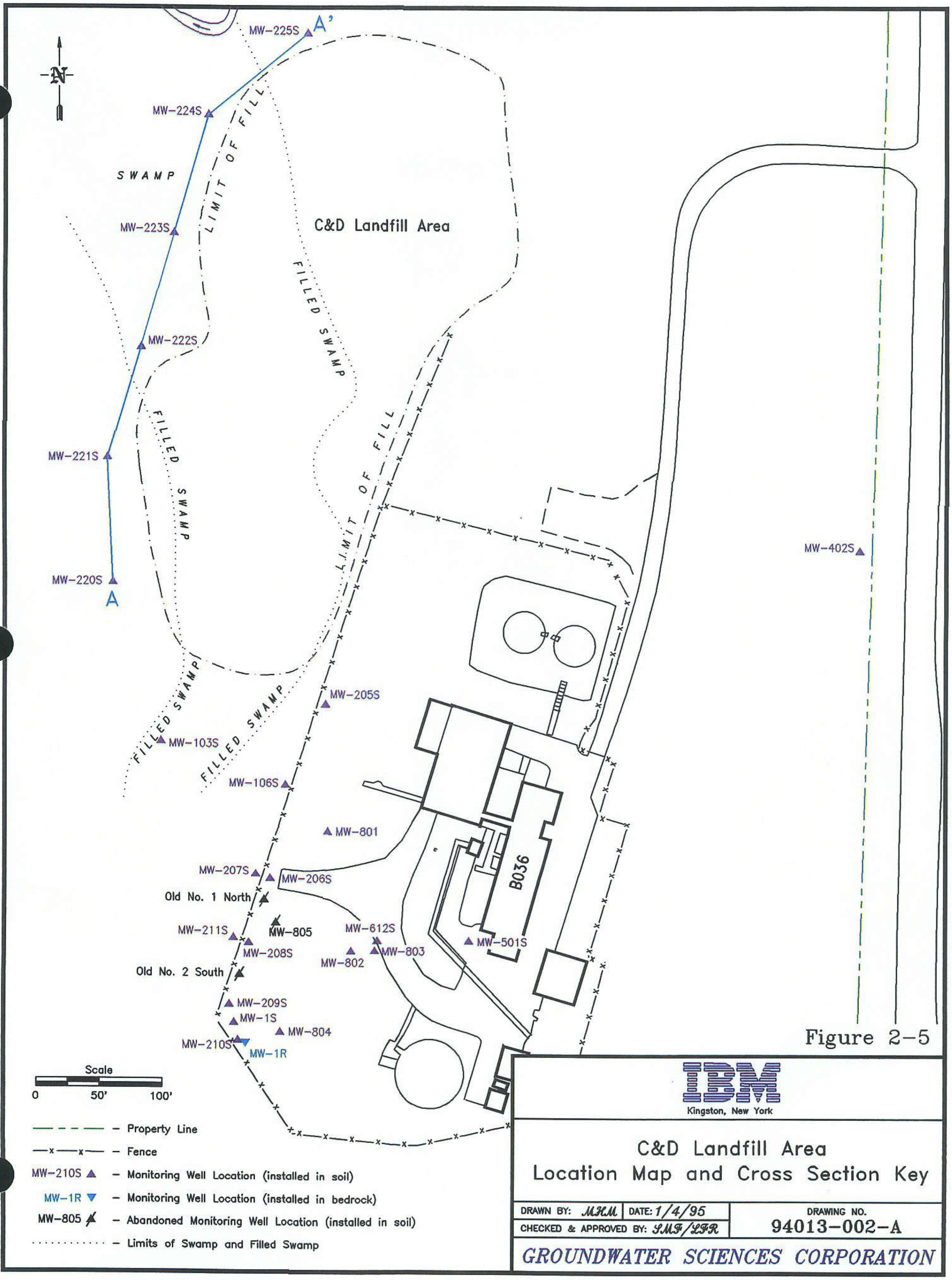

Figure 2-5

IBM
Kingston, New York

C&D Landfill Area
Location Map and Cross Section Key

DRAWN BY: MKM DATE: 1/4/95	DRAWING NO.
CHECKED & APPROVED BY: SMF/LFR	94013-002-A

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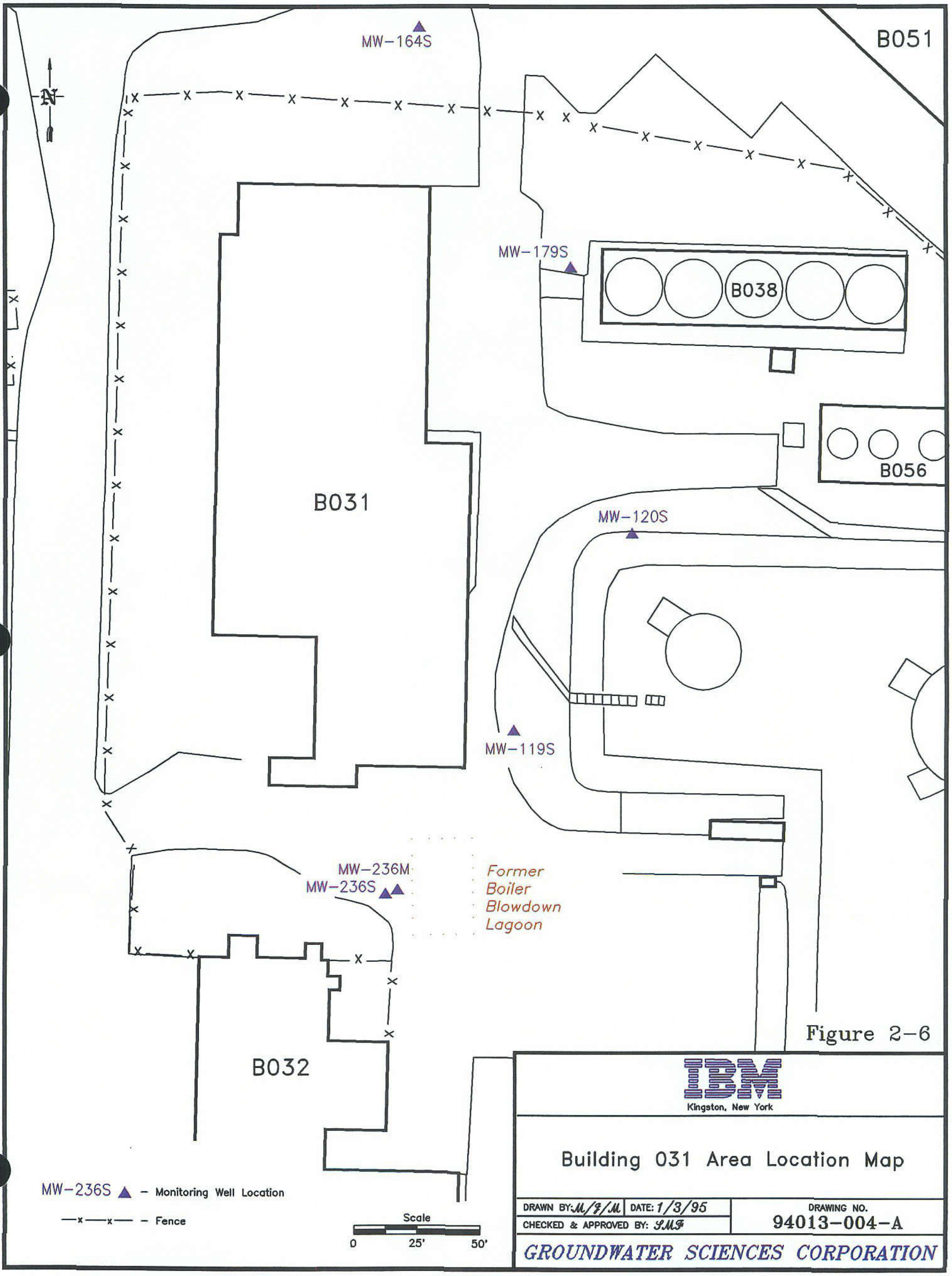

