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AT THE END OF
THE DOCUMENT

FINAL

INTERIM MEASURE/INTERIM REMEDIAL ACTION FRENCH DRAIN PERFORMANCE MONITORING PLAN

Rocky Flats Plant
881 Hillside Area

(Operable Unit No. 1)

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

ENVIRONMENTAL RESTORATION PROGRAM

13 April 1992

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LIST OF ACRONYMS

CDH	Colorado Department of Health
CLP	Contract Laboratory Program
DOE	Department of Energy
EPA	Environmental Protection Agency
ER	Environmental Restoration
FFACO	Federal Facility Agreement and Consent Order
GOCO	Government owned, contractor operated
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
IAG	Inter-Agency Agreement
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
NPDES	National Pollution Discharge Elimination System
OU1	Operable Unit No. 1
PA	Perimeter Area
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RFEDS	Rocky Flats Environmental Database System
SID	South Interceptor Ditch
TCL	Target Compound List
UV/H_2O_2	Ultraviolet/hydrogen peroxide

SECTION 1
INTRODUCTION

1.1 PURPOSE

This document is the performance monitoring plan for the french drain that has been constructed as part of the Interim Measures/Interim Remedial Action (IM/IRA) for the 881 Hillside Area (Operable Unit No. 1 (OU1) at the Rocky Flats Plant. The monitoring program is designed to provide information on the ground water intercepted by the french drain, determine the potential for migration of contaminated ground water around or under the french drain, and characterize the flow and water quality of the SID downgradient of the french drain. The U.S. Department of Energy (DOE) is implementing this IM/IRA to minimize the migration of hazardous substances in alluvial ground water from OU1 that pose a potential long-term threat to the public health and environment. Data generated pursuant to this plan will allow evaluation of the effectiveness of the french drain in capturing contaminated alluvial ground water and preventing further downgradient contaminant migration.

1.2 BACKGROUND

The IM/IRA is part of a comprehensive, phased program of site characterization, remedial investigations, feasibility studies, and remedial/corrective actions currently in progress at the Rocky Flats Plant. These investigations are pursuant to the DOE Environmental Restoration (ER) Program, and the Federal Facility Agreement and Consent Order (FFACO) (known as the Inter-Agency Agreement [IAG]). In accordance with the IAG, the Rocky Flats Plant has been subdivided into 16 operable units for prioritized implementation of remedial investigations, feasibility studies, and remedial actions. OU1 has been given the highest priority because of the presence of high concentrations of volatile organic compounds (VOCs) in alluvial ground water at the area, and its proximity to Woman Creek, which drains the southern part of the Rocky Flats Plant facility. A remedial investigation and feasibility study, which is currently in progress, will determine the full nature and extent of contamination, and the final remedy for the area.

1.3 SITE LOCATION AND DESCRIPTION

1.3.1 Location and Facility Type

The Rocky Flats Plant is located in northern Jefferson County, Colorado, approximately 16 miles northwest of downtown Denver (Figure 1-1). The Plant site consists of approximately 6,550 acres of federally owned land in Sections 1 through 4, and 9 through 15, of T2S, R70W, 6th principal meridian. Major buildings are located within an area of approximately 400 acres, known as Rocky Flats Plant perimeter area (PA). The PA is surrounded by a buffer zone of approximately 6,150 acres.

