FINAL
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TECHNICAL MEMORANDUM NO. 6

ADDENDUM TO FINAL PHASE I

RFI/RI WORK PLAN

Cone Penetrometer Testing and Groundwater Sampling Plan -- IHSS 115

Rocky Flats Plant
Woman Creek Priority Drainage

(Operable Unit No. 5)

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LIST OF ACRONYMS

Acronym	Definition
$BAT_{®}$	Bengt-Arne Torstensson ($BAT_{®}$ sampling equipment)
CDH	Colorado Department of Health
CPT	Cone Penetrometer Testing and its equipment
CLP	Contract Laboratory Program
DCN	Document Change Notice
DOE	U. S. Department of Energy
EG&G	EG&G Rocky Flats, Inc.
EPA	U. S. Environmental Protection Agency
EM	Electromagnetic
EMF	Electromagnetic Frequency
FID	Flame Ionization Detector
FY	Fiscal Year
HPGe	High Purity Germanium
HSL	Hazardous Substance List
IAG	Inter-Agency Agreement
IHSS	Individual Hazardous Substance Site
OU	Operable Unit
PCE	Tetrachloroethene
pCi/g	picoCuries per gram
PID	Photoionization Detector
PVC	Polyvinyl-chloride
RCA	Radiologically controlled area
RCRA	Resource Conservation and Recovery Act
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RFP	Rocky Flats Plant
SID	South Interceptor Ditch
SOP	Standard Operating Procedures
SOV	Soil Organic Vapor
SSHSP	Site-Specific Health and Safety Plan
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TCL	Target Contaminant List
TM	Technical Memorandum
VOC	Volatile Organic Compounds

OU 5 -DRAFT FINAL TECHNICAL MEMORANDUM NO. 6
IHSS 115 -- ORIGINAL LANDFILL
CONE PENETROMETER TESTING and GROUNDWATER SAMPLING

1.0 INTRODUCTION

This Technical Memorandum (TM) incorporates the information which is currently available from the Inter-Agency Agreement (IAG), the February 1992 Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) Work Plan for Operable Unit No. 5 (OU 5) (the Work Plan), applicable Standard Operating Procedures (SOPs), and evaluation of site investigations (see Section 2.0) conducted at Individual Hazardous Substance Site 115 (IHSS 115) at the Rocky Flats Plant (RFP) within OU 5 (see Figure 1).

1.1 BACKGROUND

Performance of Cone Penetrometer Testing (CPT) and groundwater sampling were proposed as Stage 4 of the Phase I RFI/RI of the Original Landfill (the Old Landfill) site. The Old Landfill is located within the southern buffer zone, in an area north of Woman Creek and between southerly extensions of First and Seventh Streets. It is within the Woman Creek drainage on a steeply sloping south-facing hillside (Figures 1 and 2). The original boundary of the Old Landfill has been characterized principally from review of historic aerial photographs and from the operational history of the site. The eastern and southern boundaries of this IHSS, as characterized by these reviews, have since been extended based on U.S. Environmental Protection Agency (EPA) and Colorado Department of Health (CDH) investigations. The southern boundary was extended because waste was identified in areas south of the South Interceptor Ditch (SID). The eastern boundary was extended because a surface disturbance area east of the Old Landfill once served as a pipe and scrap metal storage yard and possibly a soil disposal area concurrent with and following operations at the Old Landfill (Figure 2).

Radiological and geophysical (electromagnetic and magnetometer) surveys conducted as part of the Phase I RFI/RI investigation have yielded additional information that indicates the Old Landfill boundary and disturbed area extend to the east, south, and west of these limits (Section 2.0).

The Old Landfill and these preliminary extensions occupy approximately 330,000 square feet (7.5 acres) (Figure 2). Surface elevations at the Old Landfill range from 5,940 feet to 6,050 feet above mean sea level.

1.2 PURPOSE AND SCOPE

PURPOSE

The overall purpose of CPT and associated groundwater sampling program is to assist in the assessment of: the presence and extent of groundwater contamination; potential migration pathways from the Old Landfill; and future monitoring well locations. These data will then be used to support the baseline risk assessment. A CPT survey will provide information on the physical character of the subsurface lithology, and detect the presence of groundwater in the area downgradient of the Old Landfill. If groundwater is found to be present with CPT, samples of groundwater may be collected. Chemical analyses of groundwater samples will provide screening level information on the presence and concentration(s) of contaminants in groundwater migrating from the site.

SCOPE

The subcontractor will provide all equipment to perform this investigation including, but not limited to tips, probes, rods, replacement parts, electronic data recording equipment, trained technicians to operate the equipment, and initial CPT data interpretation.

Information that may be derived empirically or directly from CPT include, penetrometer depth, continuous measurement of soil properties, unconsolidated soil stratigraphy, pore pressures,

differential pore pressures, and hydraulic conductivity by dissipation testing. For this investigation, dissipation tests to evaluate hydraulic conductivity will not be conducted but pore water pressures will be measured.

This TM presents planned locations for CPT; however, specific locations are not presented for groundwater sampling. Selection of the groundwater sampling locations will depend on results of the soil organic vapors (SOV) surveys, CPTs, and information from other investigations (see Section 2.0) performed during Stages 1, 2, and 3 of the Phase I RFI/RI Investigation. Information that is currently lacking and needed to select groundwater sampling sites include areas exhibiting elevated concentrations of volatile organic compounds (VOCs) in soil vapor, the occurrence of groundwater, and, the depth to bedrock. Results from CPT and groundwater sampling will be included in the Phase I RFI/RI Report.

Overall scope of field investigations include:

- installing one line of CPTs at 100 foot centers just to the south of the SID, between the SID and Woman Creek at the "toe" of the disturbed area of the landfill;
- obtaining groundwater samples at 50-foot intervals through any anomalies identified in the southern (downgradient) three lines of the SOV survey; and
- obtaining one to two groundwater samples in significant bedrock lows as identified with the CPT.

Methodology to be used in implementing CPT and groundwater sampling is described in detail in Section 3.0. A total of 22 CPT probes will be installed along the line south of the SID.

2.0 PRELIMINARY FIELD WORK

Prior to the selection of number and locations of CPT sites, data from several sources were evaluated concerning the location of areas of concern or impediments regarding installation of CPT and groundwater sampling sites. These data sources included:

- the 1990 gamma radiation survey (DOE, 1992a);
- the geophysical surveys conducted during November, 1992 (DOE, 1992b);
- six soil boreholes advanced in a disturbed area to the east of IHSS 115 in December, 1992 (DOE, 1992a);
- two boreholes advanced at indicated pond locations west of the landfill in December, 1992 (DOE, 1992a); and
- several monitoring wells, installed prior to 1992, located in the vicinity of IHSS 115 (EG&G, 1991).

Rationale for the planned location of CPT sites is presented in Section 3.0 of this TM and is based on a collective evaluation of the survey results as summarized below.

An SOV survey of the Old Landfill is scheduled to be conducted during February, 1993 as specified in TM 5 - Revised Soil Gas Sampling (DOE, 1993). Six shallow well points have been installed in the vicinity of the Landfill in February, 1993 as specified in TM 1 - Revised Network Design - Field Sampling Plan (DOE, 1992d). All groundwater sampling sites are planned to be contingent on results of both the SOV and CPT surveys.

2.1 GAMMA RADIATION SURVEY RESULTS

In 1990, a radiation survey was conducted over the Old Landfill (IHSS 115) using a high purity germanium (HPGe) gamma ray detection system. The base survey was conducted utilizing a 150-foot grid pattern and additional stations were added at the discretion of the operator. Results

of the survey were reported in Volume II of the Phase I RFI/RI Work Plan (DOE, 1992a) as indicated concentrations of potassium-40 (K^{40}), radium-226 (Ra^{226}), thorium-232 (Th^{232}), cesium-137 (Cs^{137}), and uranium-238 (U^{238}). Indicated concentrations were reported in picoCuries per gram (pCi/g) for each of the above elements and, with the exception of U^{238}, each of the radionuclides listed above were present in amounts consistent with natural background concentrations. Elevated concentrations of U^{238} were indicated at areas which also exhibited substantial evidence of disturbed soil cover.