Figure 2-6

IBM
Kingston, New York

Building 031 Area Location Map

DRAWN BY: M/J/M DATE: 1/3/95
CHECKED & APPROVED BY: SMJ
DRAWING NO. 94013-004-A

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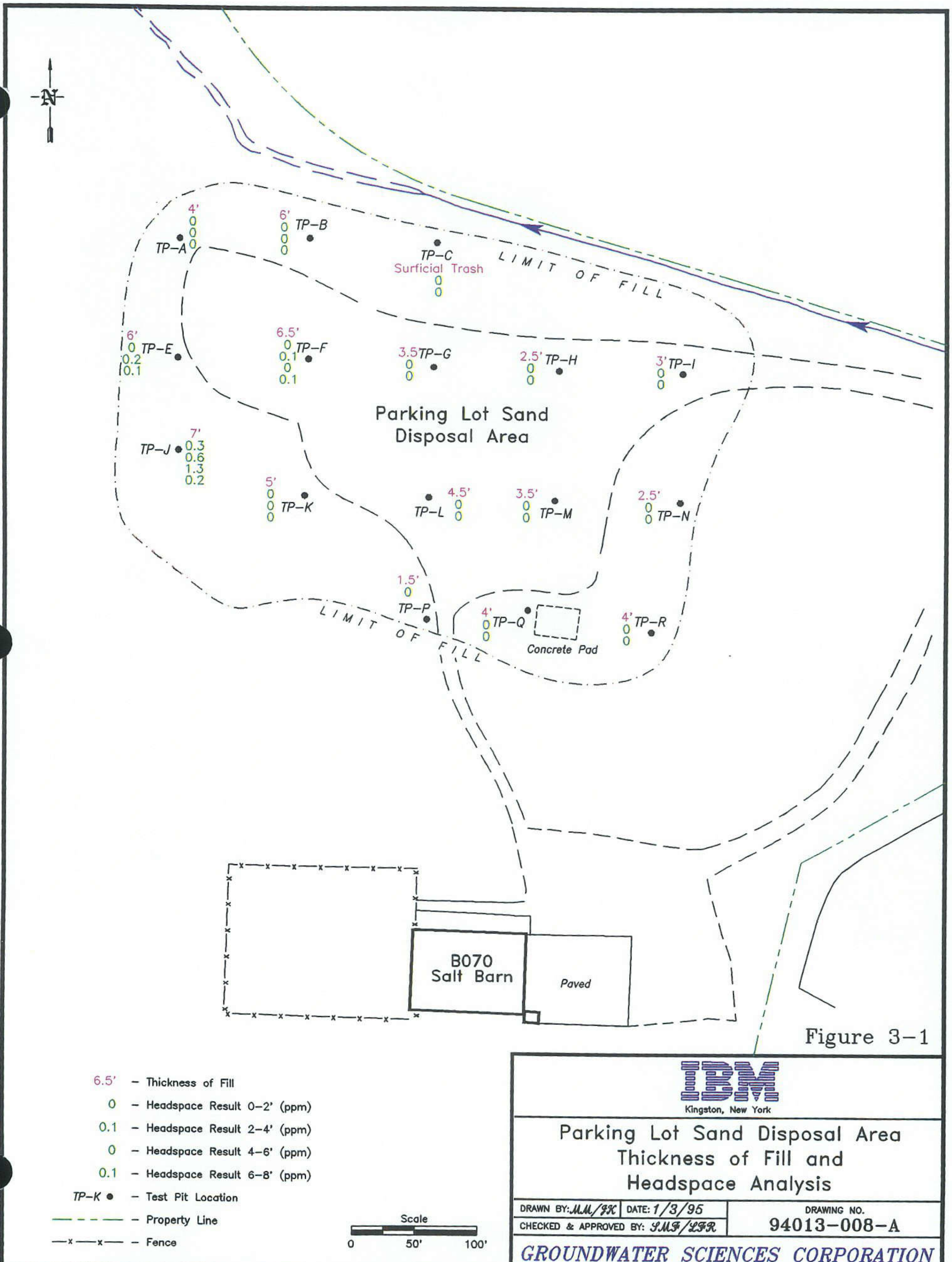

Figure 3-1

IBM
Kingston, New York

Parking Lot Sand Disposal Area
Thickness of Fill and
Headspace Analysis

DRAWN BY: MM/JK DATE: 1/3/95	DRAWING NO.
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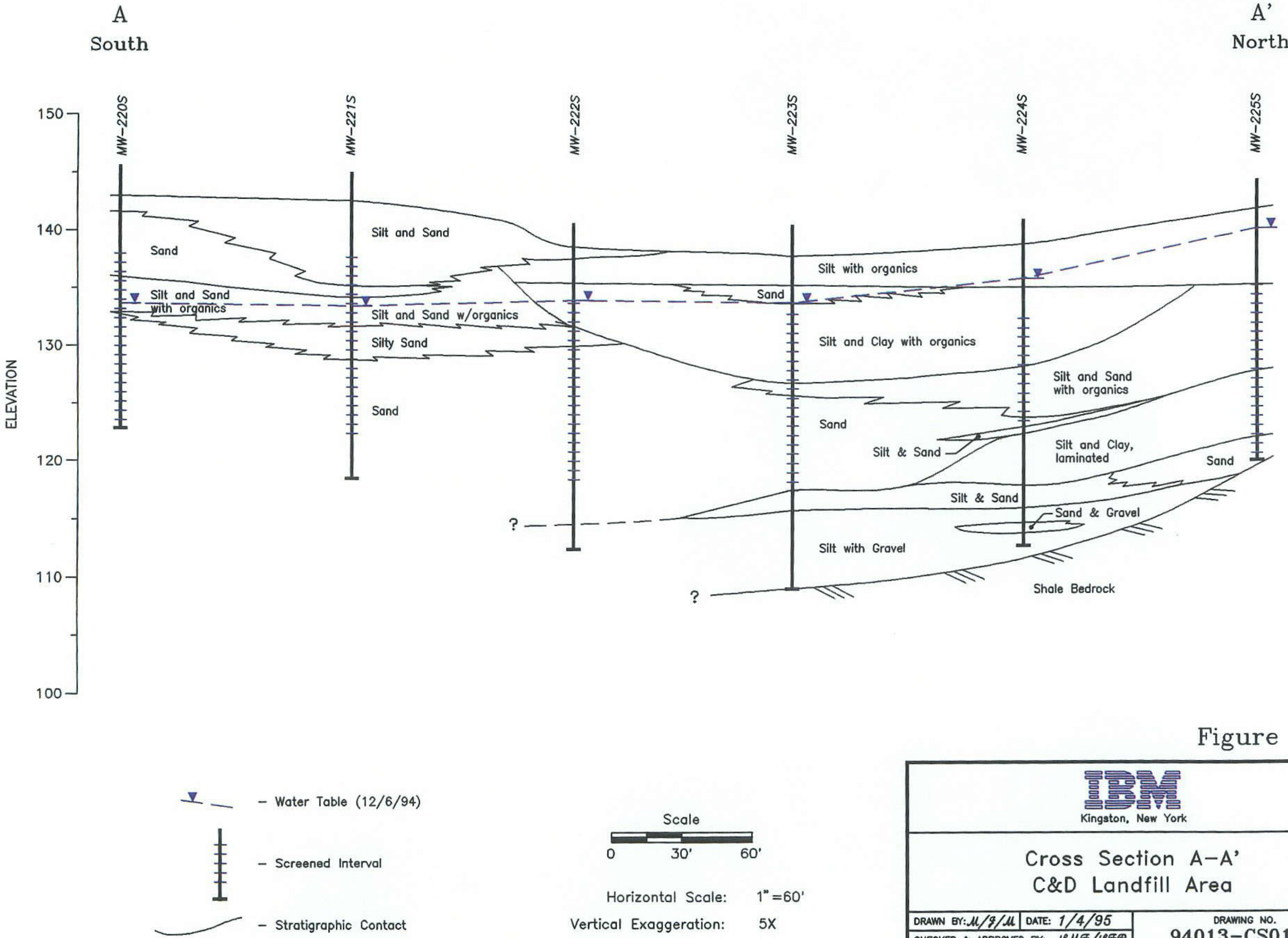


