FINAL DRAFT
TECHNICAL MEMORANDUM NO. 9

ADDENDUM TO FINAL PHASE I RFI/RI WORK PLAN

Monitoring Well Installation Plan
Ash Pits 1-4, Incinerator and Concrete Wash Pad

Rocky Flats Plant
Woman Creek Priority Drainage

(Operable Unit No. 5)

EG&G ROCKY FLATS, INC.
P.O. Box 464
Golden, Colorado 80402-0464

Prepared for:

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

May 1993

TABLE OF CONTENTS

LIST OF FIGURES

Figure

LIST OF TABLES

Table

TITLE: Technical Memorandum No. 9
Monitoring Well Installation Plan -
Ash Pits 1-4, Incinerator, and Concrete Wash Pad

Approved By:

Name (Date)

1.0 INTRODUCTION

1.1 BACKGROUND

Monitoring wells are proposed as part of the Phase I RCRA Facility Investigation/Remedial Investigation (RFI/RI) of Operable Unit No. 5 (OU5) in the areas of the Ash Pits (IHSSs 133.1-133.4), Incinerator (IHSS 133.5) and Wash Pad (IHSS 133.6) (Figure 1) to characterize subsurface contamination.

The Incinerator, Ash Pits, and Concrete Wash Pad are located south-southwest of the main security area of the Rocky Flats Plant within the Woman Creek drainage (Figure 2). The Incinerator, which had a 10- to 20-foot tall stack, was located along the plant's original west boundary, off of the west access road. The Ash Pits are located to the south and east of the Incinerator, and the Concrete Wash Pad is located to the southwest of the Incinerator (Figure 2).

The area referred to as the "Ash Pits" extends approximately 1,200 feet along an east-west axis and 500 feet along a north-south axis. Within this area are four separate previously identified ash pits (IHSSs 133.1, 133.2, 133.3, and 133.4), and four other possible ash pits, covered trenches, or disturbed areas that have been identified through aerial photograph review and geophysical surveys (see Sections 2.1 and 2.4). Based on the review of aerial photographs, the geophysical survey, the initial HPGe survey, and soil borings drilled and sampled as part of the OU5 RFI/RI, the boundaries of the Ash Pits, the Incinerator, the Concrete Wash Pad, and other areas that appear to have been disturbed during some time in the past are shown on Figure 2. The Ash Pits and other disturbed areas are located on surfaces ranging from relatively flat to steep and are currently covered by tall grasses.

The Incinerator area occupies approximately 17,500 square feet and the Concrete Wash Pad area occupies approximately 37,500 square feet. The Concrete Wash Pad area is relatively flat with a slight slope to the south. The Incinerator area has an extremely irregular, hummocky surface that slopes to the south toward Woman Creek.

The Incinerator was used to burn general plant wastes, such as general combustible and noncombustible wastes, between the 1950s and 1968 (Rockwell, 1988). An estimated 100 grams of depleted uranium is also believed to have been burned in the incinerator (Owen and Steward, 1973). A review of aerial photographs revealed that the Incinerator was removed by 1969 and the entire area had begun to revegetate by 1971 (U.S. EPA, 1988). Ashes from the Incinerator were placed in the Ash Pits or were pushed over the side of the hill into the Woman Creek drainage and/or onto the Concrete Wash Pad (Rockwell, 1988).

The history of the Concrete Wash Pad has not been as well documented as the Ash Pits or Incinerator area. However, it appears that this area was used to dispose of waste concrete from trucks involved in the construction of the plant facilities. It is also likely that the concrete trucks were washed down in this area after delivering concrete. Potentially contaminated materials consisting of concrete debris and some ashes from the Incinerator were reported to have been pushed over the side of the hill onto the Concrete Wash Pad (U.S. DOE, 1992b).

1.2 PURPOSE AND SCOPE

The purpose of this Technical Memorandum (TM) is to provide a monitoring well installation program for the Ash Pits, Incinerator, Concrete Wash Pad, and recently identified disturbed areas (i.e. covered ash pits or trenches) that is consistent with the general guidelines presented in the OU5 Work Plan.

As a result of this program, monitoring wells will be installed in an effort to characterize the groundwater downgradient of the Ash Pits, Incinerator, and Concrete Wash Pad areas and to further characterize the contamination sources in the IHSS 133 series area. The aerial photograph review and geophysical survey were partially successful in delineating the boundaries of the individual IHSSs in the 133 series. The soil boring program verified the existence of most of the Ash Pits as shown on Figure 3.

The scope of the program as presented in the OU5 Work Plan specified a maximum of three alluvial monitoring wells to be placed downgradient of the ash pits between IHSS 133 and Woman Creek. The initial HPGe Survey, EM anomalies coincident with areas identified in the aerial photograph review, and selected soil borings have identified areas affected by selected IHSSs in the series. Groundwater appears to have been affected by some of these IHSSs as well. The information from these previous investigations will be used to position the three groundwater monitoring wells in optimum locations for evaluating groundwater contamination, contaminant migration, hydrogeologic setting, and nature and extent of groundwater contaminants originating from sources within the IHSSs.

This TM incorporates currently available information from the aerial photograph review, a review of logs of wells and boreholes drilled prior to OU5 RFI/RI field activities, the initial HPGe survey, the geophysical surveys, the soil boring program, wellpoints installed to measure water levels, the Inter-Agency Agreement (IAG), OU5 Work Plan, and EG&G Environmental Management Department (EMD) Operating Procedures (OPs).

2.0 PRELIMINARY FIELD WORK

Existing aerial photographs were reviewed, a geophysical survey was conducted, and 29 soil borings were drilled as part of Stages 1, 2, and 3 of the RFI/RI for IHSSs 133.1 - 133.6. The photographs were examined to assess the extent and period of operation of the Ash Pits, Incinerator, and Concrete Wash Pad.

An initial HPGe survey of the IHSS 133 series area was performed in the summer of 1992. The final HPGe survey is scheduled for completion during the spring of 1993. The HPGe system is used to estimate in-situ concentrations of radioactive elements and/or their daughter products.

The geophysical survey of IHSSs 133.1 - 133.6 was conducted during the fall of 1992 and consisted of magnetometer and electromagnetic surveys. The magnetometer survey was used to locate subsurface ferrous objects. Such objects may be an indication of buried waste, thereby indicating possible IHSS boundaries. Results from the electromagnetic (EM) survey indicated the presence of conductive materials, thus indicating possible buried waste. In addition, the EM survey can detect differences in the conductivity of geologic materials which would assist in delineating the size of trenches.

Soil borings were drilled to characterize, geologically and chemically, the cover and subsurface materials within and downgradient of the Ash Pits, Incinerator, and Concrete Wash Pad areas and to characterize the contamination sources within the IHSS 133 series area. Final selections of soil boring locations were based on the delineation of the IHSS boundaries from the results of aerial photograph review and the geophysical surveys. The results of these field activities as well as historical data reviews are presented below.

2.1 AERIAL PHOTOGRAPH REVIEW

A review of aerial photographs covering the IHSS 133 series area was completed during Stage 1 of the RFI/RI. The objective of this review was to substantiate the locations of the IHSSs as presented on Figure 7-3 of the OU5 Work Plan, to determine if additional suspect sites exist that should be included in future site investigations, and to determine the method in which the ashes were laid into the Ash Pits.

The aerial photographs used for this review were those contained in the AERIAL PHOTOGRAPHIC ANALYSIS COMPARISON REPORT, prepared by the U.S. Environmental Protection Agency (U.S. EPA) Environmental Monitoring Systems Laboratory in 1988 (U.S. EPA, 1988) as well as additional photographs obtained from RFP photography. These photographs were taken in the years 1953, 1955, 1964, 1971, 1978, 1980, 1983, 1986, and 1988. This review was conducted using both vertical and oblique aerial photographs of the area and resulted in revisions to the locations of IHSSs 133.2, 133.3 and 133.4. Other suspect sites were identified during the review. A subsequent visual field investigation determined that some of the suspect sites were dumped concrete rather than piles of ash.

The locations of IHSSs 133.1 through 133.6 (as determined in the aerial photographic review) are shown on Figure 2. IHSSs 133.5 (incinerator) and 133.6 (concrete wash pad) are easily identifiable in both the photographs and the field. These locations essentially agreed with the locations shown in the OU5 Work Plan. IHSS 133.1 was approximately located as shown in the OU5 Work Plan but consists of a concrete dump with no visible indications that an ash pit ever existed at this site, unless it was covered by the concrete. IHSSs 133.2, 133.3, and 133.4 were easily identified on the oblique photographs and their locations correlated well with sites that were visible on corresponding vertical photographs. These sites are shown on Figure 2. They did not agree with the sites shown on Figure 7-3 of the OU5 Work Plan.

Following the aerial photograph review, all sites were located on the ground using landmarks that were visible on the oblique photographs. Several of these landmarks (concrete pad, drainage ditch, etc.), shown on Figure 2, have been helpful in locating each IHSS during the field investigations.

Additional information that was acquired from the aerial photograph review includes the routes that were taken when driving into and out of the Ash Pits. An aerial photograph of Ash Pit 133.3 shows a roadway going into and out of the ash pit at the same point. An aerial photograph of Ash Pit 133.2 shows a road way circling the ash pit with one side of the circle nearing the edge of the pit. This information indicates that the ashes were simply dumped into the pits either from within the pit (133.3) or from off the edge of the pit (133.2). It also indicates that there are no homogenous layers of ash within the pits. None of the evidence obtained indicates that the ash was placed in a systematic fashion (i.e., lifts) in the pits.

2.2 HISTORICAL WELL AND BORING LOG REVIEW

As a part of the OU5 RFI/RI, a database of all well and borehole logs was built. A list of all wells and boreholes within the OU5 area was obtained from the Rocky Flats Environmental Database (RFED) and from EG&G EMD personnel. From this list, copies of well and borehole logs were collected.