Cesium-137 is a human-made fission product deposited as a result of fallout from worldwide nuclear testing (Eisenbud, 1973). After several conversations with the manager of the HPGe program, it was decided that the Cs^{137} survey data could be used to identify areas where the soil cover appears to have remained undisturbed for several decades. Fallout concentrations of Cs^{137} over a given undisturbed area are expected to be relatively consistent. A value of at least 0.4 pCi/g of Cs^{137} was selected as a limit to outline undisturbed areas within the survey boundaries. Evaluation of survey results in those portions of the radiation survey run outside of known disturbed areas (i.e. in undisturbed areas) typically contained Cs^{137} levels at or above 0.4 pCi/g. In disturbed areas Cs^{137} levels were dramatically lower, e.g., <0.2 pCi/g. The resulting map is shown on Figure 3 and outlines an area of possibly undisturbed ground that was found to be consistent with the original topography of the site, as evaluated from the examination of aerial photographs of the area.

The U^{238} survey report identified six anomalous areas where the indicated uranium concentrations exceeded 4 pCi/g (Figure 3). Areas exceeding this value were reported as "anomalous" by those who performed the original HPGe survey in 1990; the criteria for "anomalous" values reported in the HPGe survey were not revaluated for this TM. Three of these anomalies are located on undisturbed ground and may possibly be attributed to concentrations of airborne particulates that were derived from the operation of the incinerator (IHSS 133.5) that was located approximately 2,600 feet west of IHSS 115. The remaining anomalies are associated with the landfill proper. The "known point source", shown on Figure 3, consists of a uranium nodule encrusted in an ash

material that was exposed by the slumping of a bank along the landfill. This occurrence has been documented on photographs. Given the nature of the area (i.e. a landfill), it seems reasonable that the remaining anomalies will be associated with similar point sources that may lie just below or be imbedded in the landfill cover material.

2.2 GEOPHYSICAL SURVEYS

Methods, procedures, and locations of geophysical surveys conducted at IHSS 115 are discussed in the Final TM 2 - Surface Geophysics (DOE, 1992b). Both electromagnetic and magnetometer surveys were conducted over and downgradient of the Old Landfill. Results of both geophysical surveys as they pertain to selecting locations of CPT sites and groundwater sampling locations are discussed in Section 3.0 of this document.

2.2.1 Electromagnetic (EM) Survey Results

An EM survey was conducted at the Old Landfill from September through November 1992 as Stage 2 of the OU 5 RFI/RI. Purpose of this survey was to detect conductivity differences in disturbed soil to further define landfill boundaries. Results from this survey indicate possible locations of subsurface (and near-surface) buried ferrous objects, other metallic objects, and soil conductivity based on apparent moisture content, differences in geological sediments (i.e., shallower bedrock).

Preliminary EM data (both conductivity and in-phase data) were mapped with separate patterns. Those areas differed very little in the overall configuration of anomalous areas within the Old Landfill area. Shown on Figure 4 are only the areas showing the highest conductivity. These anomalies may be attributed to the higher moisture content of disturbed ground, undisturbed wetlands or water-saturated alluvium, differences in geological sediments (i.e., shallow bedrock), or buried conductive metallic objects. Overall results tend to indicate that the conductive anomalies shown on Figure 4 can be attributed to both naturally-occurring partially saturated

alluvial or bedrock sediments, and an extensive amount of landfill cover material and other disturbed sediments. The large anomaly occurring in the main portion of the landfill is also associated with the area in which the most intensive magnetic anomalies occur and can therefore be attributed in part to buried conductive metallic objects.

Other cultural features were delineated by the EM survey including two buried gas pipelines, located along the north and south boundaries of the Old Landfill, and the conductivity anomaly that occurs along the east half of the buried outfall line. It is possible that the thickness of cover material along the west end of the outfall line exceeded the penetration depth of the EM instrument (approximately 15 to 20 feet), and that the anomaly associated with the east end of the line is due to either the natural moisture occurring in the fill material around the line, or from a leak along the line. Preliminary maps provided by the EM surveyor also show partial linear anomalies along the SID and partial linear anomalies associated either with an abandoned gas line or the overhead power lines that extends east-west along the south boundary of the Landfill.

2.2.2 Magnetometer Survey Results

A magnetometer survey was also conducted September through November 1992, primarily to further support and provide confirmation of the EM survey data. Results from the magnetometer survey were reviewed and evaluated for indications and location of subsurface (and near-surface) buried ferrous objects. Such objects may be an indication of buried waste, thereby indicating possible IHSS boundaries. Specifications regarding the extent and orientation of the soil gas survey sample locations (see Section 2.5) were based on the delineation of the IHSS boundaries from the results of these preliminary surveys, as specified by the OU 5 RFI/RI Work Plan (DOE, 1992a). Figure 4 is a generalized presentation of the results of this survey and that of the EM survey.

A baseline for the magnetometer survey was located by EG&G Rocky Flats, Inc. (EG&G) surveyors and is shown on Figure 4. Geophysical survey points were measured along lines 25

feet apart at 10-foot station intervals in a north-south direction. Northern ends of the lines were bounded by the buffer zone chain-link fence with the south bounded by Woman Creek. No data were collected inside Radiologically Controlled Areas (RCAs) as indicated by roped areas.

Initial magnetic data were presented as a total magnetic-field contour map and as a magnetic gradient map. The total magnetic field map probably reflects only the most significant anomalies, whereas the gradient map includes an abundance of anomalies that are probably associated with magnetic metallic trash throughout the area, resulting in a map with an overall cluttered appearance. Using only the total magnetic field data, the most significant anomalies are plotted on Figure 4. Areas of interest include the RCA associated with the landfill bank slump where the metallic U^{238} source was identified, the area of indicated buried metallic objects in the vicinity of the former ponds, indicated buried magnetic objects associated with the main landfill, and the area over the east half of the outfall pipe. Manholes associated with the outfall line were also defined by the magnetic survey. It was again assumed that the depth of the west end of the outfall line exceeded the detection depth of the magnetometer, or that a non-detectable concrete pipe was used between the two manholes.

Useful data could not be acquired beneath the power lines because of the overriding electromagnetic frequency (EMF) produced by the lines. Some metallic trash was displaced to the south of the SID during its construction. Anomalies shown on both the initial total magnetic field map and the magnetic gradient map appear to be random, and there is currently insufficient evidence to assess the reliability of most of these anomalies.

2.3 SOIL CORE AND SOIL BOREHOLE RESULTS

In accordance with Section 7.2.1 (Stage 3) of the OU 5 RFI/RI Work Plan (DOE, 1992a), eight soil cores and/or soil boreholes were advanced during December, 1992 within the disturbed area east of the Old Landfill. Figure 5 shows the location of these boreholes; also shown are existing

groundwater monitoring wells in the vicinity of IHSS 115. These soil boreholes were drilled for subsurface characterization of the landfill cover, subsurface materials, and exposed fill:

- one borehole was drilled at each of the indicated locations of the two former ponds (borehole numbers 50992 and 51092); and
- six boreholes were drilled in the disturbed area to the east of the landfill (borehole numbers 50392 through 50892).

These boreholes were configured to permit initial evaluation of the areal extent and gradients of contaminants that may be present. Each soil borehole was drilled at least 6 feet below the base of the alluvial material in accordance with procedures described in SOP GT.2 and sampled continuously in 2-foot intervals. Discrete samples of unsaturated alluvium from each 2-foot increment was analyzed for target compound list (TCL) VOCs. Also, samples were composited from every 6-foot interval and analyzed for TCL semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, and radionuclides. Following sampling, soil classification was completed with several samples from 0 to 2 feet depth being selected for grain size analysis. Table 2-1 summarizes the water level, total depth drilled and cored, and thickness of alluvial and bedrock strata penetrated for each borehole. Detailed descriptions of the sediments penetrated and lithology of bedrock and cored intervals are currently being prepared.

Three soil boreholes will be advanced and soil samples collected for analysis at up to three areas within the known landfill limits where anomalies are indicated by the SOV survey. These results will also provide initial screening information on the presence and levels of volatile organic contamination occurring in soils in the vicinity of the site.