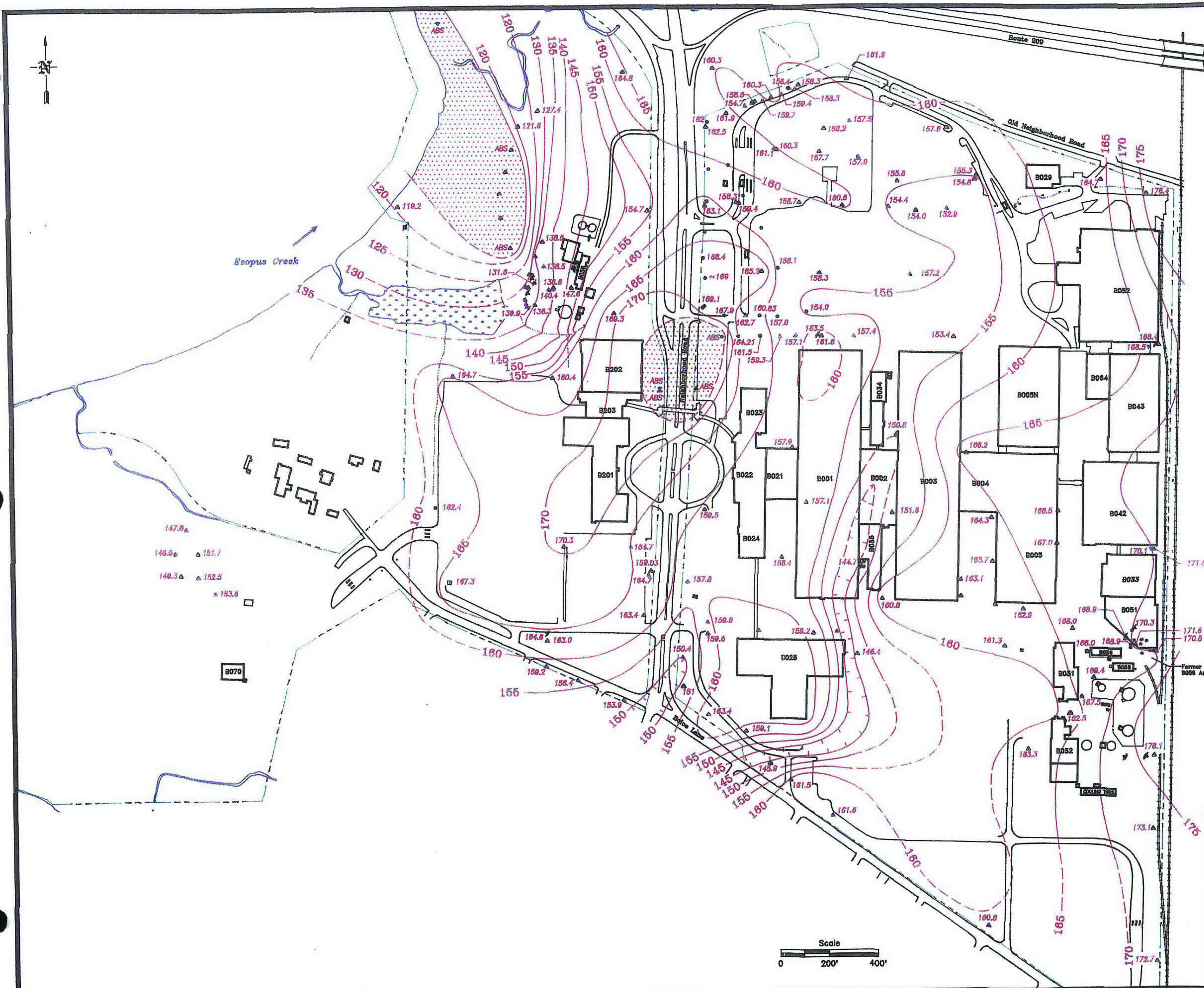
Figure 3-2

IBM
Kingston, New York

Cross Section A-A'
C&D Landfill Area

DRAWN BY: M/J/M DATE: 1/4/95	DRAWING NO.
CHECKED & APPROVED BY: SMF/LFR	94013-CS01-A

GROUNDWATER SCIENCES CORPORATION



- Monitoring Well Location (installed in soil)
- Temporary Monitoring Point
- Monitoring Well Location (installed in bedrock)
- Production Well Location (Layne)
- Property Line
- 170 — Top of Silt and Clay Unit Structure Contour (feet)
- 153.9 — Top of Silt and Clay Unit Structure (feet)
- Varved Silt and Clay Unit Absent

Note: Contours in area of Building 025 based on Dames & Moore map, which was based on Building 025 foundation borings.