A search of this database revealed only three borings in the vicinity of the IHSS 133 series area. No borehole logs were available for two of the borings (1374 and 1474). Borehole 5686 was located beside Woman Creek, south-southwest of IHSS 133.3. A review of this borehole log revealed that claystone bedrock was encountered at nine feet below ground surface and that no water was present at the time of drilling (presumably 1986).

2.3 HPGe SURVEY

The first of three radiation surveys of the IHSS 133 series area was initiated in the summer of 1992. This initial survey used tripod-mounted, single crystal, high purity germanium (HPGe) gamma-ray detector instruments. Locations were based on a 150-foot grid pattern. The initial survey, now complete, will be followed by a second HPGe survey utilizing six detector instruments arranged to count activity over a larger area. The third survey will be conducted using a field instrument for detecting low energy radiation (FIDLER) at anomalous areas identified by the two HPGe surveys.

The initial survey was conducted using instruments operating at a height of one meter. At this height, it is calculated that 90 percent of the detectable gamma-ray emissions originate within a counting area (field of view) having a radius of approximately 5 meters. The remaining 10 percent of gamma radiation detected by the HPGe, or any crystal based detector (i.e., sodium iodide FIDLER instruments), is assumed to originate outside the 5 meter counting area. The 150-foot grid spacing coupled with the 5 meter counting area give HPGe coverage of approximately 5 percent of the total surface area of the IHSS 133 series area. The second HPGe survey of the IHSS 133 series area will result in full coverage.

The HPGe system is used to estimate in-situ concentrations of radioactive elements and/or their associated daughter products. The naturally occurring elements included in the HPGe survey are uranium and thorium with their decay products, and radioactive potassium. Because some of the elements are either weak or non-gamma emitting, their in-situ concentrations must be extrapolated from their respective daughter (decay) products. The accuracy of the inferred concentrations are therefore dependent upon the equilibrium state of each of the elements at each survey station (location). In this survey the concentrations of radium 226 (Ra-226), thorium 232 (Th-232), and uranium 238 (U-238) are extrapolated (inferred) values expressed in picoCuries per gram (pCi/g). cesium 137 (Cs-137), americium 241 (Am-241), and plutonium 239 (Pu-239) were also included in the survey, with Cs-137 being the only isotope present in measurable quantities. The results of the surveys will be reported after the second HPGe survey has been completed.

12.4 GEOPHYSICAL SURVEYS AND SOIL BORINGS

2.4.1 Geophysical Survey Overview

Electromagnetic (EM) and magnetic field surveys conducted over the IHSS 133 series area were completed in mid-December, 1992. These data were used in preparing the soil boring sampling plan for the IHSS 133 series area (U.S. DOE, 1993) and subsequently this TM. Data acquired as a result of the geophysical surveys conducted within the entire IHSS 133 series area consisted of an EM31 vertical dipole conductivity contour map, an EM31 in-phase contour map, a total magnetic field contour map, a magnetic gradient contour map, and a map showing the surface features (concrete dumps, slabs, etc) encountered during the survey traverse (CRC, 1993).

The purpose of the EM31 survey was to determine if the material that was deposited in the ash pits would show a relatively lower conductivity than the surrounding sediments, therefore delineating the pit boundaries. The purpose of the magnetometer survey was to determine if ferromagnetic debris, including drums or parts of the incinerator, had been buried in the pits. This information was then used to delineate the pits and help determine where soil borings would be located. All data was acquired using a 12.5-foot line spacing and 10-foot station intervals. Only the contour interval was changed, as applicable, to enhance the definition of possible anomalous events.

The effective penetration depth of the EM31 is approximately 15 to 18 feet for the vertical dipole survey, and 5 to 8 feet for the horizontal dipole survey. Very little power line interference was experienced in the EM survey because the EM31 operates on a frequency of 9.8 KiloHertz, and incorporates 60 cycle filters to minimize the interference from power lines.

The effective penetration depth of the magnetometer depends on the size and depth of the buried object(s). The pits were estimated to be a maximum of 10 to 12 feet in depth, thus the survey was expected to be able to detect single drums or similar ferromagnetic objects. Due to the strong electromagnetic field (EMF) produced from the power lines, interference was expected in the proximity of the overhead lines.

Conductivity was measured using an EM31 in both a vertical and horizontal dipole mode. The vertical dipole conductivity, which was used exclusively to interpret the conductivity of the area, measures the conductivity of an induced EMF to determine the conductivity of the earth at a predetermined depth range (depending upon the horizontal spacing of the coils of the instrument being used). A high instrument response indicates the presence of a highly conductive material, which can include highly conductive groundwater, the presence of metallic debris, or a buried strata that is more conductive than the overlying or surrounding sediments.

The EM and the magnetometer surveys were partially successful in delineating or confirming the indicated locations of most of the individual IHSSs in the project area. The power line which crosses the area from west to east, and a branch line which turns to the north (located just to the west of the incinerator site), caused interference with the magnetic survey. Some usable data was acquired over the IHSSs located an adequate distance from the power lines to allow magnetic measurements of sufficient intensities to override the EMF interference produced by these power lines.

A surface survey was conducted by traversing the IHSS 133 series area. The traverse was tied to land surveyed base lines enabling landmarks such as the concrete pad (just to the west of IHSS 133.1) to be more accurately located. Slight adjustments were then made to some of the IHSS locations and other prominent features located within the IHSS 133 series area based on the traverse and the relocated landmarks. These changes resulted in improved correlations of some surface features with anomalies occurring on the EM and magnetic contour maps (Figure 2).

2.4.2 Soil Boring Program Overview

The soil boring program at the IHSS 133 series area was completed in late April, 1993. This program included the drilling of a total of 29 soil borings within or adjacent to the ash pits and other surface disturbances. The boreholes were drilled through the alluvium and six feet into bedrock. Table 1 lists these boreholes; their corresponding IHSS locations; total depths; depths to bedrock; and, if groundwater, ash or other material was encountered, its approximate depth interval. Borehole number designations have been abbreviated on the location maps. The borehole numbers and their associated abbreviations are shown on Table 1 also.

In addition to the 29 soil borings, an exploratory borehole program was initiated resulting in 14 shallow exploratory borings. Due to the narrow geometry of the ash pits and the limited historical information available, the exploratory program was necessary to more accurately locate those pit locations that were suspect. Up to four exploratory boreholes were drilled per proposed soil boring location. The first was placed at the proposed center borehole location. If no ash or incinerator related debris was found, another was drilled approximately 10 feet offset, and again, if no ash/debris was found, a third was drilled approximately 10 feet offset in the opposite direction. The exploratory boreholes were drilled to a maximum of 10 feet in depth, under the assumption that it was not likely that ash or debris would have been buried deeper than this. Also, if bedrock was encountered in an exploratory borehole prior to the 10 foot maximum, the exploratory boring was abandoned. Split spoon samples were taken from 5 to 7 feet and from 10 to 12 feet below ground surface. The recovery was visually checked for ash/debris and scanned with field instruments for radionuclide activity and organic vapors. If nothing was found after three attempts, the actual numbered boring was drilled and sampled six feet into bedrock as the original OU5 Work Plan directed. If ash/debris was found in the first or second exploratory borehole, drilling would cease and the actual numbered borehole would be offset approximately two feet and drilled and sampled to six feet into bedrock. Samples for laboratory analysis were not collected on the exploratory borings. The samples taken from the actual numbered boring was used to characterize its associated exploratory boreholes.

TABLE 1
IHSS 133 BOREHOLE SUMMARY TABLE

Borehole Number	Borehole Abbreviation	IHSS Number	Total Depth (Ft.)	Depth to Bedrock (Ft.)	Depth to Groundwater (Ft.)	Ash Interval (Ft.)
54893	48	133.6	15.0	8.1		
54993	49		14.0	8.0		
55093	50		14.5	8.6	5.0 - 8.0 Hydropunch	
55193	51	133.5	12.0	6.0		
55293	52		14.0	8.0		
55393	53		33.3	27.3		15.9 - 17.5
55493	54		36.2	29.9		
55593	55	133.4	30.0	24.0		
55693	56		29.0	23.0		15.5
55793	57		25.9	20.4		
55893	58		8.0	4.2		
55993	59		21.0	15.0		2.3 - 11.0*
56093	60		16.0	8.9		
56193	61	133.1	34.0	28.0		
56293	62	133.3	14.0	8.0		
56393	63		12.0	6.9	0.5/6.0 - 8.0 Hydropunch	0 - 6.9*
56493	64		10.0	4.6		
56593	65		19.0	13.6		
56693	66		9.0	2.5		
56793	67		18.0	10.9		

TABLE 1 - Continued
IHSS 133 BOREHOLE SUMMARY TABLE

Borehole Number	Borehole Abbreviation	IHSS Number	Total Depth (Ft.)	Depth to Bedrock (Ft.)	Depth to Groundwater (Ft.)	Ash Interval (Ft.)
56893	68	133.2	24.3	18.2		2.4 - 7.7*
56993	69		32.3	26.3	12.0 - 14.0 and 24.7 - 26.3	8.1 - 8.7
57093	70		37.1	33.9		
57193	71		18.5	12.5		
57293	72		30.9	26.4		
57393	73		30.2	24.8	Unknown	
57493	74	Pit and Disturbed Area	30.4	18.6	16.0 - 18.5 (Described as "very moist")	
57593	75		18.0	11.7		
58093	80	Rad Area	16.0	10.0	5.5	0 - 10.0*

*Radioactivity greater than background.

The purpose of the soil boring program was to characterize, geologically and chemically, the cover and subsurface materials within and/or downgradient of the Ash Pits, Incinerator, and Concrete Wash Pad areas and to characterize the contamination sources within the IHSS 133 series area. The soil borings were also intended to assist in assessing the lateral and vertical extent of the ash pits.