Table 2-1

BOREHOLES INSTALLED DECEMBER, 1992
IHSS 115 - ORIGINAL LANDFILL

Borehole Number	Approximate Borehole Location		Alluvium Thickness	Bedrock Depth	Bedrock Lithology	Total Depth & Core	Water Level
	Northing	Easting					
50392	748,085	2,082,627	24.0'	24.0'	Claystone	30.0'	23.5'
50492	748,065	2,082,460	27.2'	27.2'	Clayey Siltstone	38.0'	26.5'
50592	748,045	2,082,350	26.0'	26.0'	Silty Claystone	32.0'	Dry
50692	747,915	2,082,510	15.0'	15.0'	Claystone	21.0'	5.5'
50792	747,883	2,082,380	8.5'	8.5'	Claystone	16.0'	Dry
50892	747,880	2,082,280	10.4'	10.4'	Claystone	16.0'	Dry
50992	747,845	2,081,530	12.5'	12.5'	Sandy Claystone	19.0'	6.0'
51092	747,765	2,081,490	6.2'	6.2'	Sandy Siltstone	12.0'	Dry

2.4 EXISTING GROUNDWATER MONITORING WELLS

In the area due north of the Old Landfill approximately six alluvial groundwater monitoring wells are in place (monitoring well numbers P416189, P416289, P416489, P416589, P416689, and P416789). These six wells should provide background information concerning the nature and concentrations of contaminants that may be migrating toward the Old Landfill. In addition, three monitoring wells (numbers 0481, 5786, and 7086) were installed to the south of the "toe" of the Old Landfill and should provide information regarding contaminants migrating from the vicinity of the Old Landfill. Table 2-2 summarizes construction details for the latter three wells. Figure 5 shows locations of all existing wells and recently installed boreholes near the Old Landfill.

Considering their proximity to the downgradient extent of the Old Landfill, two of the wells south of the Old Landfill were considered for "twinning" with a CPT for equipment calibration to establish geotechnical parameters to known stratigraphic conditions. Monitoring wells numbered 5786 and 0481 are within 50 feet and 25 feet of the planned CPT line, respectively. However, a log for 0481 has not been located and the log for 5786 indicates that the alluvium was not sampled. Therefore, these two boreholes cannot be use as twins for calibration of the CPT. A third well, number 7086, is about 75 south of the planned nearest CPT location. This well will serve as a twin for calibration of the CPT.

2.5 SOIL ORGANIC VAPOR SURVEYS

Installation procedures, sampling methods, analytical protocols, and location of the SOV surveys to be conducted at the Old Landfill are discussed in the Final Technical Memorandum No. 5. - Revised Soil Gas Sampling Plan (DOE, 1993).

A real time SOV survey is being conducted as Stage 2 of the RFI/RI field investigations for OU 5 to identify areas of VOC contamination within the Old Landfill. The survey is currently being implemented (expected completion early-April, 1993) and may indicate the presence and extent

Table 2-2

EXISTING MONITORING WELLS SOUTH OF IHSS 115
ORIGINAL LANDFILL

Well Number	Date Drilled	Alluvium Thickness	Bedrock Depth	Bedrock Lithology	Total Depth	Total Core	Water Level	Comment
0481	4-81	--	--	--	--	--	--	--
5786	5-86	6.0'	6.0'	Claystone	12.0'	6.0'	5.0'	--
7086	7-86	7.0'	7.0'	Claystone	13.0'	13.0'	3.4'	--

of VOC contamination plumes that may be present under or migrating from the Old Landfill. Evaluation of the SOV results will be used to select the location of soil boreholes and monitoring wells under TM 5 and TM 8, respectively (DOE, 1993 and DOE, 1992c). Figure 6 illustrates the proposed location of individual sampling probes and overall (primary, secondary, and tertiary) grid of the SOV survey at this site. Total number of SOV samples to be collected is currently planned at approximately 320 sites in vicinity of the landfill. Various surface features and RCAs may preclude the performance of the survey in certain areas.

Should all, or a portion, of the SOV surveys be completed prior to conducting the CPT survey, available results will be reviewed and evaluated to consider access to planned locations (Section 3.1.2). Meaningful information that may be expected from preliminary evaluation include;

- site-specific (i.e., location) screening and monitoring results,
- occurrence of detectable levels of VOCs, and
- presence of surface and subsurface conditions that may inhibit or impact operations during installation of CPT or groundwater sampling equipment.

SOV samples will be analyzed for 1,1,1-trichloroethane (TCA), dichloromethane, benzene, carbon tetrachloride, tetrachloroethene (PCE), and trichloroethene (TCE) utilizing a portable gas chromatograph (GC) located in an on-site mobile facility (trailer).

2.6 WELL POINT INSTALLATION

A series of temporary, shallow well points have been driven into the Woman Creek alluvium to provide for measurement of groundwater fluctuations and gradient at several locations along and perpendicular to Woman Creek (TM 1 -Revised Network Design, DOE, 1992d). As of the end of February, 1993 approximately 38 well points had been installed during Stage 3 investigations of IHSS 142 - C-Series Detention Ponds. Approximate locations of the well points along Woman Creek and in the vicinity of the Old Landfill are shown on Figure 5. Monthly monitoring of

water levels in the well points is planned. Samples of groundwater or core of the alluvial sediments have not and are not planned to be collected from the well points. Sediment cores cannot be collected with the well points, therefore, they are not useable for calibration purposes of the CPT. Water-level data has limited usefulness in the selection of groundwater sampling sites because of the wide areal distribution of the well points and that only one line of well points have been installed in a line perpendicular to the CPT line.

Installation records indicate that subsurface obstructions were limited and in a few cases were overcome by moving the location a few feet. Access to locations was adequate and penetration or installation depths of greater than 20 feet were achieved. Preliminary groundwater level data indicate saturated thicknesses of greater than 3 feet in the vicinity of the Old Landfill. Groundwater near Woman Creek, down slope from the Old Landfill, appears to be at the same level or higher than the water level in Woman Creek.

3.0 CPT AND GROUNDWATER SAMPLING PROGRAMS

A CPT program will be conducted during Stage 4 of the Phase I RFI/RI along a single line downgradient of the Old Landfill, near its southern boundary. CPT will be used to:

- characterize subsurface sediment type (lithology),
- locate the possible occurrence of saturated soils,
- assist in selecting locations for groundwater samples, and
- assist in selecting locations for monitoring wells in the vicinity of the Old Landfill.

At locations where soil pore pressures indicate saturated conditions, a groundwater sample may be obtained for analysis. Analytical results of the groundwater samples will be used for screening purposes to ascertain the presence/absence of analytes to be tested and concentrations present. Comparison of laboratory results from the various groundwater sample locations may also assist in assessing the potential for contaminant migration from the Old Landfill past the SID and towards Woman Creek.

3.1 CPT PROGRAM

3.1.1 Planned CPT Locations

CPT probes were originally planned to be installed on 100-foot centers along each of two lines of investigation. As stated in the Work Plan, groundwater is expected to flow downslope or towards the south. Therefore, the lines were placed generally downslope (downgradient) of the Old Landfill. Initial geometry (two lines) and spacing was based on the then known areal extent of the Old Landfill, and was prior to completing evaluation of results of investigations and aerial photographic reviews discussed in Section 2.0. Results of these evaluations have identified additional disturbed areas and extended the boundary (size) of the Old Landfill.

Consistent with these areal changes, only one line of CPT probes is now planned to be installed in the southern portion of the Old Landfill. The line of CPT sites will be located near the "toe" of the Old Landfill and south of the SID. Figure 7 presents the planned location of the line; locations take into consideration currently known conditions including contamination, terrain, and access; however, some locations may change due to site specific conditions encountered in the field (such as buried obstructions). CPT sites are planned to be installed at a maximum of 100-foot intervals along the full length of the line. The line is approximately 2,200 feet long; therefore, 22 CPT sites are currently planned along this line. The line will be offset from the existing geophysical survey baseline approximately 100 feet to the south. Offsetting distances may vary somewhat depending on site access and terrain conditions existing at the time the program is implemented. CPT locations will be referenced to the existing geophysical survey baseline. This method of locating CPT lines will allow for comparison of results and accurate location of CPTs relative to the SOV and geophysical surveys.

Prior to initiating the CPT program, one CPT will be advanced adjacent to or "twinned" with one of the soil boreholes installed during Stage 3 (see Section 2.3). This will calibrate the cone penetrometer to known lithologies and soil saturations existing at the location at the time of the CPT. Borehole number 50692 has been selected to be "twinned" for calibration purposes of the CPT equipment because artificial fill, alluvium, bedrock, and saturated conditions all appear to have been encountered. This will be the first CPT driven during the investigation. This borehole occurs approximately 250 feet north of the west end of the line. As discussed earlier, the line of CPTs will pass within about 25 feet of well 0481 and within 75 feet of monitoring wells 5786 and 7086. Unless a detailed core description from well 0481 can be located, the CPT location nearest to well 7086 will also be used as a twinned location. Monitoring well 5786 cannot be used for this purpose because the alluvium was not sampled during drilling.