Figure 4-1

IBM
Kingston, New York

Top of Varved Silt & Clay Unit Structure Contour Map

DRAWN BY: MHM	DATE: 1/6/95	DRAWING NO. 93002-009-D
CHECKED & APPROVED BY: LJR/SMF		

GROUNDWATER SCIENCES CORPORATION

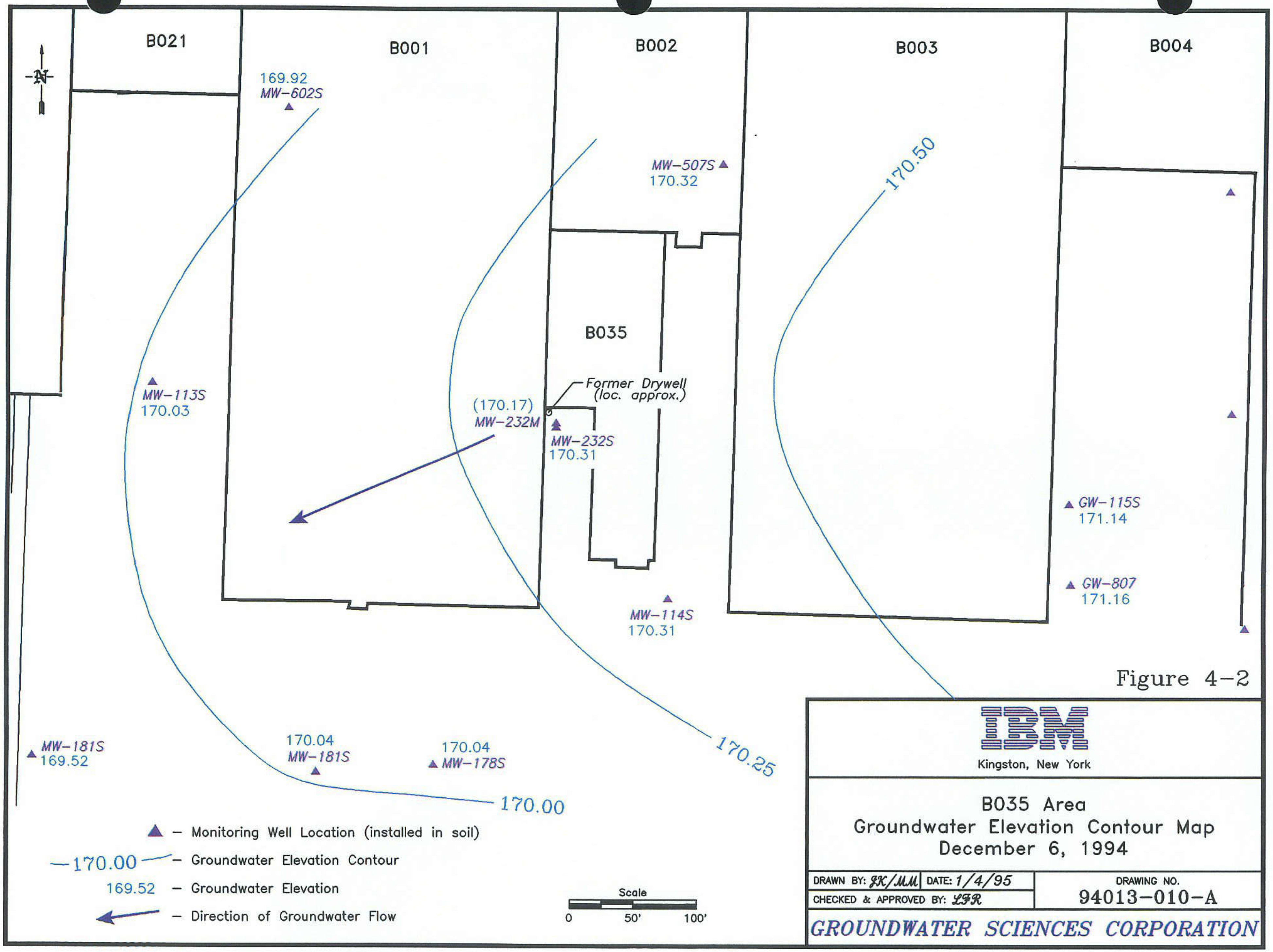

B021
B001
B002
B003
B004
B035
N
169.92
MW-602S
MW-507S
170.32
170.50
MW-113S
170.03
(170.17)
MW-232M
Former Drywell
(loc. approx.)
MW-232S
170.31
GW-115S
171.14
GW-807
171.16
MW-114S
170.31
MW-181S
169.52
170.04
MW-181S
170.04
MW-178S
170.25
170.00
– Monitoring Well Location (installed in soil)
170.00 – Groundwater Elevation Contour
169.52 – Groundwater Elevation
– Direction of Groundwater Flow
Scale
0
50'
100'
IBM
Kingston, New York
B035 Area
Groundwater Elevation Contour Map
December 6, 1994
DRAWN BY: JK/MM
DATE: 1/4/95
CHECKED & APPROVED BY: LFR
DRAWING NO.
94013-010-A
GROUNDWATER SCIENCES CORPORATION

Figure 4-2

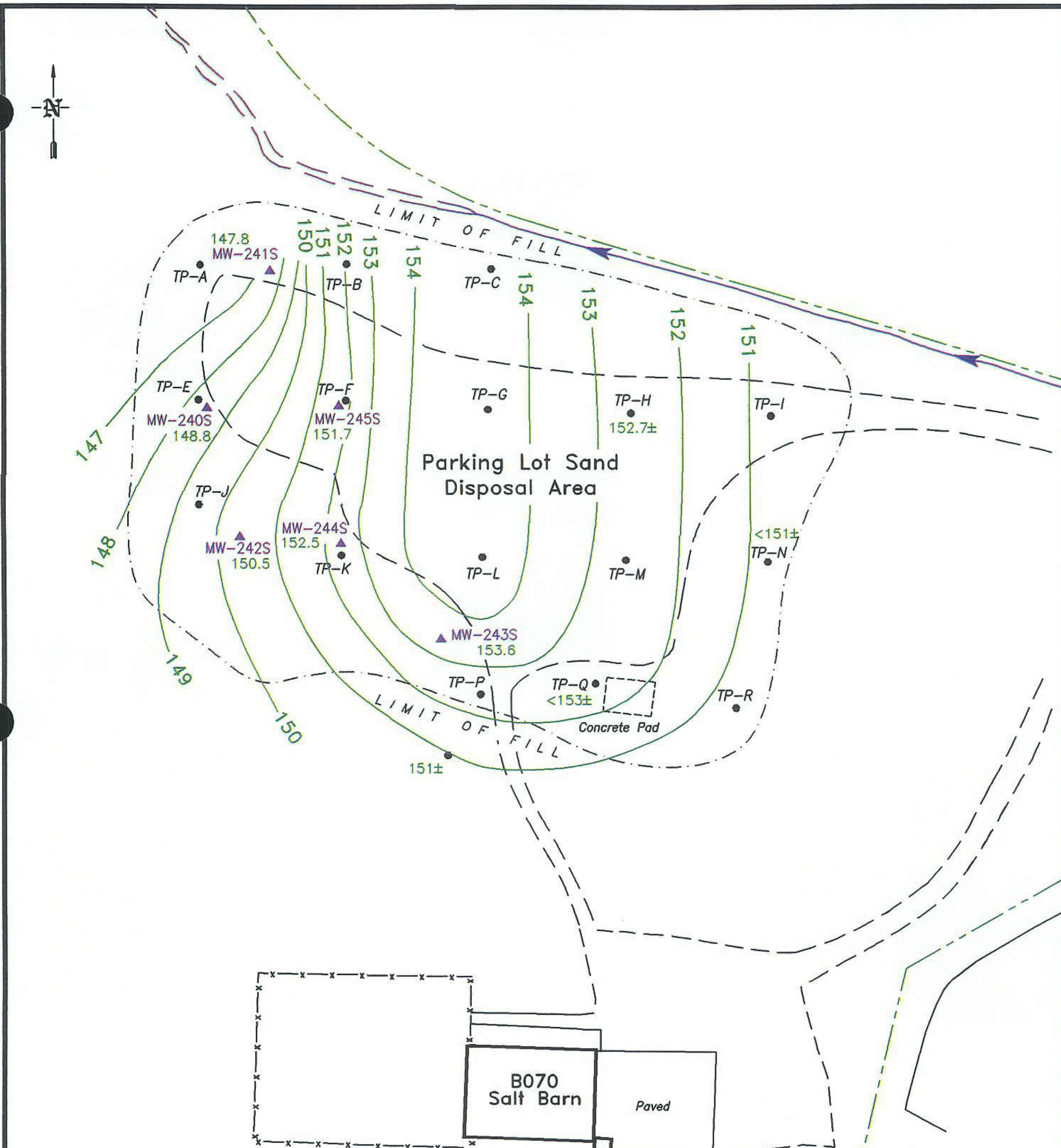


Figure 4-3

150.5 – Top of silt and clay unit

150 – Top of silt and clay unit contour

MW-244S ▲ – Monitoring Well Location

TP-K ● – Test Pit Location

– – – – – Property Line

—x—x— – Fence

Scale: 0 50' 100'