Further, these borings were drilled to determine the presence of groundwater, and if present, at what depth. This information was used to determine if groundwater is flowing through the material buried in the Ash Pits. At the locations where groundwater was encountered, groundwater samples were collected from the soil borings via the Hydropunch system. The Hydropunch system allows for sampling of groundwater at a location without the installation and development of a groundwater monitoring well. The data collected from the analysis of these samples will be used to assess if contaminants from the Ash Pits, Incinerator, and/or Concrete Wash Pad areas have affected groundwater in immediate contact with these areas. These laboratory analyses are not yet available.

The following sections discuss currently available information obtained from the geophysical surveys and the soil boring program on an IHSS by IHSS basis.

2.4.3 IHSS 133.1

There is some doubt as to whether there is anything present in the area designated IHSS 133.1. Neither the EM nor the magnetometer surveys of the area were able to substantiate its existence, thus the inferred ash pit probably does not exist. An on-site examination of the area found only small amounts of dumped concrete, with little or no indication of any surface disturbance. A small magnetic anomaly was identified that corresponds to an area of dumped concrete. Because drum lids were found in the area, the anomaly is probably attributed to metallic debris in or under the concrete. Further review of the AERIAL PHOTOGRAPHIC ANALYSIS COMPARISON REPORT (U.S. EPA, 1988) suggests that the northern pit of IHSS 133.3 may actually be the location of IHSS 133.1.

One borehole was drilled directly in the center of the area designated as IHSS 133.1. This area is shown on Figure 2. This borehole (56193), drilled to a depth of 34.0 feet, did not encounter any ash material or groundwater. The absence of ash material at this location substantiates the assumption resulting from previously conducted surveys that an ash pit does not exist within this area.

2.4.4 IHSS 133.2

Based on the previous investigations discussed in Sections 2.1 and 2.4, the area designated as IHSS 133.2 was expanded to include a previously undesignated area to the south of the power lines. This expansion added approximately the same amount of surface area to the IHSS as was indicated for the original IHSS 133.2 pit area (200 feet x 40 feet), thus doubling its size. A vertical aerial photograph taken on April 10, 1968, indicates that the initial north IHSS 133.2 pit area was approximately 150 feet in length. It appeared to be half covered in the photo. From this photograph, it also appears that the pit was filled by direct dumping, and that the material was not evenly distributed throughout the pit. Although both the north and south IHSS 133.2 pit areas are located within close proximity of the power lines, the magnetic survey resulted in a typical magnetic response to buried magnetic objects. This suggests the presence of metallic debris in the north pit. The magnetic data over the south pit was obscured by power-line interference, however, it was presumed that metallic debris exists in this area. The EM conductivity data did not delineate the trenches or disturbed ground in either area.

Magnetic objects or debris would not indicate the presence of ash, but would show that ferrometallic objects were buried. Photographs of the incinerator, taken just prior to its removal, showed metallic debris mixed in with the ash in the combustion chamber. This is an indication of the operating practices that existed at that time.

A magnetic low associated with the pit on the north side of IHSS 133.2 is a typical magnetic signature for large buried magnetic objects in the northern hemisphere. This is comparable to the magnetic anomalies found at IHSS 133.3 and IHSS 133.4, where each has a magnetic low located to the north of a magnetic high. In the case of IHSS 133.2, the magnetic high was obliterated by power-line interference. However, a sensor height test conducted over IHSS 133.2 showed that the response was the same with the detector height set at four feet, six feet, or eight feet. Under normal conditions (no metallic objects present), the highest detector position would pick up the power-line interference before the lowest detector position resulting in a staggered response plot.

Six boreholes were drilled in IHSS 133.2. Their total depths and depths to bedrock are presented in Table 1. As discussed above, this IHSS includes the original ash pit and a second trench located to the south of the ash pit (Figure 2). Two boreholes, 56893 and 56993, located at the western end and center of the original (north) ash pit, encountered ash in the intervals from approximately 2 to 8 feet below ground surface and 8 to 9 feet below ground surface respectively (Figure 3 and Table 1). None of the other boreholes within the designated IHSS 133.2 area encountered ash. Groundwater was encountered in Boreholes 56993, 57093, and 57393 as shown on Figure 3. Approximate depths to groundwater ranged from 12 to 25 feet below ground surface (Table 1). The depth of the water bearing zone in Borehole 57393 is not known, as water was not detected until abandonment procedures. It is assumed that the water came from a gravelly layer just above the bedrock at a depth of 23 feet below ground surface.

2.4.5 IHSS 133.3

The area designated as IHSS 133.3 has been modified to include two trenches within the IHSS boundary. Vertical aerial photographs taken on October 10, 1964, and April 15, 1966, show an open trench on the north with its approximate center as indicated on Figure 2. A vertical photograph taken on April 10, 1968, shows what appears to be a second filled trench approximately 40 feet to the south of the original trench. The approximate center of this trench is also shown on Figure 2. A vertical photo taken on August 7, 1969, shows a large reclaimed area that was large enough to accommodate both trenches. Further review of the AERIAL PHOTOGRAPHIC ANALYSIS COMPARISON REPORT (U.S. EPA, 1988) suggests that the northern pit of IHSS 133.3 may actually be the location of IHSS 133.1.

As a result of the geophysical study, well defined magnetic anomalies were seen that correspond to the location of the southern pit shown on Figure 2. The configurations and sizes of the anomalies indicate that metallic debris was not uniformly distributed throughout the trench. Data over the north pit area was distorted by power-line interference.

The EM survey data defined an area of relative high conductivity at IHSS 133.3. This high conductivity was interpreted to be related to the varying saturation of alluvial sediments, which can vary from clay to gravel within the general area. The conductivity data was not interpreted to delineate the trenches identified on the aerial photographs because the material filling the trenches and the sediments surrounding the trenches are probably similar and equally saturated. Although the trenches were not delineated based on the EM data, a disturbed area corresponding to IHSS 133.3 was visually identified on the ground.

Six boreholes were drilled in the area designated as IHSS 133.3. As discussed above, this IHSS is believed to include two trenches with the original ash pit in the north trench (IHSS 133.1) and a second trench located to the south (IHSS 133.3) (Figure 2). Borehole 56393 encountered ash in the interval from 2 to 5 feet below ground surface, and groundwater from approximately 0.5 to 5 feet below ground surface (Figure 3). None of the other boreholes within the area designated as IHSS 133.3 encountered either ash or groundwater (Table 1).

2.4.6 IHSS 133.4

The boundary of the area designated as IHSS 133.4 has been expanded to include an apparent disturbed area extending to the northeast from the original trench area (Figure 2). The sizes of the two areas were estimated to be 180 feet x 40 feet and 190 feet x 40 feet, respectively.

The EM data supported the estimate of the locations of the disturbed areas. The data appeared to be reliable enough to support a slight site modification to the boundary of the IHSS (Figure 2). A well defined elongated magnetic anomaly was recorded over IHSS 133.4, probably indicating the presence of magnetic debris within the east-west pit. The configuration of the anomaly also indicates a moderately uniform distribution of metallic debris throughout the trench. No significant anomalies were detected over the northeast area which is subject to EMF interference from the power lines.

Six boreholes were drilled within the area designated as IHSS 133.4. As discussed above, this IHSS includes the original ash pit and a second suspected trench located to the northeast of the ash pit (Figure 2). Borehole 55993, located in the center of the northeastern trench encountered ash in the interval from 2.3 to 9.3 feet below ground surface (Figure 3). Borehole 55693 also encountered a small amount of material that may be ash at 15.5 feet below ground surface. None of the remaining boreholes within the designated IHSS 133.4 area encountered ash; however, an exploratory borehole (55793A), offset approximately 12 feet to the north of Borehole 55793, encountered asbestos containing material at depths from five to seven feet (Figure 3). None of the boreholes within the IHSS 133.4 boundary encountered groundwater.

2.4.7 IHSS 133.5

The area designated as IHSS 133.5, which includes the old incinerator site, consists of a broad area covered with gravel and cement rubble piles with scattered metallic debris. Vertical and oblique aerial photographs taken in 1966, show the incinerator while it was in operation. Its approximate location has been plotted on Figure 2. Anomalies occurring on the EM survey maps coincide with the plotted location of the incinerator. This indicates that the foundation and floor of the incinerator were left in place when it was demolished. The magnetometer data did not fully delineate the site, but contained some weak anomalies that may correspond to the buried foundation.

The topography, as it originally existed within the IHSS 133 series area, can be interpreted from the EM conductivity map. Old topographic highs (now covered with fill) are shown as areas of low conductivity (presumably due to a greater thickness of coarser unsaturated alluvial material) and the drainage ways and topographic lows are shown as areas of higher conductivity (composed of mixed, possibly more saturated alluvial sediments). Information obtained from the EM vertical dipole conductivity survey clearly defines the topography of the area and the previously existing road that was located below the incinerator. The floor and foundation of the incinerator occur as a rectangular shaped low conductivity anomaly surrounded by a high conductivity halo on both the EM conductivity and in-phase maps that are provided in the final geophysical report (CRC, 1993).

The reliability of the magnetic data varies from good to questionable because of the north-south power lines that cross the site on the west side. The best interpretation that could be made from this data is that some anomalies occurring in the vicinity of the incinerator site, which are assumed to be far enough away from the power lines to override any EMF interference, may be attributed to shallow or surface metallic debris.

Two boreholes were drilled in the area designated as IHSS 133.5 and two boreholes were drilled downslope of IHSS 133.5 (Figure 2). Of the four boreholes that were drilled in the vicinity of this IHSS, only one borehole (55393) encountered material that may be ash. This finding, however, is questionable due to its depth (15.9 feet) and location. None of the boreholes that were drilled in or adjacent to the area designated as IHSS 133.4 encountered groundwater (Figure 3).

2.4.8 IHSS 133.6

The area designated as IHSS 133.6 encompasses the concrete wash pad area that was active during the 1950's. The general configuration of the site was derived from vertical aerial photographs (Figure 2). The concrete appeared to be the thickest along the north side where the trucks were probably dumped and washed out.