Drive depth from surface for the CPTs is expected to range from approximately 10 to 30 feet, and average about 15 feet. Penetration depth of each CPT will be to bedrock or refusal after a minimum of 2.0 feet below the groundwater (saturated) table. Estimates of the CPT depth are

based on soil boreholes installed during Stage 3 (see Section 2.3) of the OU 5 RFI/RI Work Plan (DOE, 1992a); actual depth may vary depending on conditions existing at the site at the time of the investigation.

The CPT line will extend from 100 feet east of the rubble piles east of the Old Landfill access road to the end of the SID on the west (a total length of approximately 2,200 feet). Due to site conditions, controlled areas, and general access at the time testing is commenced, final alignment may be changed slightly from that show on Figure 7. Results of the CPT program will be included in the Phase I RFI/RI Report as well as summarized in TM 8 - IHSS 115 Monitoring Wells (DOE, 1992c).

3.1.2 Equipment and Installation Method

CPT provides a way to rapidly measure soil parameters such as tip resistance, local friction, and pore pressure. Four important uses of the CPT data are:

- To identify soil types;
- To interpolate subsurface conditions between control boreholes;
- To detect presence of saturated conditions; and (to a lesser degree for this investigation)
- To evaluate soil parameters (i.e., shear strength, etc.).

A special rig is used to hydraulically push the CPT tool into the subsurface. Segments of rod are added as the probe is advanced at a constant rate (typically 0.6 - 1.0 inches per second). "Continuous" measurements of the penetration tip resistance and sleeve friction are recorded: typically, data is recorded at approximately every 0.4 - 0.8 inches of penetration. Collected data can then be interpreted to provide information on the engineering characterization of the subsurface soils (lithology).

The CPT probe is composed of a 1.4-inch to 1.8-inch diameter probe with a conical point. Most CPT probes are 1.4 inches in diameter. Typically, CPTs have strain gauges that measure penetration resistance and side friction of soils. Continuous data from the strain gauges is transferred electronically through a cable connected to the CPT probe to a computerized data acquisition system in the CPT rig.

A friction reducer or coupling is usually placed approximately 1.0 to 3.3 feet behind the cone tip. Purpose of the friction reducer is to increase the hole diameter in order to reduce soil contact against the cone rods. This friction reduction makes the CPT easier to push into the subsurface. Typically, a 2-inch long steel tube is welded (and chamfered to 30°) over the cone rod as a friction reducer. Refer to SOP GT.21, Cone Penetrometer Testing (EG&G, 1992a), for a list of equipment required for CPT.

CPT may not be successful in soils or materials that contains cobbles, boulders, rock, or other discarded debris. These materials may damage the CPT probe or make it impossible for it to penetrate into the material. Each of the planned sites has been field checked for access, terrain and slope, and surface debris to evaluate if CPT may be feasible at that location. Subsurface conditions that may preclude CPT installation at a specific site could not be determined. Where CPT refusal is encountered in the subsurface, the equipment will be removed and an offset penetration attempted. A total of two offsets within a radius of 3.3 to 10.0 feet (1 to 3 meters) from the original location will be attempted before the site will be abandoned and deleted from the investigation. Location, depth attained, and material type encountered (if known) will be recorded in field documentation records for each abandoned location. Additionally, the location, distance, azimuth, and sequence of each offset CPT location will be recorded in field documentation records.

3.1.3 Testing Procedures

Before testing, sites will be located, numbered, and identified using wooden stakes. Refer to SOP GT.17, Land Surveying (EG&G, 1992b), for site location procedures. After the sites have been located, an exclusion zone will be established according to the Site-Specific Health and Safety Plan (SSHSP), and the rig will be set up. Procedures for conducting CPT at a specific location are currently specified in SOP GT.21, Cone Penetrometer Testing (EG&G, 1992a).

3.1.4 Calibration and Checks

The CPT probe and rods will be checked before a test begins and between test holes to ensure that its dimensions and surface roughness are within acceptable limits. The test system will also be calibrated as needed, and the calibration will be documented. Specifically, the load cells will be calibrated according to manufacturer specifications and industry standards at least every three months. A certified copy(s) of the calibration record for the load cell, and/or other CPT equipment similarly calibrated, will be obtained from the CPT subcontractor prior to commencing field activities.

Before performing CPT, the straightness of the push rods will be checked. The bottom five push rods will be particularly checked by rotating them to see if they are bent enough to observe a significant wobble. If a significant wobble is noticeable, the push rod(s) will not be used.

CPT will not be performed within 3.3 feet (1 meter) of an existing CPT site. In addition, CPT will not be performed within 10 feet (3 meters) of an uncased or unfilled borehole or well.

3.2 GROUNDWATER SAMPLING PROGRAM

The Final Phase I RFI/RI Work Plan for the RFP, Woman Creek Priority Drainage, OU 5, Revision 1, proposed groundwater sampling at the Old Landfill site (DOE, 1992a). Specifically,

it stated that groundwater be sampled with a Bengt-Arne Torstensson ($BAT_®$) (or equivalent) sampling device. Groundwater samples specified herein will be obtained with the use of well points. For initial evaluation of the nature and extent of contamination, well points should be considered equivalent to the $BAT_®$ sampling device. Well points can provide samples of sufficient quality to meet or exceed the Data Quality Objectives specified in the Work Plan.

Well points are small diameter (approximately one inch) wells that are driven into the ground rather than drilled. A threaded expendable stainless steel point is advanced by either hydraulically pushing or hammering to desired depth. Then, the end of a hand-perforated three-eights inch Teflon tubing with a threaded stud attached is inserted into the probe rods. This is threaded into the expendable drive point. Probe rods are then removed from the hole and a sand filter pack and a granular bentonite seal are placed. Well points will be installed according to Document Change Notice (DCN) 93.02, Well Point Installation for OPS GT.06, Monitoring Well and Piezometer Installation.

After installation, well points may be developed and sampled in much the same manner a monitoring well is developed and sampled. Water level measurements can also be obtained. Because of the small diameter of the tubing, well points should be developed/sampled by either a suction type pump (e.g. peristaltic) at the surface or with a downhole inertia pump. A downhole inertia pump should provide a sample of quality similar to that of a bailer, thereby providing samples adequate for EPA's Level IV of analytical data.

Well points of this variety offer several advantages to the $BAT_®$ sampling device. In addition to the implicit advantages of being able to actively develop and measure water levels as mentioned above, well points offer a longer sampling interval (i.e. a longer screened interval). A longer sampling interval allows for the detection of floating product and larger sample volumes in the same period of time. This second item (larger volumes per unit time) is of particular advantage when sampling relatively impermeable formations. Since sample volumes for some

of the analyses is quite large (greater than 250 milliliters), a larger sample volume will allow for more analyses to be conducted.

3.2.1 Selection of Sampling Sites

Following evaluation of CPT and SOV results and pertinent information from other surveys (see Section 2.0) the groundwater sampling locations will be selected. Groundwater sampling locations will be along the same general line as the CPTs. They will be located at 50-foot spacings through anomalies identified with the SOV survey data. Additionally, one to two groundwater sampling points will be placed in each significant bedrock low or other suspected migration pathways (i.e. saturated sand). The total number of well points will not exceed 15.

3.2.2 Equipment and Sampling Method

The necessary equipment includes:

- rig capable of driving the well points;
- steel drive casing;
- threaded expendable points;
- threaded studs to attach tubing to expendable points;
- 3/8" perforated tubing;
- 3/8" tubing;
- 3/16" sampling tubing; and
- protective surface casing and cap.

Well points can be sampled by either a suction type pump (e.g. peristaltic) at the surface or with a downhole inertia pump. A DCN to SOP GW.06, Groundwater Sampling is being prepared to specify sampling details. Time required to fill the sample container will depend on the hydraulic conductivity of the soil and the saturated screened length.

In the event that a well point cannot be driven into the soil due to physical restrictions, a borehole will be drilled, the well point will be inserted into soil at the base of the borehole, and sealed in accordance with procedures discussed in Section 3.5.

3.2.3 Analytical Requirements

Groundwater that is collected via well points will be analyzed at an off-site analytical laboratory for the same list of analytes required by Section 5.8.1, SOP GW.6, Rev. 2 - Groundwater Sampling (EG&G, 1992h). Sequence and type of analyte suites will be prioritized on the basis of the actual (gross) volume of groundwater produced and collected during a single, consecutive 2-hour sampling event. Because an off-site laboratory will be used, a sample for radiation screening will be collected prior to collecting other samples. Transfer of the sample to the specified container(s) and the addition of preservative (and quantity) will be in accordance with Section 5.8.1 and Table GW.6-1 of SOP GW.6, Rev.2, respectively.