IBM
Kingston, New York

Parking Lot Sand Disposal Area
Top of Silt and Clay Unit Structure
Contour Map

DRAWN BY: M/J/M	DATE: 1/3/95	DRAWING NO.
CHECKED & APPROVED BY: SMF/LFR		94013-011-A

GROUNDWATER SCIENCES CORPORATION

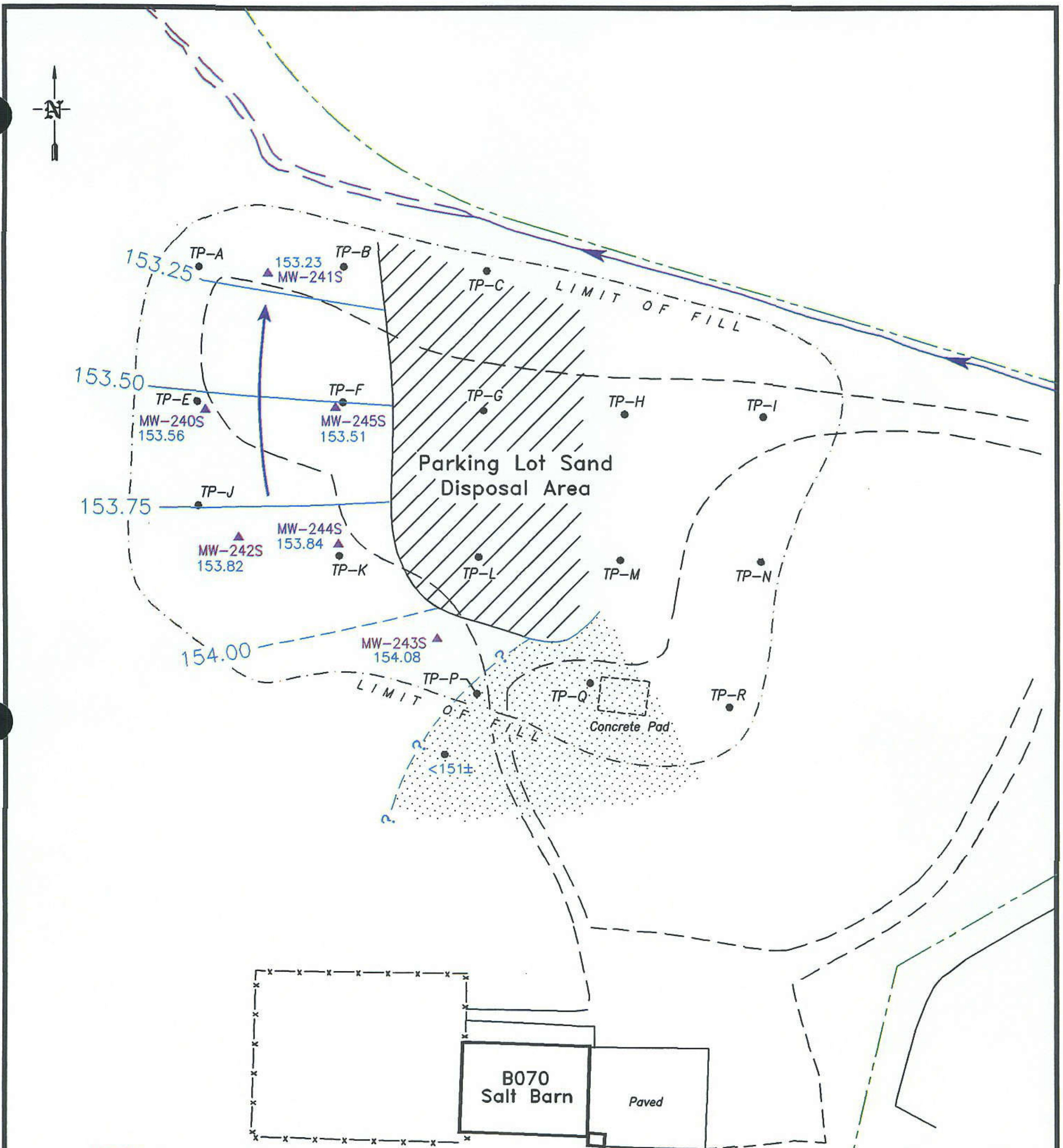


Figure 4-4

153.82 – Groundwater Elevation

154.00 – Groundwater Elevation Contour

– Direction of Groundwater Flow

– Varved Silt and Clay Above Water Table

– Perenially Saturated Sand Appears to be Absent

MW-244S ▲ – Monitoring Well Location

TP-K ● – Test Pit Location

– Property Line

—x—x— – Fence

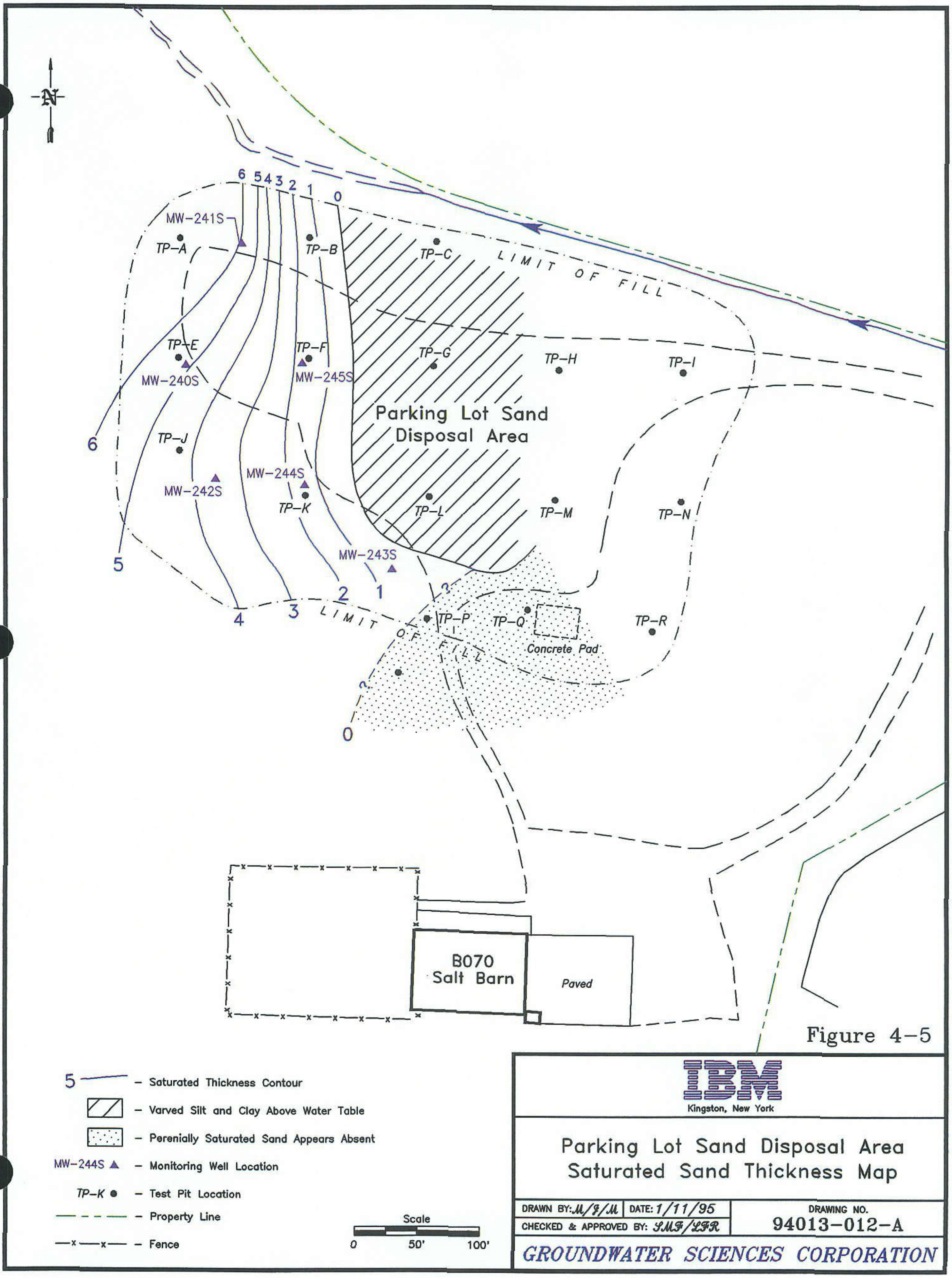
Scale: 0 50' 100'