The site was partially delineated by the EM survey. The vertical dipole conductivity map survey indicated an area of low conductivity that probably coincides with the area of thick concrete cover. This area grades into a larger area of higher conductivity that probably indicates more conductive or partially saturated alluvial sediments that underlie the dump area.

The magnetic survey detected a strong magnetic anomaly occurring along the north side of the area that appears to be outside of the interference from the power lines. Continuing to the south, this anomaly grades into a band of lower magnetic intensities. The perimeter of the site was mapped at background levels with no significant anomalies. Based upon the above configuration, it can be assumed that some magnetic metallic debris was buried or dumped along the north half of the site.

Three boreholes were drilled downslope of the area designated as IHSS 133.6 (Figure 2). No suspected ash material was encountered in the three boreholes. One borehole (55093) encountered groundwater (Figure 3).

2.4.9 Pit and Disturbed Area

A previously undocumented pit and disturbed area was identified by the aerial photograph review (Figure 2). During the implementation of the soil boring program, two boreholes were drilled in this area. No suspected ash material was encountered in either of these two boreholes. Groundwater was encountered in Borehole 57493 at a depth of approximately 16 feet below ground surface.

2.4.10 HPGe Anomaly

A previously undocumented waste disposal area was identified by the initial HPGe survey. One borehole (58093) was drilled within this anomaly. This borehole encountered waste material in the form of ash, broken glass, and metallic debris. It also encountered groundwater.

2.5 WELLPOINTS

Alluvial groundwater levels near selected sections along the creek within the IHSS 133 series area are being measured at locations consistent with those used for surface-water gain/loss measurements associated with OU5 RFI/RI surface water studies. These measurements are being made using temporary shallow wellpoints driven into the alluvium at the edge of, or in lines perpendicular to, Woman Creek. The locations of the wellpoints installed in the vicinity of the

IHSS 133 series area are shown on Figure. Borehole numbers 51393 through 52293, and 52593 represent wellpoints whose water level measurements were considered for this TM.

2.6 ADDITIONAL INVESTIGATIONS

Interviews were conducted in an attempt to acquire information about the operational history of the ash pits. Employees who worked at the ash pits during the early 1960's, indicated that the ashes were collected at the Incinerator in a dumpster. The dumpster was then transported to one of the ash pits and dumped. There was no spreading of the ashes, therefore it is assumed that there are no homogenous layers of ash in the ash pits.

3.0 MONITORING WELL INSTALLATION PROGRAM

Groundwater monitoring wells will be installed to characterize the hydrogeologic setting in the vicinity of the IHSS series area and to monitor alluvial groundwater conditions downgradient. These wells will be sampled after completion and development, and the results will be included in the Phase I OU5 RFI/RI Report.

Activities related to the Monitoring Well Installation Program will be carried out in accordance with all applicable EMD OPs. The following EMD OPs are applicable to this Program:

- FO.02 Field Document Control
- FO.03 General Equipment Decontamination
- FO.04 Heavy Equipment Decontamination
- FO.05 Handling of Purge and Development Water
- FO.06 Handling of Personal Protective Equipment
- FO.07 Handling of Decontamination Water and Wash Water
- FO.08 Handling of Drilling Fluids and Cuttings
- FO.10 Receiving, Labeling, and Handling Waste Containers
- FO.11 Field Communications

- FO.12 Decontamination Facility Operations
- FO.14 Field Data Management
- GW.01 Water Level Measurements in Wells and Piezometers
- GW.02 Well Development
- GW.06 Groundwater Sampling
- GT.01 Logging Alluvial and Bedrock Material
- GT.02 Drilling and Sampling Using Hollow-Stem Auger Techniques
- GT.03 Isolating Bedrock from the Alluvium with Surface Casing
- GT.05 Plugging and Abandonment of Boreholes
- GT.06 Monitoring Well and Piezometer Installation
- GT.10 Borehole Clearing
- GT.15 Geophysical Borehole Logging
- GT.17 Land Surveying
- GT.22 BAT In-Situ Sampler (Proposed)

3.1 MONITORING WELL LOCATIONS

As specified in the Work Plan, three monitoring wells will be drilled, installed, developed, and sampled downgradient of the ash pits between the IHSS 133 series area and Woman Creek. It is assumed that these wells will be not greater than 30 feet deep. The wells will be screened in the saturated section of the alluvium. If water-bearing sandstone is found beneath the alluvium, one of the three wells will be completed in the sandstone at that location. If there is no saturated alluvium at a site, either a BAT sampler or equivalent will be installed for vadose zone sampling.

Proposed monitoring well locations have been selected for this TM based on the results of the aerial photograph review, the HPGe survey, the geophysical surveys, the soil boring program, wellpoint water level data, and by field reconnaissance as discussed in Section 2.0 of this TM. The proposed locations are depicted on Figure 3.

Three cross sections were developed from field logs of the soil borings discussed in Section 2.4. The locations of these cross sections are shown on Figure 3. Cross Section A-A' traverses the IHSS 133 series area from north to south (Figure 4). Cross Sections B-B' and C-C' traverse the area from west to east (Figures 5 and 6).

The proposed locations of the three monitoring wells shown on Figure 3 result from interpretations of the cross sections to determine potential groundwater flow paths. Flow paths of particular interest were those originating from or going through areas that were known to have contained ash or waste material.

The proposed eastern well location (location A) was selected based on a number of factors. Two of the six boreholes within the area designated as IHSS 133.2 encountered ash and three encountered groundwater (Figure 3). Cross Sections B-B' and C-C' illustrate what may be interpreted as an alluvial channel incised in bedrock beneath IHSS 133.2 (Figures 5 and 6). A well located in this possible channel will presumably characterize groundwater percolating through contamination associated with IHSS 133.2. It is possible that groundwater percolating through the disturbed area located to the northeast of IHSS 133.2 could also be characterized because bedrock appears to slope from the disturbed area toward the channel (Figure 6).

The proposed center monitoring well (location B), positioned to the south of the HPGe anomaly, was located in an attempt to characterize groundwater that may have percolated through IHSSs 133.4, 133.3, and HPGe anomaly (Borehole 58093 was drilled directly in the center of this anomaly) (Figure 3). The direction of flow of groundwater affected by contaminants detected in Borehole 56393 is interpreted to be to the southwest. This interpretation is based on an interpretation of bedrock surface topography and the lithology of the alluvium within the IHSS 133.3 area. Field borehole logs from Boreholes 56393, 56493, 56793, and 56693 indicate that the alluvial materials are predominantly clay. The alluvial material in Borehole 56593 is clayey to silty sands and clayey to sandy gravels from four feet below ground surface to bedrock. This, together with this boring's depth to bedrock, appears to allow a preferential flow path to the southwest. A bedrock low beneath Borehole 58093 is a potential flow path for the contaminants associated with this boring (Figure 6). It is assumed that bedrock slopes to the south, directing groundwater within this channel toward the proposed well location B. The low point in the top of bedrock in the area of Borehole 55993 is interpreted to be evidence that weathered bedrock was excavated to form the ash pit (Figure 6). Bedrock in the area of Borehole 55993 is assumed to slope to the south. Groundwater in the area of Borehole 55993 is assumed to flow to the southeast. The proposed location of this center well is believed to be the optimum location for the confluence of these three flow paths.

The proposed west well location (location C) was chosen in an effort to characterize groundwater travelling to the southeast from the IHSS 133.4 boreholes west of Borehole 55993. It is presumed that groundwater would flow to south and east from these boreholes. This is based on the probable slope of bedrock, and the flow of Woman Creek to the east. No geologic control (borehole logs) exists to verify this assumption.

The drilling and soil sampling, well installation, and well development techniques that will be implemented during this monitoring well installation program are described in detail in the following sections.

3.2 DRILLING PROCEDURES

Hollow-stem augers will be used for advancing boreholes. With this technique, samples will be obtained either with standard split spoon or California drive samplers, or with a continuous core augering technique. The continuous coring technique can obtain up to 5-foot-long cores in a 5-foot-long sample barrel provided the geologic material is fairly cohesive. Drive sampling will obtain an 18- to 24-inch-long sample depending on the length of the sampler. Visual logging of the alluvial and bedrock materials will be performed according to OP GT.1, Logging Alluvial and Bedrock Material (EG&G, 1992a). All sampling equipment will be protected from the ground surface with clear plastic sheeting. Drilling and sampling equipment and materials that will be available will be as specified in OP GT.2, Drilling and Sampling Using Hollow-Stem Auger Techniques (EG&G, 1992b). Drilling and sampling activities will be conducted in accordance with the Site-Specific Health and Safety Plan.

All drilling equipment, including the rig, water tanks, augers, drill rods, samplers, etc., will be decontaminated before arrival at the work site (i.e. any area to be investigated within OU5). Between boreholes, all down-hole equipment will be decontaminated, and sampling equipment will be decontaminated between samples. The drill rig will be decontaminated between each monitoring well installation. Equipment will be inspected for evidence of fuel oil or hydraulic system leaks (See OP FO.3, General Equipment Decontamination (EG&G, 1992c), and OP FO.4, Heavy Equipment Decontamination (EG&G, 1992d)). If lubricants are required for down-hole equipment, only pure vegetable oil will be used.

Before drilling, boring locations will have been numbered and identified using stakes. Utility clearance will have been accomplished according to OP GT.10, Borehole Clearing (EG&G, 1992e). The results of the geophysical survey will also be reviewed in an attempt to locate possible buried metal objects at each boring location.

After borehole locations have been cleared and obstructions removed, an exclusion zone will be established according to the Site-Specific Health and Safety Plan, and the drill rig will be set up. The boring will be advanced to the depth indicated and sampled according to Section 3.3.