Analysis parameters and sequence of collection, in order of priority, for all groundwater samples will be as shown on Table 3-1. Also shown on Table 3-1 are which samples will be filtered.

One duplicate sample will be collected for every ten groundwater samples, one field blank or equipment rinsate blank will be collected for every 20 groundwater samples, and one travel blank will be submitted every day VOC samples are collected. All analyses will be by methods specified in Table 3-1 of the Work Plan. Samples will be handled according to SOP FO.13 Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1992f). Analytical results of these samples will be used for screening purposes only. This data will provide information concerning the presence or absence of contaminants and their concentrations, if present.

Table 3-1

ANALYSIS PARAMETERS, SEQUENCE OF COLLECTION, AND ORDER OF PRIORITY FOR ALL GROUNDWATER SAMPLES

Parameter (in order of priority)	Minimum Volume
• Radiation Screening	6 oz (180 ml)
• HSL VOCs	2 - 40 ml
• $^{233/234}U$, ^{235}U, ^{238}U	100 ml*
• ^{241}Am	1 L
• $^{239/240}Pu$	1 L
• Field Test Parameters:	
•• Ph, Conductivity, and Temperature	35 ml
• Metals - CLP w/ Cs, Li, Sr, Sn, Mo, Si	1 L*
• BNA (Base Neutral Acid)	1 L (1000 ml)
• Pesticides / PCB	1 L
• Gross Alpha and Gross Beta	550 ml*
• ^{3}H	100 ml
• TSS (Total Suspended Solids)	125 ml
• TOC (Total Organic Carbon)	125 ml
• COD (Chemical Oxygen Demand)	125 ml
• Orthophosphate	250 ml*
• Nitrate / Nitrite as N	250 ml
• $^{89/90}Sr$	700 ml*
• $^{226/228}Ra$	750 ml*
• TDS, Cl, F, SO_4, CO_3, HCO_3	1 L
• Cyanide	1 L
• ^{137}Cs	2.5 L (2500 ml)*

* = On-site filtered sample (0.45-micrometer filter)

3.3 EQUIPMENT DECONTAMINATION

All CPT and well point equipment including the rig, rods, etc. will be decontaminated at the main decontamination facility prior to and immediately after completion of activities at the Old Landfill investigation site. Between testing and sampling holes, all downhole equipment will be decontaminated at the sample site in accordance with DCN Number 5-21000-92.02 - Heavy Equipment Decontamination (dated November 2, 1992). All fluids will be handled in accordance with SOP FO.7 (EG&G, 1992g). Decontaminated equipment will be placed in new plastic bags or on racks until it is used. The rig will be decontaminated whenever it is moved outside of the revised boundaries of IHSS 115 (i.e., investigation area), when it becomes unusually dirty as a result of site or testing conditions, or at the discretion of the site or project manager. See also SOP FO.3, General Equipment Decontamination (EG&G, 1992c), and SOP FO.4, Heavy Equipment Decontamination (EG&G, 1992d) for further discussion of details concerning decontamination requirements.

3.4 DOCUMENTATION

All information required by SOP GT.21, Cone Penetrometer Testing (EG&G, 1992a), will be documented on the Cone Penetrometer Testing Form (Figure 8) and/or the CPT log. A Cone Penetrometer Testing Form will be filled out for each day of testing at a given location and, in situations where more than one test hole is completed per day per rig, at least one form will be completed per test hole.

3.5 HOLE ABANDONMENT

Upon reaching total penetration depth with the CPT probe, the CPT push rods be pulled out of the subsurface. Holes may be sealed and abandoned by either pump grouting or the placement of bentonite pellets into the open hole. If pumping grout is selected, the rods will then be

returned to the bottom of the hole after the sampling equipment has been removed. The hole will be then grouted from the bottom to the surface as the rods are withdrawn.

If the rig is not equipped to pump grout the hole, the open hole will be screened for VOCs after the subsurface equipment has been pulled out of the ground (see SOP FO.15 for monitoring equipment information). If the hole is collapsed, hollow CPT rods and a sacrificial tip will be used. Polyvinyl-chloride (PVC) pipe may be used as a "tremmie pipe" if the hole did not collapse. PVC pipe or CPT rods will be pushed to the bottom of the hole. Bentonite pellets will then be "tremmied" to the bottom of the hole as the CPT rods or PVC pipe are withdrawn. DCN procedure number 5-21000-OPS GT.21, Rev. 1 (dated January 8, 1993) has been issued to allow usage of bentonite pellets for CPT abandonment at landfill investigations. This DCN expires January 8, 1994.

4.0 ALLUVIAL MONITORING WELLS

Based on information from the geophysical, SOV, and CPT surveys, the location for alluvial monitoring wells will be selected and submitted to the regulatory agencies for review. Methods, procedures, and locations for the alluvial wells to be installed in the vicinity of the Old Landfill are discussed in the preliminary Draft TM 8. (DOE, 1992c). Location, type, and number of monitoring devices will depend upon all other data gathered during the Phase I investigation. Locations of the monitoring devices will allow for monitoring the principal groundwater and downgradient migration pathways of the Old Landfill. The need for bedrock wells will be evaluated after lithologic and preliminary chemistry data has been gathered and interpreted.

5.0 REFERENCES

DOE, (Department of Energy), 1992a, Final Phase I RFI/RI Work Plan for the Rocky Flats Plant Woman Creek Priority Drainage (Operable Unit No. 5), Revision 1, February.

DOE, 1992b, Final Technical Memorandum No. 2, Addendum to Final Phase I RFI/RI Work Plan, Surface Geophysical Surveys -- Original Landfill, October.

DOE, 1992c, Draft Phase I Technical Memorandum No. 8, Addendum to Final Phase I RFI/RI Work Plan, Monitoring Well Installation Plan -- IHSS 115 -- Original Landfill, July.

DOE, 1992d, Final Technical Memorandum No. 1, Addendum to Final Phase I RFI/RI Work Plan, Revised Network Design -- Field Sampling Plan, October.

DOE, 1993, Draft Final Technical Memorandum No. 5, Addendum to Final Phase I RFI/RI Work Plan, Revised Soil Gas Sampling Plan -- Original Landfill, January.

EG&G, 1991, Geological Characterization, July 31, 1991.

EG&G, 1992a, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) GT.21, Revision 1, Cone Penetrometer Testing, March 1, 1992.

EG&G, 1992b, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) GT.17, Revision 2, Land Surveying, March 1, 1992.

EG&G, 1992c, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.3, Revision 2, General Equipment Decontamination, March 1, 1992.

EG&G, 1992d, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.4, Revision 2, Heavy Equipment Decontamination, March 1, 1992.

EG&G, 1992e, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.15, Revision 2, Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs), March 1, 1992.

EG&G, 1992f, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.13, Revision 2, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples, March 1, 1992.

EG&G, 1992g, Environmental Management Department (EMD) Manual Operation Standard Operating Procedure (SOP) FO.7, Revision 2, Handling of Decontamination Water and Wash Water, May 12, 1992.

EG&G, 1992h, Environmental Management Department (EMD) Manual Operation Standard Operating Procedures (SOP) GW.6, Revision 2, Groundwater Sampling, March 1, 1992.

Eisenbud, Merril, 1973, Environmental Radioactivity, 2nd. edition, Academic Press, New York.