IBM
Kingston, New York

Parking Lot Sand Disposal Area
Groundwater Elevation Contour Map
December 6, 1994

DRAWN BY: M/J/M DATE: 1/11/95	DRAWING NO.
CHECKED & APPROVED BY: SMF/LFR	94013-013-A

GROUNDWATER SCIENCES CORPORATION



N
6
5
4
3
2
1
0
MW-241S
TP-A
TP-B
TP-C
LIMIT OF FILL
TP-E
TP-F
TP-G
TP-H
TP-I
MW-240S
MW-245S
Parking Lot Sand Disposal Area
TP-J
MW-244S
MW-242S
TP-K
TP-L
TP-M
TP-N
MW-243S
?
TP-P
TP-Q
TP-R
Concrete Pad
LIMIT OF FILL
B070 Salt Barn
Paved
Figure 4-5
5 – Saturated Thickness Contour
– Varved Silt and Clay Above Water Table
– Perenially Saturated Sand Appears Absent
MW-244S – Monitoring Well Location
TP-K – Test Pit Location
– Property Line
– Fence
Scale
0 50' 100'
IBM
Kingston, New York
Parking Lot Sand Disposal Area
Saturated Sand Thickness Map
DRAWN BY: M/J/M
DATE: 1/11/95
CHECKED & APPROVED BY: SMF/LFR
DRAWING NO.
94013-012-A
GROUNDWATER SCIENCES CORPORATION