The borings will be logged lithologically by examination and geologic classification of the samples. Documentation will be completed by the site geologist according to Section 8.0 of OP GT.2, Drilling and Sampling Using Hollow-Stem Auger Techniques (EG&G, 1992b). OP GT.1, Logging Alluvial and Bedrock Material (EG&G, 1992a), describes procedures for material classification and borehole logging.

During the drilling and while the augers are being removed, the cuttings and unsaved portions of samples from the boring will be containerized according to OP FO.8, Handling of Drilling Fluids and Cuttings (EG&G, 1992f), and OP FO.9, Handling of Residual Samples (EG&G, 1992i).

3.3 MONITORING WELL INSTALLATION PROCEDURES

As specified in the IAG, groundwater monitoring wells will be installed according to OP GT.6, Monitoring Wells and Piezometer Installation (EG&G, 1992h) and as outlined below.

Water table wells will have screens of sufficient length and at the appropriate depth to monitor the water table. Wells with slow recharge will have sufficient screen area to allow adequate sample volume. Screened intervals across different hydrostratigraphic units will be avoided, particularly where there is a potential for cross-contamination to occur (EG&G, 1992h).

Well casings will consist of new, threaded, flush-joint schedule 40 poly-vinyl chloride (PVC). The well casing will extend from the top of the well screen to approximately 2 feet above ground surface. The tops of all well casings will be fitted with slip-on or threaded PVC caps. All joints within the casing string will be threaded. O-rings or Polytetra flouroethylene (PTFE) tape will be wrapped around the joint threads to improve the seal. All well casings will be steam cleaned and stored in plastic sleeves prior to use (EG&G, 1992h).

Well screens will consist of new threaded PVC pipe with 0.010-inch factory-machined slots or wrapped screen. All well screens will have an I.D. equal to or greater than that of the well casing. The wall thickness will be the same as the well casing. A 2-foot deep sediment sump will be used beneath the screen. A threaded or slip-on cap secured with stainless steel screws will be provided at the bottom of the sump (EG&G, 1992h).

The filter pack material will be chemically inert, rounded, silica sand of approximately 16-40 gradation. The filter pack will extend approximately 2 feet above the top of the screen unless otherwise specified. Where the thickness of the alluvium is insufficient, the top of the filter pack may extend 6 inches above the top of the screen (EG&G, 1992h).

A bentonite seal will be installed above the filter pack. The seal will consist of a layer of bentonite pellets that is at least 3 feet thick when measured immediately after placement, without allowance for swelling (EG&G, 1992h).

The annular space between the well casing and the borehole will be grouted from the top of the bentonite seal to ground surface (EG&G, 1992h).

OP GT.6, Monitoring Wells and Piezometer Installation (EG&G, 1992h) provides details on the actual installation procedures to be used.

3.4 MONITORING WELL DEVELOPMENT PROCEDURES

Monitoring wells will be developed for groundwater sampling and aquifer testing purposes as specified in OP GW.2, Well Development (EG&G, 1992i). Procedures for the development of wells to be used during aquifer testing activities will be designated by the aquifer testing hydrogeologist/hydrologist. Should these procedures differ from those specified in OP GW.2, the project hydrogeologist/hydrologist will secure a Document Change Notice (DCN) to the OP through the EG&G Project Manager.

Monitoring Well development is the process by which the well drilling fluids and mobile particulates are removed from within and adjacent to newly installed wells. The objective of a completed well development activity is to provide groundwater inflow that is as physically and chemically representative as possible of the aquifer that is open to the piezometer or well (EG&G, 1992i).

Well development will be conducted as soon as practical after installation, but no sooner than 48 hours after grouting and pad installation is completed. Monitoring wells will be developed utilizing low energy methods. An inertial pump or bottom discharge/filling bailer will be used in development activities (EG&G, 1992i).

All newly installed wells will be checked for the presence of immiscible layers prior to well development. Once determined free of an immiscible layer, a water level measurement will be taken according to OP GW.1, Water Level Measurements in Wells and Piezometers (EG&G, 1992j), and well development activities will continue. The water level measurement along with the total depth measurement will be used to determine the volume of water in the well casing (EG&G, 1992i).

Formation water and fines will be evacuated by slowly lowering and raising the inertial pump or bailer intake throughout the water column. Development equipment will be protected from the ground surface with clear plastic sheeting. Development equipment, including bailers and pumps, will be decontaminated before well development begins and between well sites according to OP FO.3, General Equipment Decontamination (EG&G, 1992c).

Estimated recharge rates will be measured following the procedures outlined in OP GW.1, Water Level Measurements in Well and Piezometers (EG&G, 1992j).

3.5 DECONTAMINATION

Generalized equipment decontamination procedures will include decontamination of sampling equipment and decontamination of drilling equipment.

Decontamination of sampling equipment will be conducted between individual sampling points to minimize potential cross-contamination. Sampling equipment will be decontaminated according to OP FO.3, General Equipment Decontamination (EG&G, 1992c). During drilling and sampling, decontaminated equipment will be placed on new plastic or racks until used. At least two sets of samplers will be available so that one set can be used while the other is being decontaminated.

Decontamination of augers, drill stems, drill bits, and other down-hole equipment will be conducted after each boring is complete. The drill rig will be decontaminated when moved out of the IHSS 133 series area or when it becomes unusually dirty as a result of site or drilling conditions, at the discretion of the site or project manager. Decontamination of drilling equipment is described in more detail in OP FO.4, Heavy Equipment Decontamination (EG&G, 1992d).

3.6 DOCUMENTATION

Information required by the OPs related to monitoring well drilling and installation will be reported on their associated forms as specified in the OPs. The required forms specific to monitoring well drilling and installation include:

- Borehole Log Form (Form GT.1A)
- Hollow-Stem Auger Drilling Field Activities Report Form (Form GT.2A)
- Groundwater Monitoring Well and Piezometer Report (Form GT.6A)
- Well Development and Sampling Form (Form GW.2A)

3.7 SAMPLING PROCEDURES

Two possible methods for collecting core and environmental samples are the continuous core method and the drive sample method. The continuous coring method advances a split barrel that is contained within the lead auger. The augers rotate around the sampler and cut while the sample barrel is prevented from rotating. Continuous core samples are collected in the barrel. The drive sample method collects the core sample through the center of a hollow-stem auger. The auger, assembled with a center bit, drills to the desired sample depth. The center bit is then removed and the drive sampler is inserted through the augers. The 18- or 24-inch split barrel sampler is then driven with a 140-pound hydraulic or manually operated hammer to collect the sample. Drive samples will be obtained in general accordance with ASTM Designation D 1586 and OP GT.2, Drilling and Sampling Using Hollow-Stem Auger Techniques (EG&G, 1992b).

The drive sample method is the method that will be used unless conditions require that the continuous core method be used. Examples of conditions requiring the use of continuous core may include poor core recovery, the inability to drive the sampler, or when, in the driller's judgement, continuous core sampling would obtain better recovery. Once the drive sampler or the core barrel has been removed from the borehole, it will be opened, scanned for radionuclides with both an alpha and a beta-gamma detector, scanned for organic vapors with a photo-ionization detector, and measured.

Soil samples will be collected from ground surface to the first bedrock interval collected. Six-foot composite samples will be collected during drilling and analyzed for TAL metals, total uranium, plutonium, americium, gross alpha, and gross beta as specified in the OU5 Work Plan. In order to collect these composite samples, the recovered material will be placed in a safe location, out of direct sunlight, until three consecutive 2-foot, or four consecutive 18-inch drive samples have been collected. Once the three consecutive drive samples have been collected, the recovered material will then be classified, logged, peeled, disaggregated and mixed into a six-foot composite, and placed in appropriate containers for laboratory analysis according to OP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1992k). Procedures for sample peeling, handling and compositing will be followed according to OP GT.2, Drilling and Sampling Using Hollow-Stem Auger Techniques (EG&G, 1992b).

An alternative sampling method to be followed will be composite sampling based on lithology as opposed to six-foot intervals. The rig geologist will be responsible for implementing this method provided there is a distinct visible lithologic difference between natural geologic materials, fill, ash material and/or visible changes within the ash layer(s). If this distinction can be made during drilling operations, composite samples will be made up of natural geologic materials and artificial fill, and ash materials, separately, and possibly separate subsamples within the ash layer(s) if visible changes occur.

Groundwater sample collection will be performed in accordance with OP GW.06 Groundwater Sampling. The groundwater will be sampled and analyzed for:

total uranium
gross alpha and gross beta
TAL metals

Field measurements will be measured at the time of sample collection and will include:

pH
specific conductance
temperature
dissolved oxygen
barometric pressure

If the amount of groundwater is limited, collection of the analytes will be prioritized in the following order: total uranium (requiring 100 ml), gross alpha and gross beta (requiring 550 ml), and total TAL metals (requiring 1 L). The groundwater samples are being analyzed for the same analytes as the soil samples provided enough water is available. Samples will be handled according to OP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1992k).

Quality assurance/quality control (QA/QC) samples will also be collected to assure that the QA/QC procedures are followed according to the Quality Assurance Project Plan (QAPjP), the site-specific Quality Assurance Addendum (QAA), and the QC requirements presented in OP FO.13.

3.7.1 Sample Containers and Preservative

In accordance with OP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1992k), only sample containers certified as clean by the manufacturer will be used for sample collection. The containers and preservatives will be obtained from the contracted analytical laboratory, their designated supplier, or a suitable chemical supply company. Any preservative(s) required will be added to the container by the contracted analytical laboratory or the field sample manager prior to or during sample collection.

Subsequent to sample collection the exterior of the sample containers will be decontaminated according to OP FO.3, General Equipment Decontamination (EG&G,1992c), and placed in coolers lined with a plastic bag dedicated for sample and sample container transportation. Blue ice (or an equivalent) will be placed in the coolers.

Official custody of samples will be maintained and documented from the time of collection until the time that valid analytical results have been obtained or the laboratory has been released to dispose of the sample. Chain-of-custody procedures will be in accordance with OP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1992k).