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT FORM GT.21A (REV.1)

CONE PENETROMETER TESTING FORM

Project Name: _____ Date: _____

Site Location/Identification: _____

Coordinates: _____ North (Y) _____ East (X)

Weather Conditions: _____

Testing Company: _____

Testing Team Leader: _____

Testing Team Member: _____

Testing Team Member: _____

Rig Type: _____

Cone Type and Size (In): _____

Total Depth (Ft): _____

Grouting Details: _____

End-of-Day Status: _____

HIGHEST ENVIRONMENTAL MONITORING RESULTS

Organic Vapors: _____ (Value) _____ (Units) _____ (Instrument Used)

Comments: _____

_____

_____

_____

_____

Completed By: _____ (Print Name) _____ (Signature) _____ (Date)

Subcontractor: _____

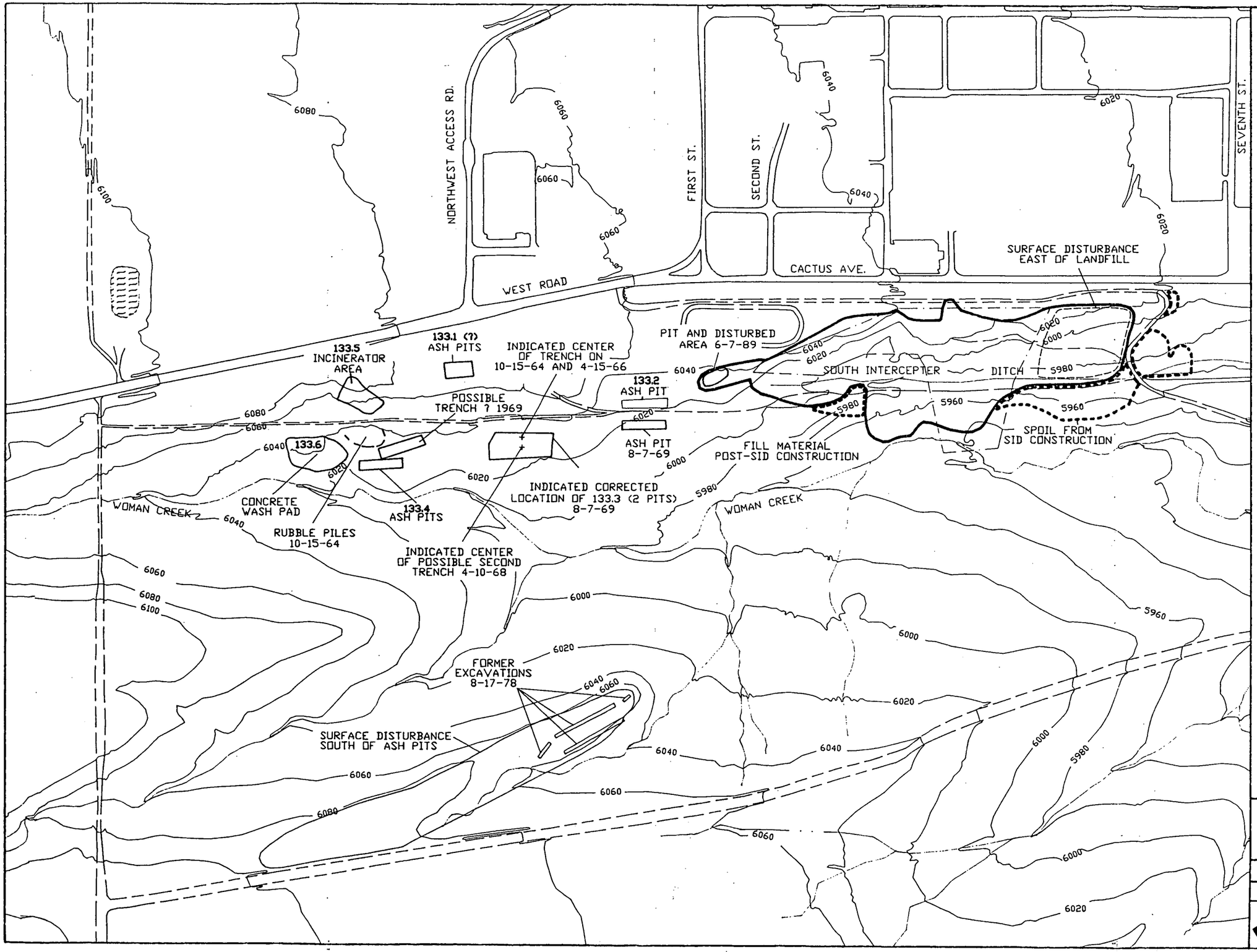
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden Colorado

OPERABLE UNIT NO. 5
TECHNICAL MEMORANDUM 6

FIGURE 8

CONE PENETROMETER TESTING FORM

APPROVED BY RSS DATE: 3-19-93



MAP LEGEND

- INTERMITTENT STREAMS DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- SURFACE WATER IMPOUNDMENTS
- 133.1 INDIVIDUAL HAZARDOUS SUBSTANCE SITES
- EXTENDED OR CORRECTED IHSS LOCATION (Incl. AERIAL PHOTOGRAPH DATE)
- IHSS 115 (ORIGINAL LANDFILL AND DISTURBED AREAS)
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)

-N-

0 200 400

FEET

LOCATION MAP OF INDIVIDUAL HAZARDOUS SUBSTANCE SITES (REVISED LOCATIONS)

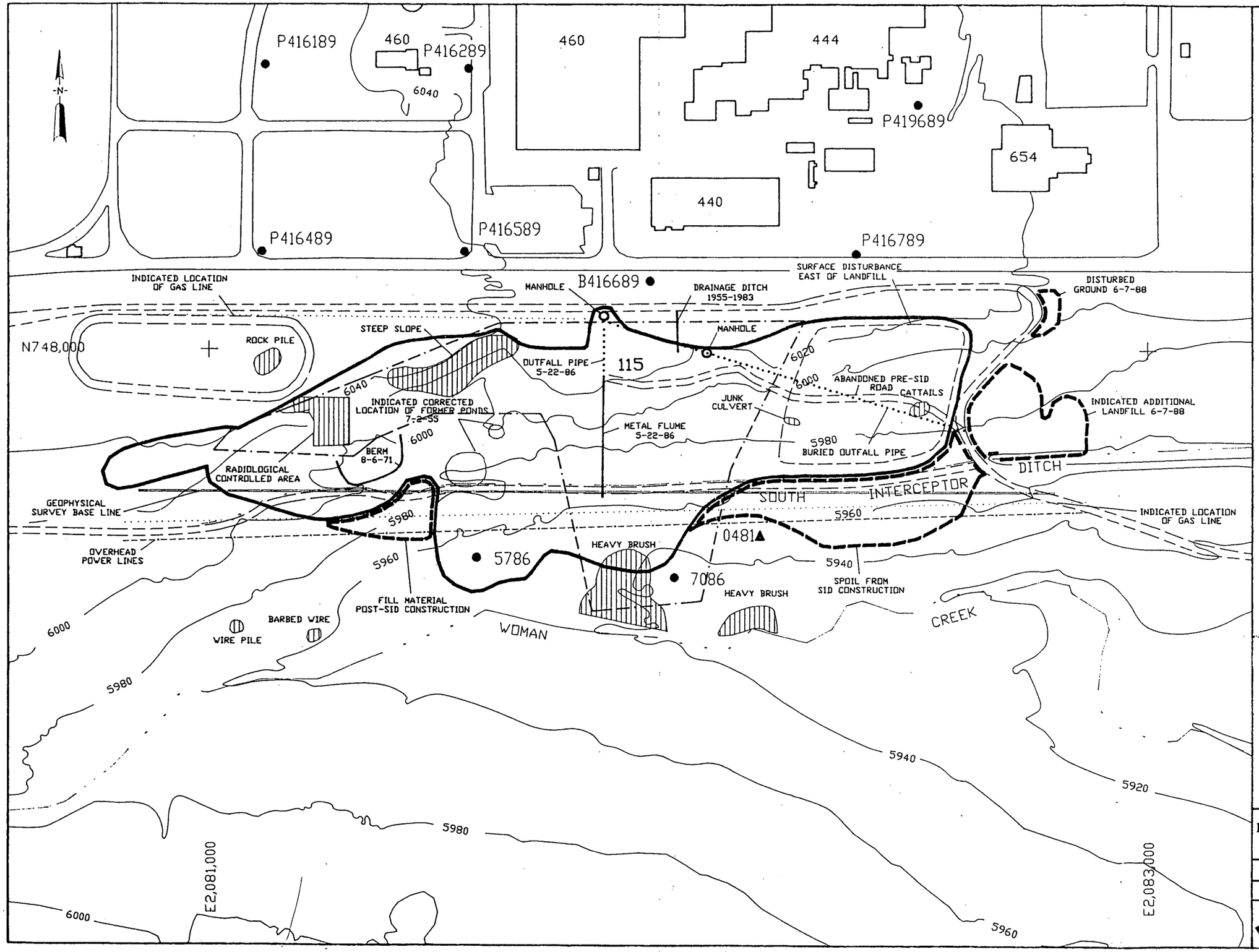
TM6 - CPT AND BAT® TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