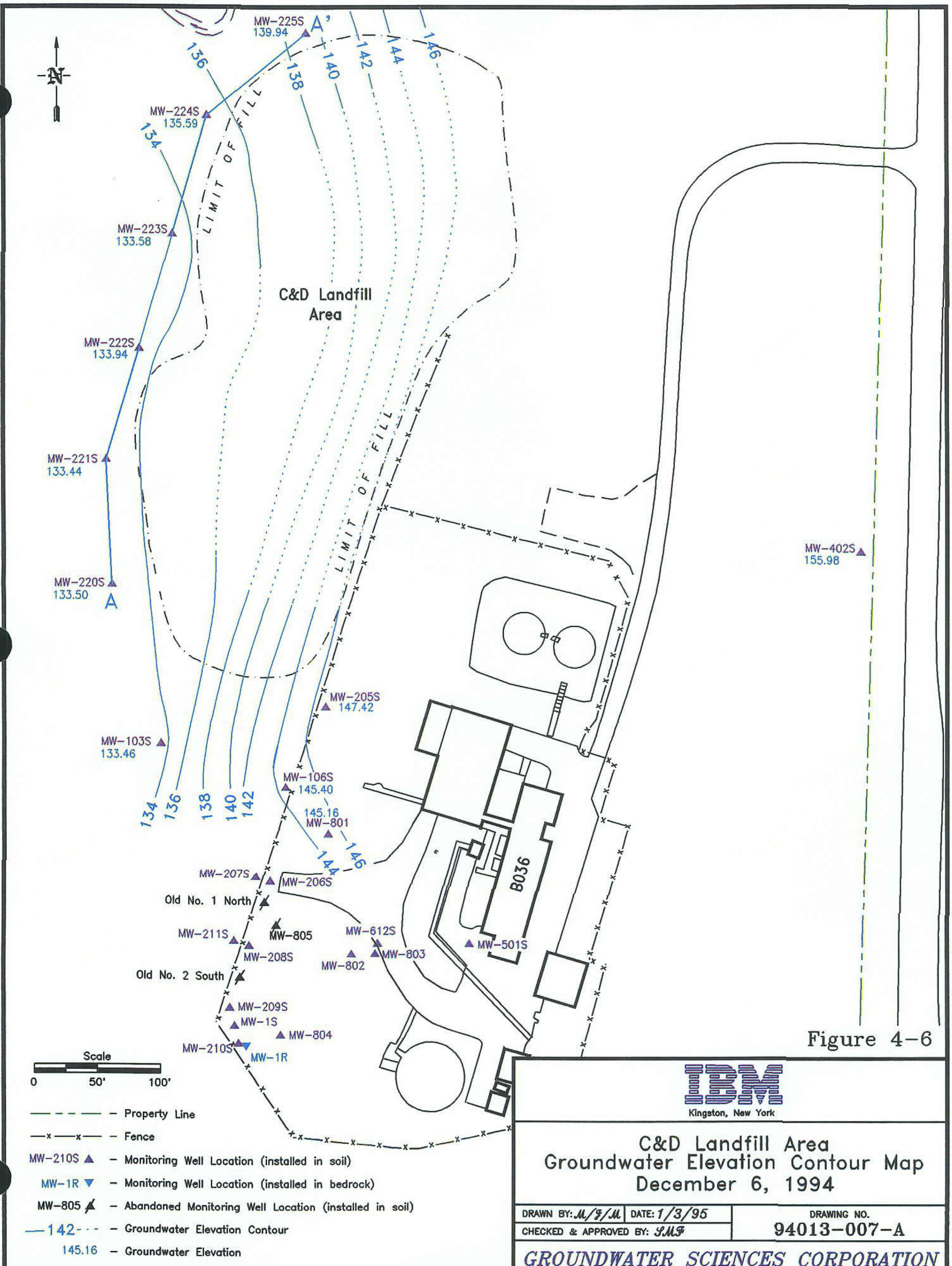


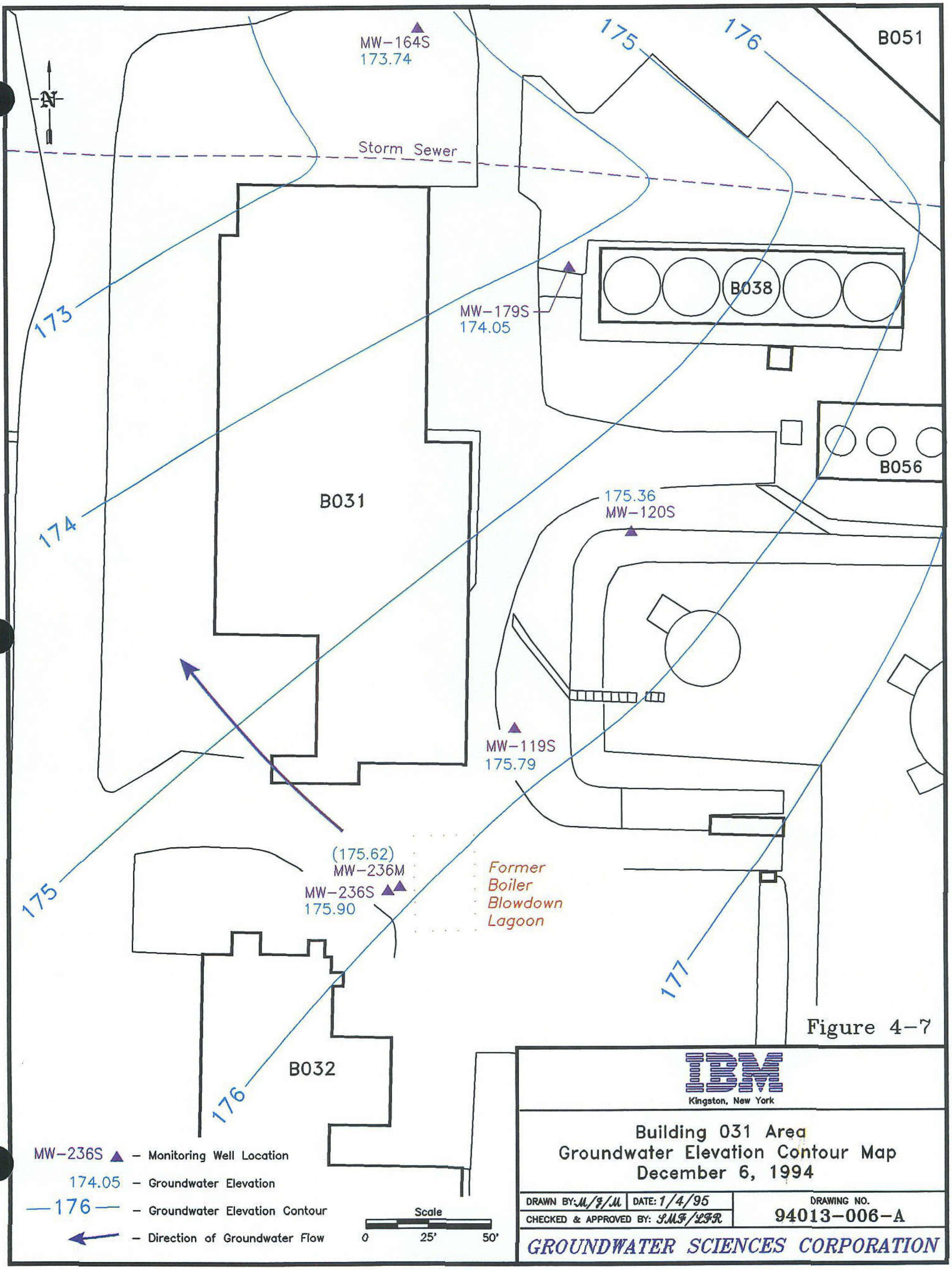
Figure 4-6

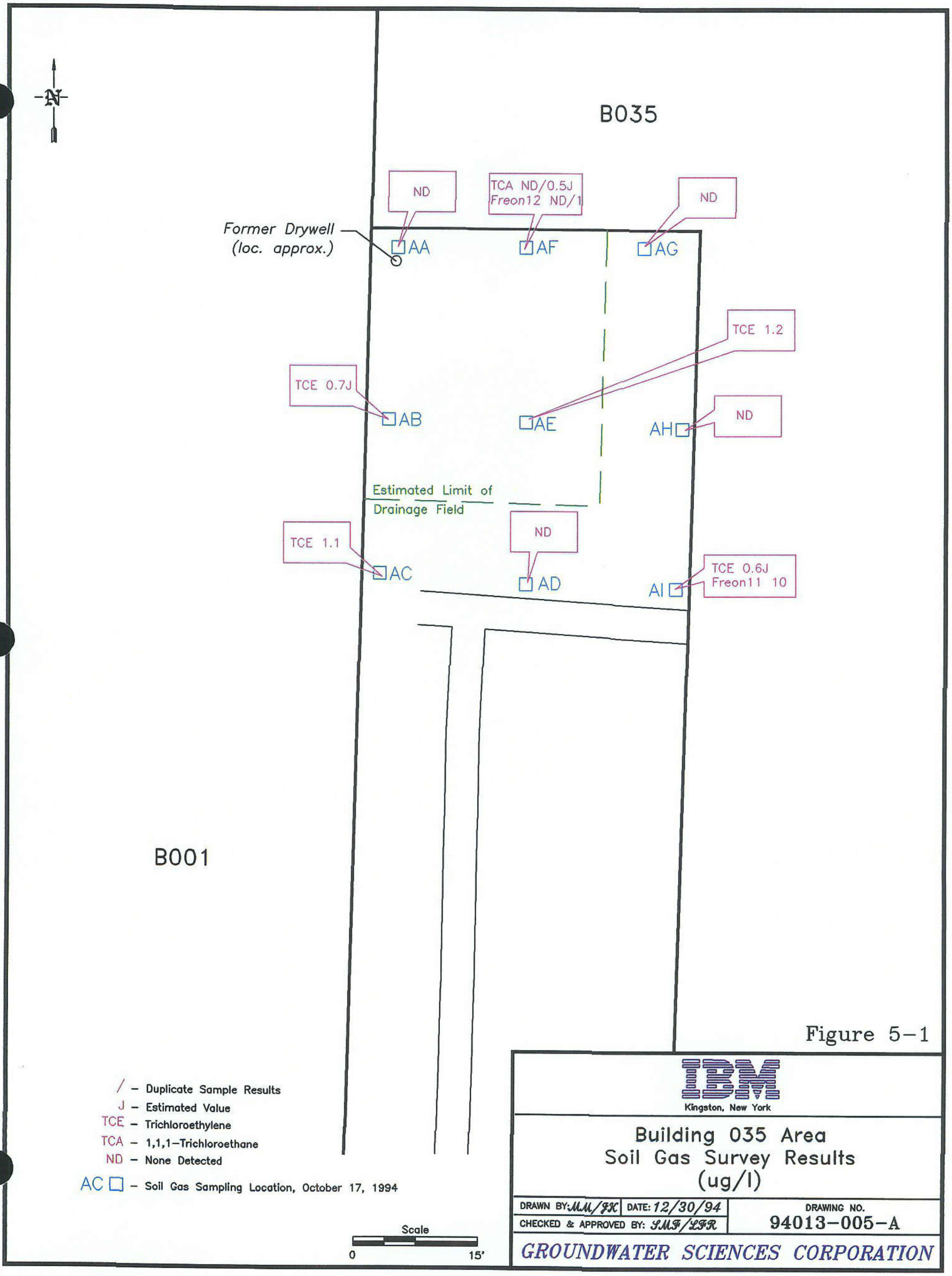
IBM
Kingston, New York

C&D Landfill Area
Groundwater Elevation Contour Map
December 6, 1994

DRAWN BY: M/J/M DATE: 1/3/95	DRAWING NO.
CHECKED & APPROVED BY: SMF	94013-007-A

GROUNDWATER SCIENCES CORPORATION


MW-164S
173.74
175
176
B051
N
Storm Sewer
173
174
175
176
177
MW-179S
174.05
B038
B056
B031
175.36
MW-120S
MW-119S
175.79
(175.62)
MW-236M
MW-236S
175.90
Former
Boiler
Blowdown
Lagoon
B032
Figure 4-7
IBM
Kingston, New York
Building 031 Area
Groundwater Elevation Contour Map
December 6, 1994
DRAWN BY: M/J/M
DATE: 1/4/95
DRAWING NO.
94013-006-A
CHECKED & APPROVED BY: SMJ/LJR
GROUNDWATER SCIENCES CORPORATION
MW-236S – Monitoring Well Location
174.05 – Groundwater Elevation
176 – Groundwater Elevation Contour
– Direction of Groundwater Flow
Scale
0
25'
50'


N
B035
B001
Former Drywell
(loc. approx.)
ND
AA
TCA ND/0.5J
Freon12 ND/1
AF
ND
AG
TCE 0.7J
AB
TCE 1.2
AE
ND
AH
Estimated Limit of
Drainage Field
TCE 1.1
AC
ND
AD
TCE 0.6J
Freon11 10
AI
/ – Duplicate Sample Results
J – Estimated Value
TCE – Trichloroethylene