4.0 DATA REDUCTION AND REPORTING

Prior to reporting any data, data validation must be performed. Guidelines used to evaluate analytical data are referenced in subsection 3.4.2 of Section No. 3.0 of the QAPjP. The laboratory validation process is also illustrated in Figure 3-1 of Section No. 3.0 of the QAPjP. Field data validation will be performed as specified in subsection 3.4.2 of Section No. 3.0 of the

QAPjP. The Data Quality Objectives (DQOs) for validating the OU5 measurement data are presented in the OU5 Work Plan (U.S. DOE, 1992a).

Reduction of field and laboratory data shall comply with OP FO.14, Field Data Management, and the data reduction functions summarized in subsections 3.4.1 of Section No. 3.0 of the QAPjP. Laboratory data reduction will comply with the data deliverable requirements specified in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP). Field data reduction shall be used in the data validation process to verify that the laboratory field controls and DQOs for measurement of data have been met.

Depending on the data validation process, data are flagged as either "valid", "acceptable with qualifications", or "rejected". The results of the data validation shall be reported in the EMD Data Assessment Summary reports. The usability of data (the criteria of which is also described in subsection 3.3.7 of Section No. 3.0 of the QAPjP) shall also be addressed by the EG&G RFI/RI Project Manager.

5.0 REFERENCES

Coleman Research Corporation (CRC), 1993. Surface Geophysical Surveys, Operable Unit No. 5 (OU5), IHSS 155 and IHSS 133, February 1, 1993.

EG&G, 1991. Environmental Restoration Program (ERP) Quality Assurance Project Plan For CERCLA Remedial Investigations/Feasibility Studies and RCRA Facility Investigations/Corrective Measures Studies Activities, May 5, 1991.

EG&G, 1992a. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) GT.1, Revision 2, Logging Alluvial and Bedrock Material, March 1, 1992.

EG&G, 1992b. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) GT.2, Revision 2, Drilling and Sampling Using Hollow-Stem Auger Techniques, March 1, 1992.

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

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

EG&G, 1992e. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) GT.10, Revision 2, Borehole Clearing, March 1, 1992.

EG&G, 1992f. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) FO.8, Revision 2, Handling of Drilling Fluids and Cuttings, March 1, 1992.

EG&G, 1992g. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) FO.9, Revision 2, Handling of Residual Samples, March 1, 1992.

EG&G, 1992h, Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) GT.6, Revision 2, Monitoring Well and Piezometer Installation, March 1.

EG&G, 1992i, Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP), GW.2, Revision 2, Well Development, March 1.

EG&G, 1992j, Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) GW.1, Revision 2, Water Level Measurements in Wells and Piezometers, March 1.

EG&G, 1992k. Environmental Management Department (EMD) Operating Procedures Manual-Operating Procedure (OP) FO.13, Revision 2, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples, March 1, 1992.

Owen, J.B. and L.M. Steward, 1973. Environmental Inventory: A Historical Summation of Environmental Incidents Affecting Soils at or Near the USAEC, Rocky Flats Plant. Dow Chemical Company, Rocky Flats Division, draft report.

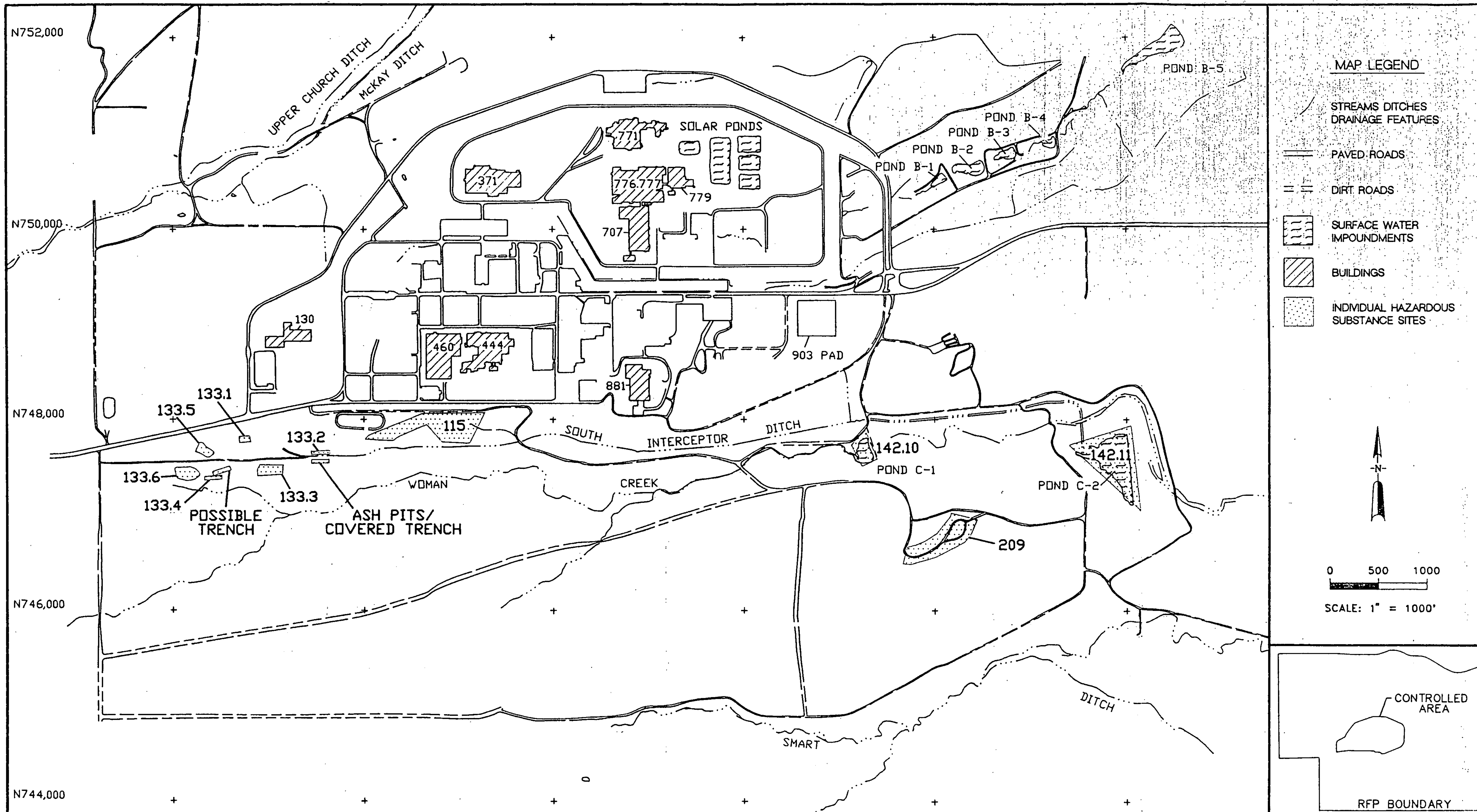
Rockwell International, 1988. Draft Remedial Investigation and Feasibility Study Plans for Low Priority Sites. Rocky Flats Plant, Golden, Jefferson County, Colorado. Vol. 1, June 1988.

U.S. Department of Energy (U.S. DOE), 1992a. Phase I RFI/RI Work Plan - Woman Creek Priority Drainage Operable Unit No. 5. Manual 21100-WP-OU 05.1. Vol. 1. February 1992.

U.S. Department of Energy (U.S. DOE), 1992b. Historical Release Report For The Rocky Flats Plant Vol. 1. June 1992.

U.S. Department of Energy (U.S. DOE), 1993. Technical Memorandum No. 7, Addendum to Final Phase I RFI/RI Work Plan, Soil Boring Sampling Plan -- Ash Pits 1-4, Incinerator and Concrete Wash Pad, Rocky Flats Plant, Woman Creek Priority Drainage (Operable Unit No. 5), February, 1993.

U.S. Environmental Protection Agency (U.S. EPA), 1988. Research and Development Aerial Photographic Analysis Comparison Report, Rocky Flats, Golden, Colorado. EPA Region VIII. TS-PIC-88760. July 1988.