FOSTER WHEELER | 9208.15.01.16 | MARCH 1993 | FIGURE 1

35TM6-1.DWG

APPROVED BY PJJ DATE: 3-15-93



MAP LEGEND

- SOUTH INTERCEPTOR DITCH (SID) AND WOMAN CREEK
- PAVED ROADS
- DIRT ROADS
- 440 — BUILDINGS
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- EXTENDED OR CORRECTED LOCATION OF LANDFILL AND/OR DISTURBED GROUND FROM AERIAL PHOTOGRAPHS (Incl. DATE)
- 7086 ● EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- 0481 ▲ PRE - 1986 MONITORING WELL

0 100 200

SCALE: 1" = 200'

IHSS 115 ORIGINAL LANDFILL AND EXTENDED AREAS

TM6 - CPT AND BAT® TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

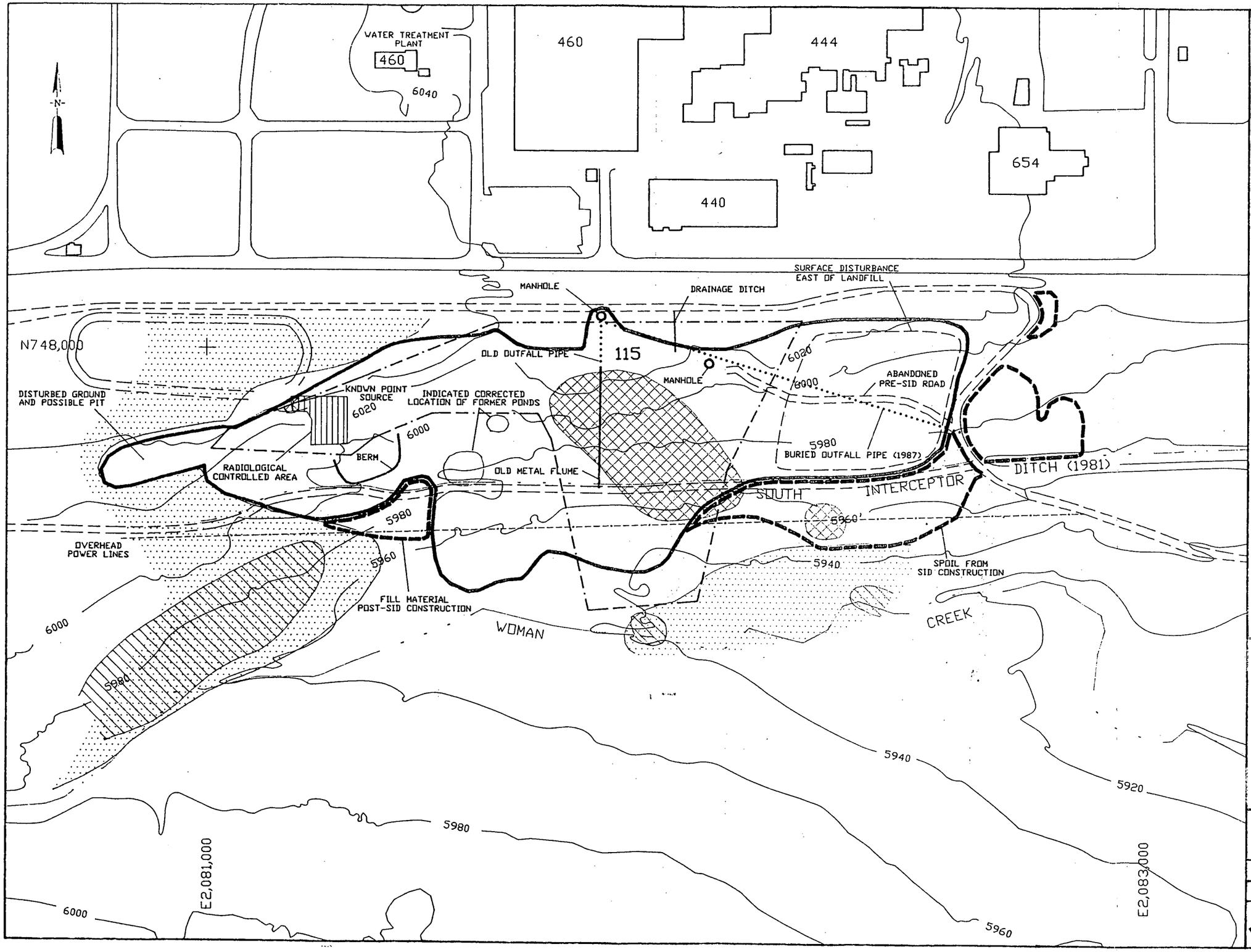
9208.15.01.16

MARCH 1993

FIGURE 2

DSTM6-2.DVG

APPROVED BY PJS DATE: 3-19-93



MAP LEGEND

- STREAMS DITCHES DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- 440 BUILDINGS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- LANDFILL AND DISTURBANCE POST - SID
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- INDICATED UNDISTURBED GROUND FROM Cs^{137} DATA
- U^{238} ANOMALY (>4 pCi/g) PROBABLE AIRBORNE PARTICULATE SOURCE
- U^{238} ANOMALY (>4 pCi/g) ASSOCIATED WITH LANDFILL MATERIAL

0 100 200

SCALE: 1" = 200'

SUMMARY OF HPGe SURVEY RESULTS

TM6 - CPT AND BAT® TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G

9208.15.01.16

MARCH 1993

FIGURE 3

DST-M6-3.DWG

APPROVED BY PJS DATE: 3-15-93

WATER TREATMENT PLANT
460
6040
460
444
654
440
-N-
SURFACE DISTURBANCE EAST OF LANDFILL
MANHOLE
DRAINAGE DITCH
DISTURBED GROUND (1988)
OLD OUTFALL PIPE
N748,000
INDICATED CORRECTED LOCATION OF FORMER PONDS
BURIED OUTFALL PIPE (1987)
6020
MANHOLE
6000
DISTURBED GROUND AND POSSIBLE PIT
6020
115
6000
RUBBLE PILES FOR COLLECTION BASIN (1988)
BERM
5980
RADIOLOGICAL CONTROLLED AREA
DITCH (1981)
SOUTH INTERCEPTOR
GEOPHYSICAL SURVEY BASE LINE
5980
5960
OVERHEAD POWER LINES
OLD METAL FLUME
5940
5960
6000
SPOIL FROM SID CONSTRUCTION
WOMAN CREEK
5980
FILL MATERIAL POST-SID CONSTRUCTION
5940
5920
5980
E2,081,000
E2,083,000
6000
5960

MAP LEGEND

- STREAMS DITCHES DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- 440 BUILDINGS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- LANDFILL AND DISTURBANCE POST - SID
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- INDICATED UNDISTURBED GROUND FROM Cs^{137} DATA
- TOTAL MAGNETIC FIELD > 54200 GAMMAS
- CONDUCTIVITY > 60 mMHOS/M

0 100 200

SCALE: 1" = 200'

SUMMARY OF ELECTROMAGNETIC AND MAGNETOMETER SURVEY DATA

TM6 - CPT AND DAT$_{z}$ TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G | 9208.15.01.16 | MARCH 1993 | FIGURE 1

APPROVED BY PJJ DATE: 3-19-93

P416189 460 P416289 460 444 P419689 654 440 P416489 P416589 P416789

WATER TREATMENT PLANT

B416689 MANHOLE DRAINAGE DITCH SURFACE DISTURBANCE EAST OF LANDFILL DISTURBED GROUND (1988)

N748,000 OLD OUTFALL PIPE 115 MANHOLE ABANDONED PRE-SID ROAD RUBBLE PILES FOR COLLECTION BASIN (1988)

DISTURBED GROUND AND POSSIBLE PIT INDICATED CORRECTED LOCATION OF FORMER PONDS BERM RADIOLOGICAL CONTROLLED AREA OLD METAL FLUME BURIED OUTFALL PIPE (1987) SOUTH INTERCEPTOR DITCH (1981)

OVERHEAD POWER LINES FILL MATERIAL POST-SID CONSTRUCTION SPOIL FROM SID CONSTRUCTION WOMAN CREEK

#50392 #50492 #50592 #50692 #50892 #50792 #51092 #50992

5786 7086 10481

52693 52993 52893 52793 53293 53193 53093 53393 53493 52593

6000 5980 5960 5940 5920 6040 6020

E2,081,000 E2,083,000

MAP LEGEND

- STREAMS DITCHES DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- 440 BUILDINGS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- LANDFILL AND DISTURBANCE POST - SID
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- 7086 EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- 0481 PRE - 1986 MONITORING WELL
- #50792 SOIL CORES AND BORINGS (INSTALLED DECEMBER, 1992 LOCATIONS APPROXIMATE)
- #52493 WELL POINT SITE