TCA – 1,1,1–Trichloroethane
ND – None Detected
AC – Soil Gas Sampling Location, October 17, 1994
Scale
0
15'
Figure 5–1
IBM
Kingston, New York
Building 035 Area
Soil Gas Survey Results
(ug/l)
DRAWN BY: MM/JK
DATE: 12/30/94
CHECKED & APPROVED BY: SMF/LFR
DRAWING NO.
94013–005–A
GROUNDWATER SCIENCES CORPORATION

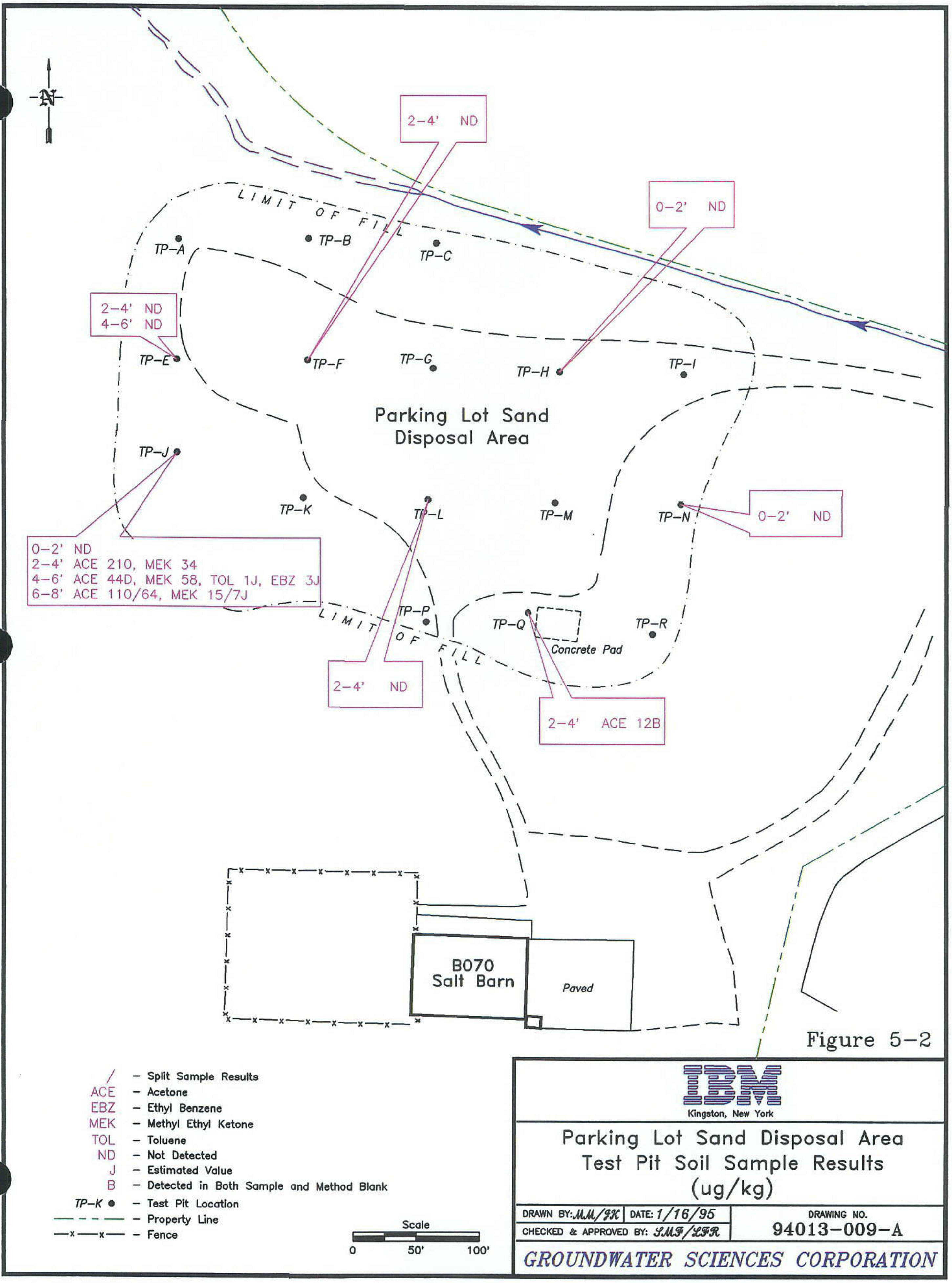

N
LIMIT OF FILL
TP-A
TP-B
TP-C
2-4' ND
0-2' ND
2-4' ND
4-6' ND
TP-E
TP-F
TP-G
TP-H
TP-I
Parking Lot Sand
Disposal Area
TP-J
TP-K
TP-L
TP-M
TP-N
0-2' ND
0-2' ND
2-4' ACE 210, MEK 34
4-6' ACE 44D, MEK 58, TOL 1J, EBZ 3J
6-8' ACE 110/64, MEK 15/7J
TP-P
TP-Q
TP-R
Concrete Pad
2-4' ND
2-4' ACE 12B
B070
Salt Barn
Paved
/ - Split Sample Results
ACE - Acetone
EBZ - Ethyl Benzene
MEK - Methyl Ethyl Ketone
TOL - Toluene
ND - Not Detected
J - Estimated Value
B - Detected in Both Sample and Method Blank
TP-K ● - Test Pit Location
- Property Line
-x-x- - Fence
Scale
0 50' 100'
IBM
Kingston, New York
Parking Lot Sand Disposal Area
Test Pit Soil Sample Results
(ug/kg)
DRAWN BY: MM/JK
DATE: 1/16/95
CHECKED & APPROVED BY: SMF/LFR
DRAWING NO.
94013-009-A
GROUNDWATER SCIENCES CORPORATION

Figure 5-2