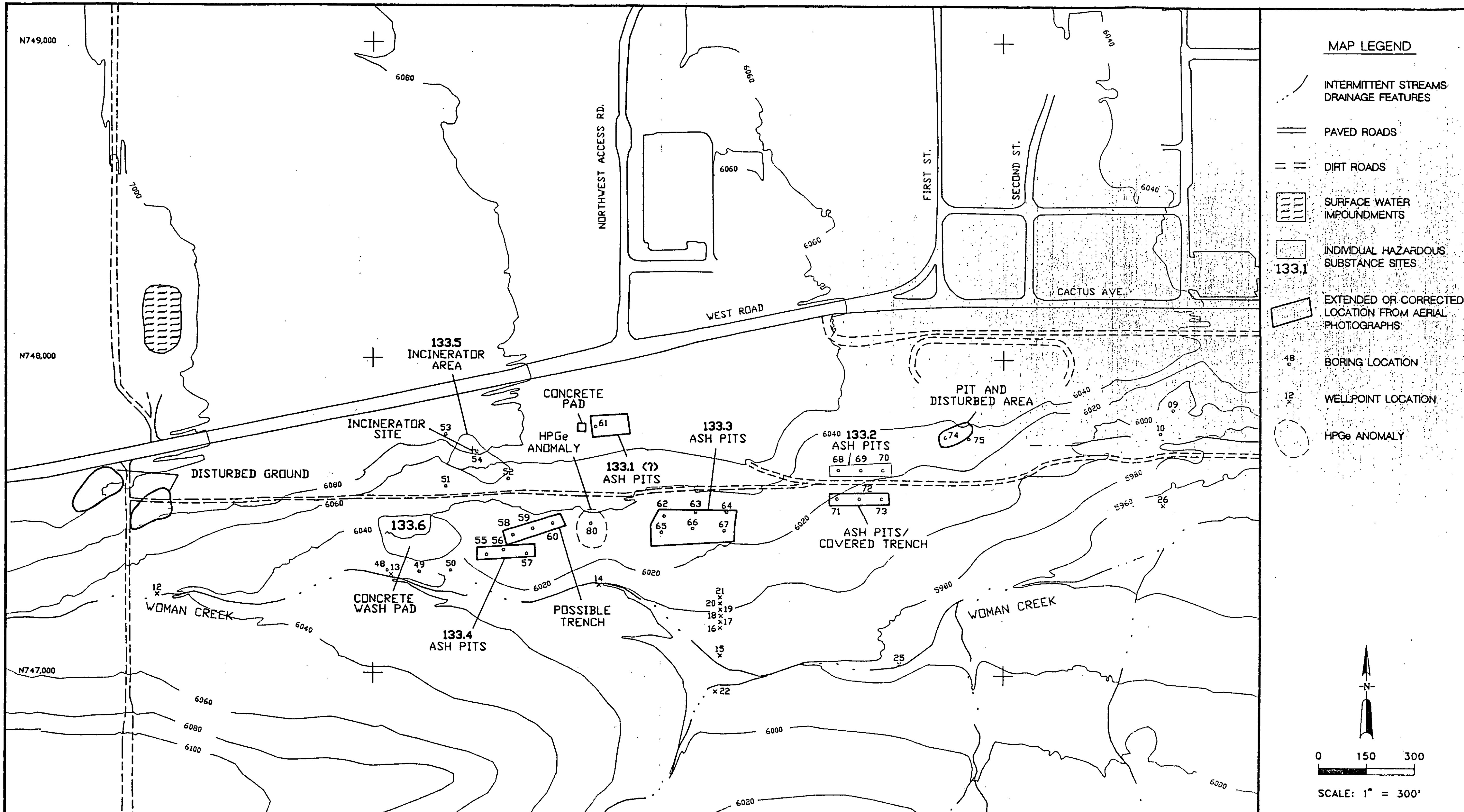
SITE LOCATION MAP

TM9 - MONITORING WELL INSTALLATION PLAN

OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G | 9208.15.01.19 | MAY 1993 | FIGURE 1