0 100 200

SCALE: 1" = 200'

EXISTING MONITORING WELLS, SOIL CORES, BORINGS, AND PROPOSED SHALLOW WELLPOINTS

TM6 - CPT AND BAT(E) TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

GO:G

0208.15.01.16

MARCH 1993

FIGURE 5

APPROVED BY PJS DATE 3-19-93

WATER TREATMENT PLANT
460
6040
460
444
654
440
-N-
SURFACE DISTURBANCE EAST OF LANDFILL
INDICATED LOCATION OF GAS LINE
SOV 100-FOOT SAMPLING GRID
MANHOLE
DRAINAGE DITCH 1955 - 1983
DISTURBED GROUND
N.748,095
ROCK PILE
STEEP SLOPE
747,995
OLD OUTFALL PIPE
115
MANHOLE
6020
6000
ABANDONED PRE-SID ROAD
CATTAILS
RUBBLE PILES FOR COLLECTION BASIN
747,895
6040
6020
INDICATED CORRECTED LOCATION OF FORMER PONDS
DISTURBED GROUND AND POSSIBLE PIT
747,795
6000
OLD METAL FLUME
JUNK CULVERT
5980
BURIED OUTFALL PIPE
BERM
RADIOLOGICAL CONTROLLED AREA
SOUTH INTERCEPTOR DITCH (1981)
747,695
GEOPHYSICAL SURVEY BASE LINE
5980
5960
INDICATED LOCATION OF GAS LINE
747,595
OVERHEAD POWER LINES
AIR MONITOR AND PROPANE TANK
AIR MONITOR AND PROPANE TANK
5960
5940
SPOIL FROM SID CONSTRUCTION
747,495
E.2,080,750
850
950
E.2,081,050
150
250
350
450
550
650
750
850
950
E.2,082,050
150
250
350
450
550
650
750
E.2,082,850
6000
WIRE PILE
BARBED WIRE
FILL MATERIAL POST-SID CONSTRUCTION
WOMAN
HEAVY BRUSH
HEAVY BRUSH
SOV 100-FOOT SAMPLING GRID
CREEK
5980
5940
5920
5980
E2,081,000
E2,083,000
6000
5960

MAP LEGEND

- STREAMS DITCHES DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- 440 BUILDINGS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, (PRE - SID)
- LANDFILL AND DISTURBANCE (POST - SID)
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- PROMINENT SURFACE FEATURES
- TOTAL MAGNETIC FIELD > 54200 GAMMAS
- SURVEY BASELINE
- PROPOSED 100-FOOT SOV SAMPLE GRID
- \+ PROPOSED 50-FOOT SOV SAMPLE GRID
- × PROPOSED 20-FOOT SAMPLE GRID

0 100 200

SCALE: 1" = 200'

PROPOSED SOV SAMPLING GRID

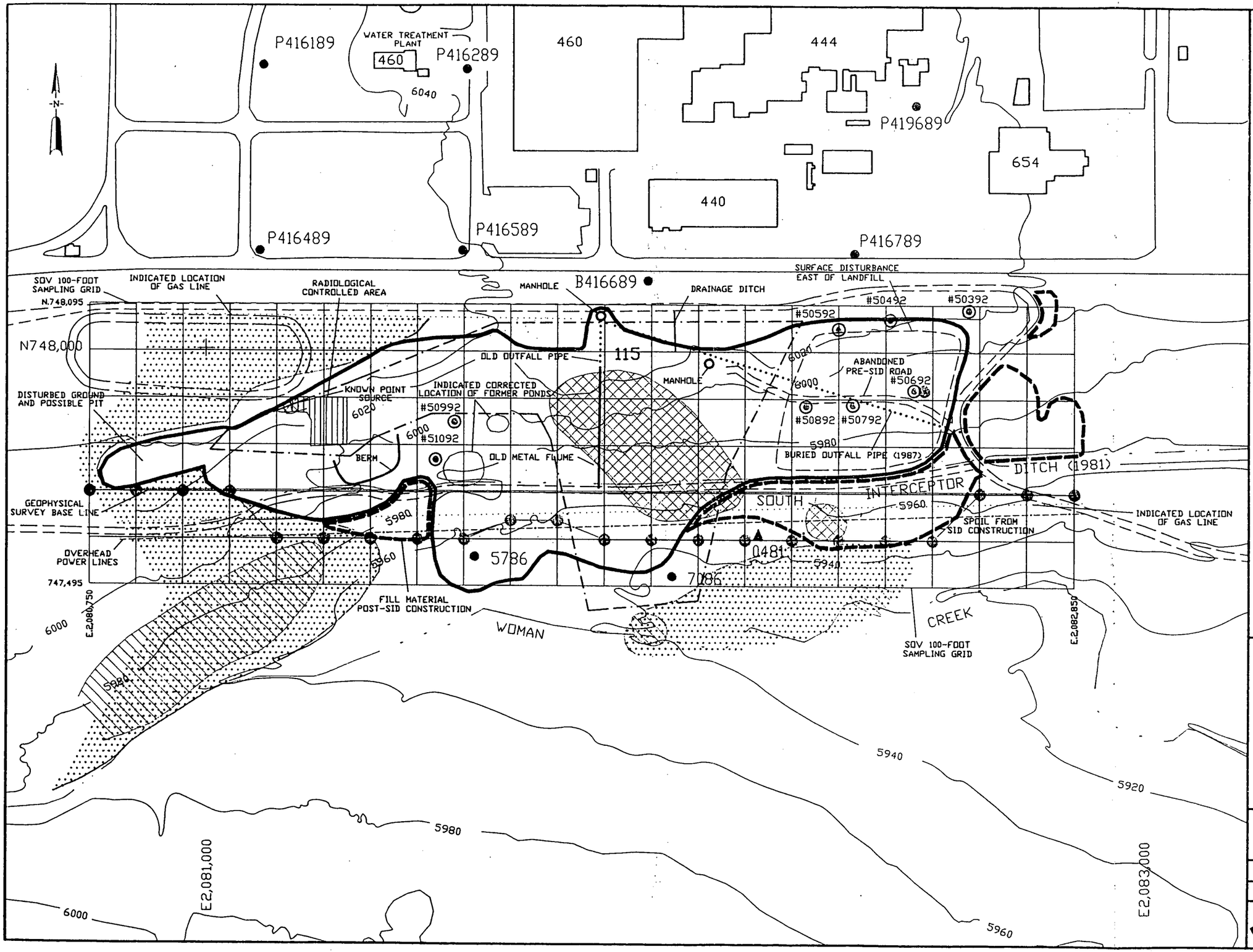
TM6 - CPT AND BAT TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

GE&G | 9208.15.01.16 | MARCH 1993 | FIGURE 6

OSTM6-6.DVG and OSTM6-6.PLT

APPROVED BY PJS DATE: 3-19-93



MAP LEGEND

- STREAMS DITCHES DRAINAGE FEATURES
- PAVED ROADS
- DIRT ROADS
- ORIGINAL LANDFILL AND SURFACE DISTURBANCE, PRE - SID
- LANDFILL AND DISTURBANCE POST - SID
- EPA/CDH LANDFILL BOUNDARY (Incl. IAG BOUNDARY OF IHSS 115)
- INDICATED UNDISTURBED GROUND FROM Cs^{137} DATA
- U^{238} ANOMALY (>4 pCi/g) PROBABLE AIRBORNE PARTICULATE SOURCE
- U^{238} ANOMALY (>4 pCi/g) ASSOCIATED WITH LANDFILL MATERIAL
- 7086 EXISTING ALLUVIAL GROUNDWATER MONITORING WELL
- 0481 PRE - 1986 MONITORING WELL
- #50792 SOIL CORES AND BORINGS (INSTALLED DECEMBER, 1992 LOCATIONS APPROXIMATE)
- CONE PENTROMETER TESTING (CPT) LOCATIONS

0 100 200

SCALE: 1" = 200'

PLANNED LOCATION OF CPT SITES

TM6 - CPT AND BAT® TESTING

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G | 9208.15.01.16 | MARCH 1993 | FIGURE 7

OS1M6-7.DVG