05TM9-1.DWG



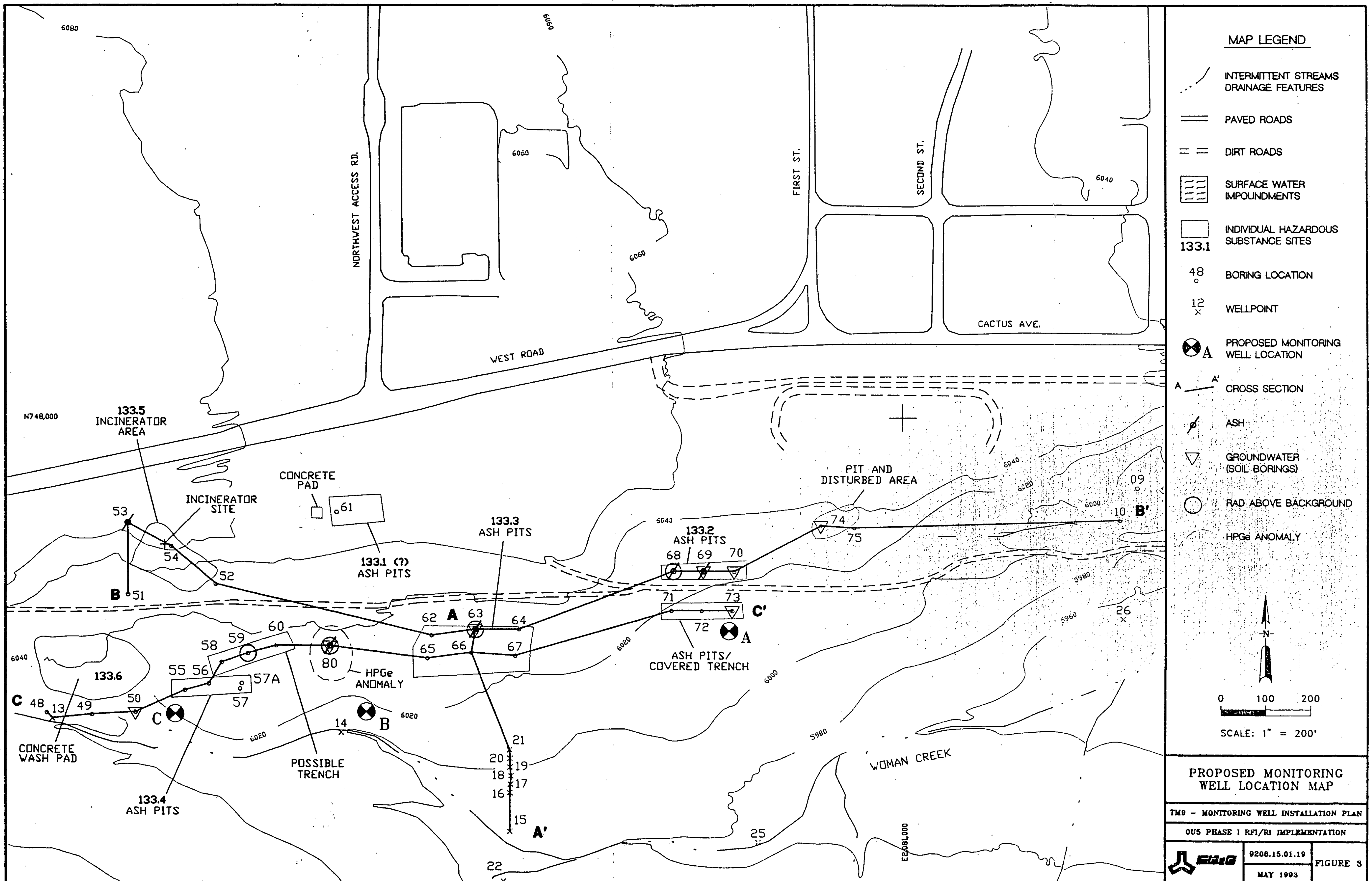
SOIL BORING, AND WELLPOINT LOCATION MAP

TM9 – MONITORING WELL INSTALLATION PLAN

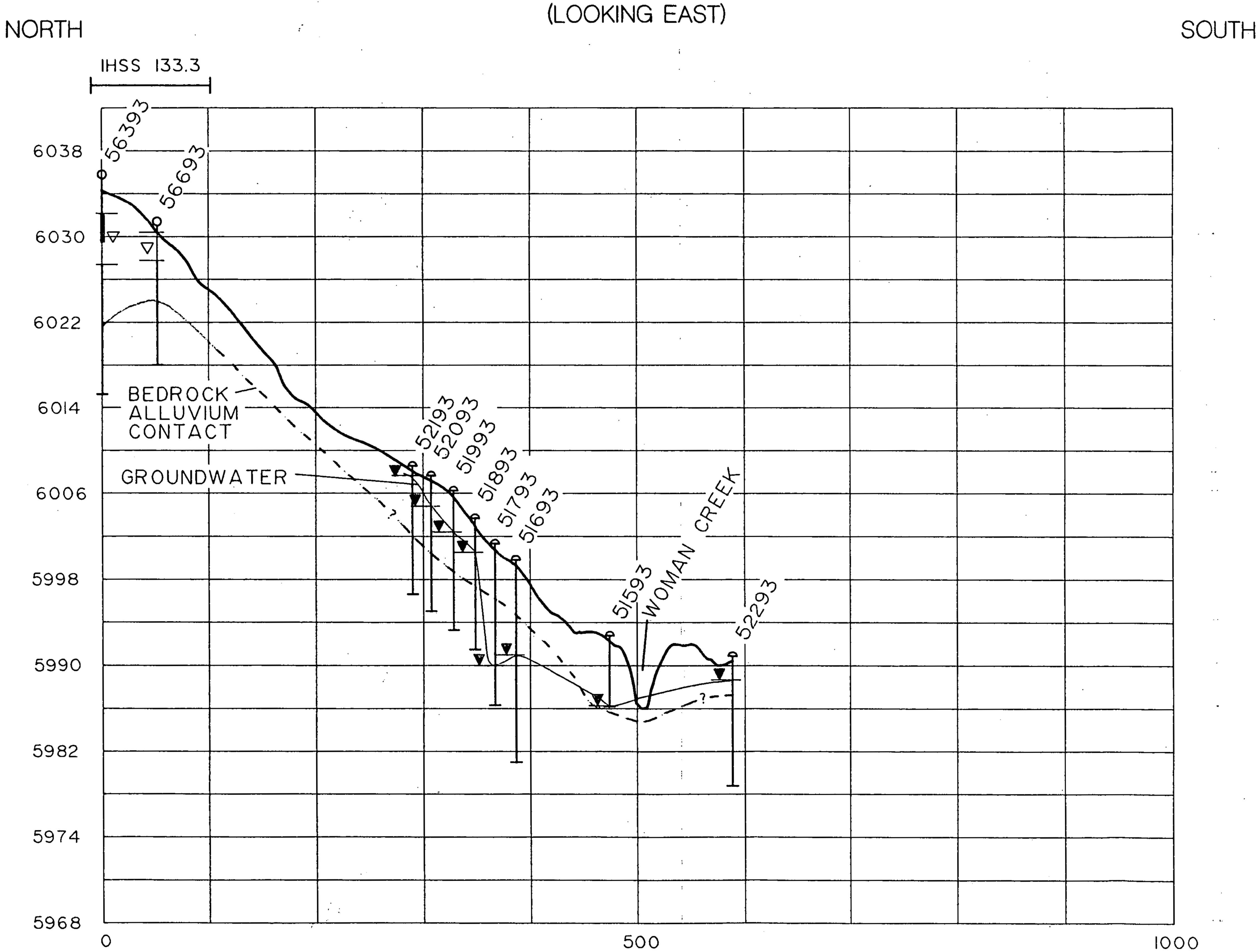
OU5 PHASE I RFI/RI IMPLEMENTATION

EG&G | 9208.15.01.19 | MAY 1993 | FIGURE 2

05TM9-2.DWG


MAP LEGEND
INTERMITTENT STREAMS DRAINAGE FEATURES
PAVED ROADS
DIRT ROADS
SURFACE WATER IMPOUNDMENTS
INDIVIDUAL HAZARDOUS SUBSTANCE SITES
133.1
BORING LOCATION
WELLPOINT
PROPOSED MONITORING WELL LOCATION
CROSS SECTION
ASH
GROUNDWATER (SOIL BORINGS)
RAD ABOVE BACKGROUND
HPGe ANOMALY
N
0 100 200
SCALE: 1" = 200'
NORTHWEST ACCESS RD.
FIRST ST.
SECOND ST.
CACTUS AVE.
WEST ROAD
N748,000
E2,081,000
133.5 INCINERATOR AREA
INCINERATOR SITE
CONCRETE PAD
133.1 (?) ASH PITS
133.3 ASH PITS
133.2 ASH PITS
PIT AND DISTURBED AREA
ASH PITS/ COVERED TRENCH
133.6
HPGe ANOMALY
CONCRETE WASH PAD
POSSIBLE TRENCH
133.4 ASH PITS
WOMAN CREEK
PROPOSED MONITORING WELL LOCATION MAP
TM9 - MONITORING WELL INSTALLATION PLAN
OU5 PHASE I RFI/RI IMPLEMENTATION
EG&G
9208.15.01.19
MAY 1993
FIGURE 3
05TM9-3.DWG

CROSS SECTION A - A'
(LOOKING EAST)



BOREHOLE

WELL POINT

WATER LEVEL MEASUREMENT APRIL, 1993

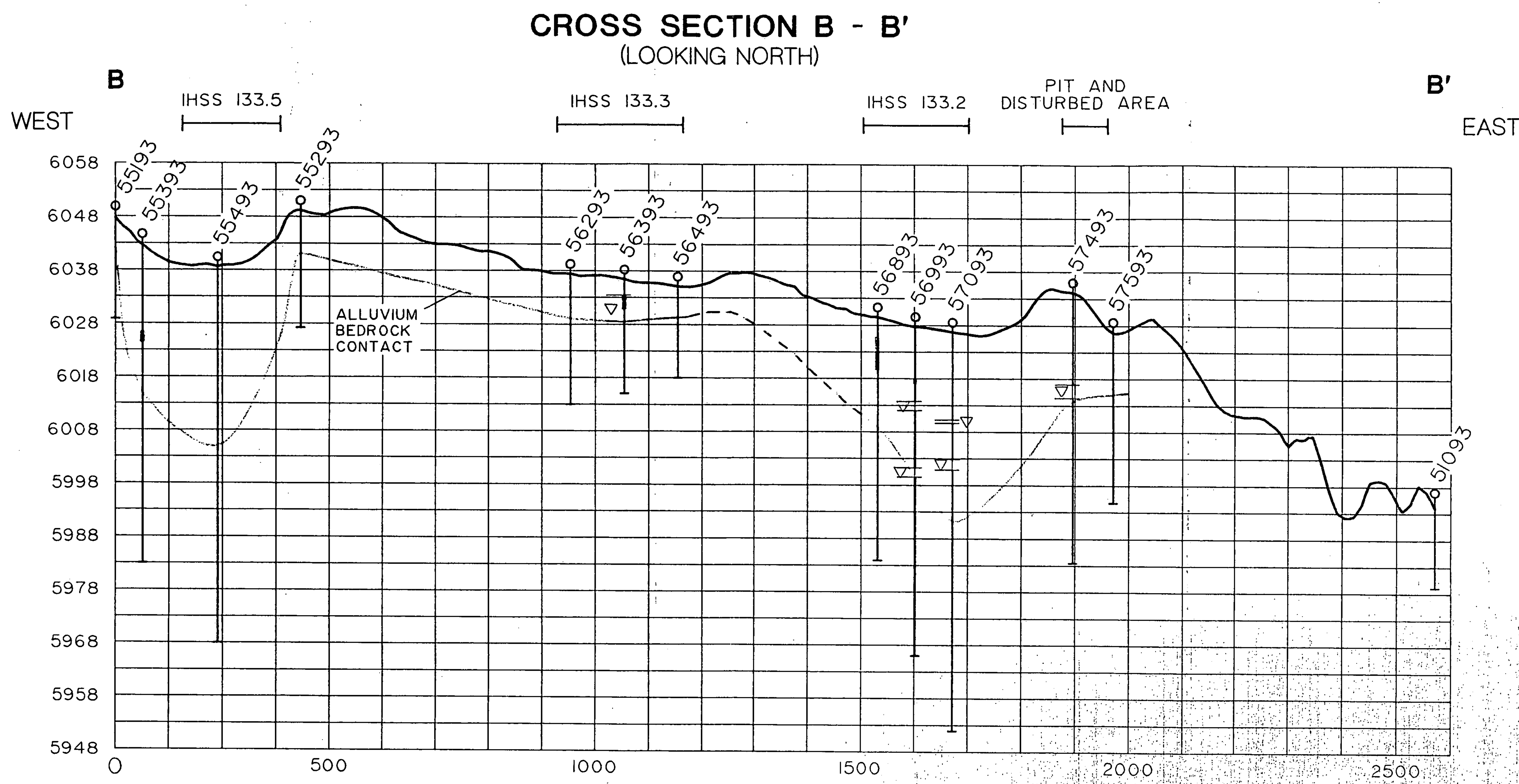
ASH

SATURATED INTERVAL BASED ON WELL-SITE FIELD LOGS

NOTE: GEOLOGIC DATA DERIVED FROM WELL-SITE FIELD LOGS

05TM9-4.DWG

CROSS SECTION A - A'	
TM9 - MONITORING WELL INSTALLATION PLAN	
OU5 PHASE I RFI/RI IMPLEMENTATION	
EG&G 9208.15.01.19 APRIL 1993	FIGURE 4



BOREHOLE

WELL POINT

WATER LEVEL MEASUREMENT APRIL, 1993

ASH

SATURATED INTERVAL BASED ON WELL-SITE FIELD LOGS

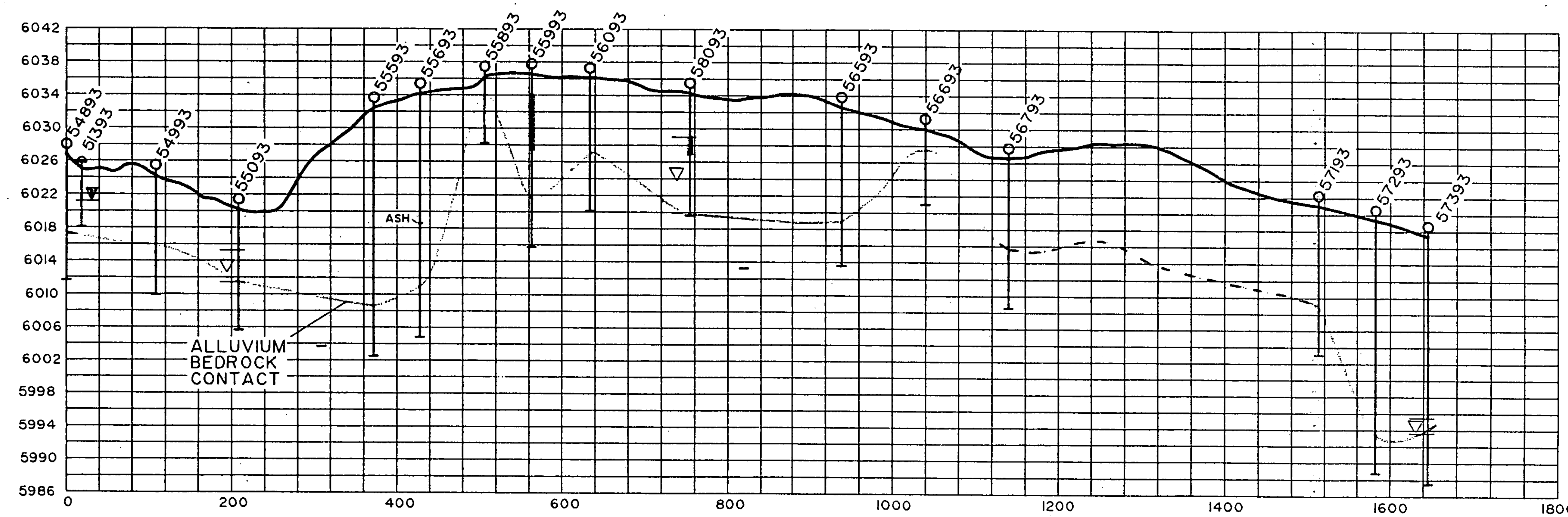
NOTE: GEOLOGIC DATA DERIVED FROM WELL-SITE FIELD LOGS

05TM9-5.DWG

CROSS SECTION B - B'		
TM9 - MONITORING WELL INSTALLATION PLAN		
OU6 PHASE I RFI/RI IMPLEMENTATION		
EG&G	9208.15.01.19 MAY 1993	FIGURE 5

CROSS SECTION C - C'

(LOOKING NORTH)



BOREHOLE

WELL POINT

WATER LEVEL MEASUREMENT APRIL, 1993

ASH

SATURATED INTERVAL BASED ON WELL-SITE FIELD LOGS

NOTE: GEOLOGIC DATA DERIVED FROM WELL-SITE FIELD LOGS

CROSS SECTION C – C'	
TM9 – MONITORING WELL INSTALLATION PLAN	
OU5 PHASE I RFI/RI IMPLEMENTATION	
EG&G 9208.15.01.19 MAY 1993	FIGURE 6

05TM9-6.DWG