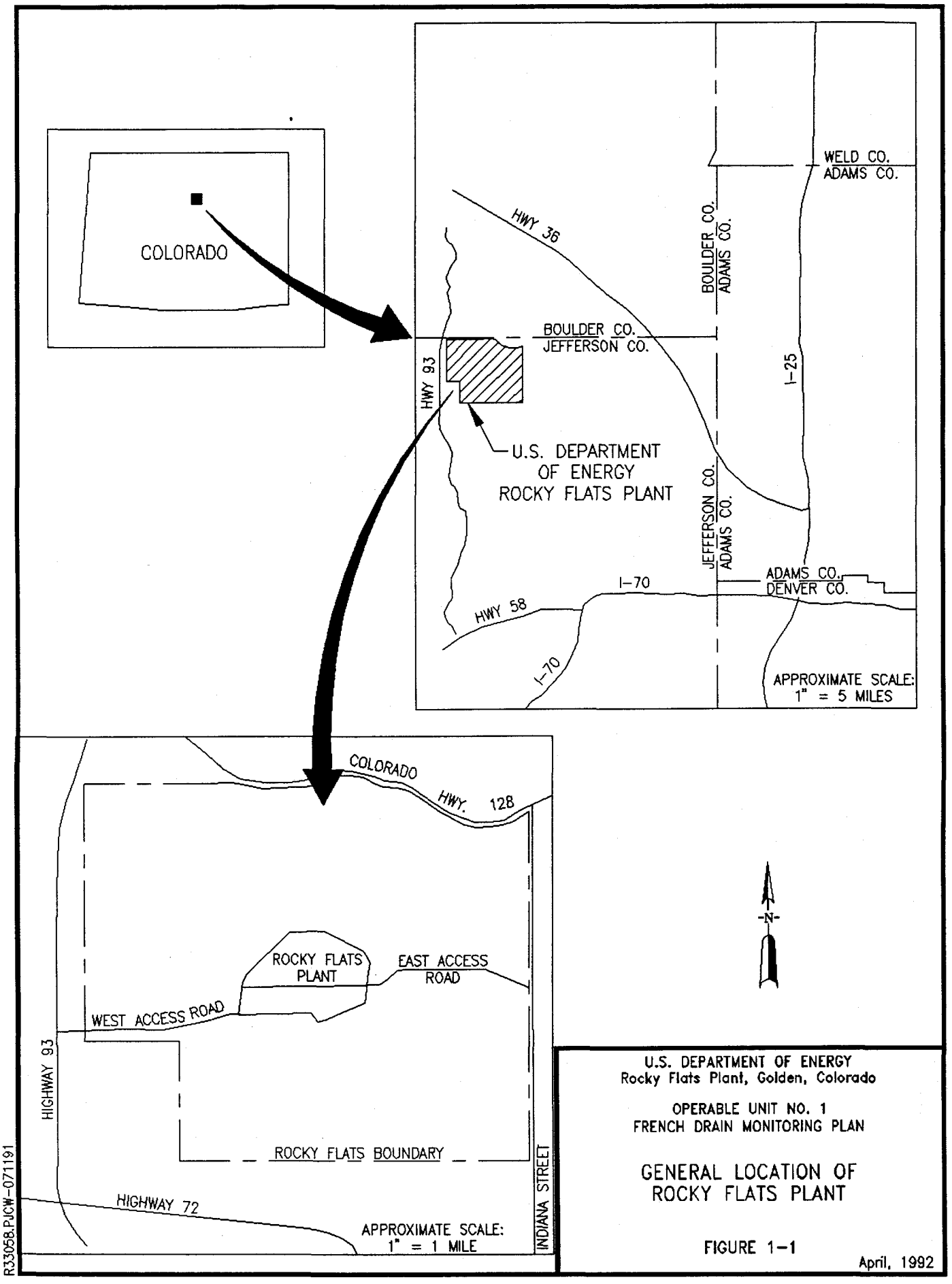
The Rocky Flats Plant is a government-owned, contractor-operated (GOCO) facility. It is part of a nationwide nuclear weapons research, development, and production complex administered by the Albuquerque Operations Office of DOE. The operating contractor for the Rocky Flats Plant is EG&G. The facility manufactures components for nuclear weapons and has been in operation since 1951, and fabricates components from plutonium, uranium, beryllium, and stainless steel. Production activities include metal fabrication, machining, and assembly. Both radioactive and nonradioactive wastes are generated in the process. Current waste handling practices involve on-site and off-site recycling of hazardous materials and off-site disposal of solid radioactive materials at other DOE facilities.

The Rocky Flats Plant is currently an interim status Resource Recovery and Conservation Act (RCRA) hazardous waste treatment/storage facility. In the past, both storage and disposal of hazardous and radioactive wastes occurred at on-site locations.

1.3.2 OU1 (881 Hillside) Area Description

There are 12 sites designated as Individual Hazardous Substance Sites (IHSSs) that comprise the OU1 Area. The OU1 Area is located at the southeast corner of the Rocky Flats Plant (Figure 1-2). A brief description of each site in the OU1 Area is presented below.

1. **Oil Sludge Pit (IHSS 102)** — A small pond located south of Building 881 was used for disposal of oil sludges in the late 1950s.



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

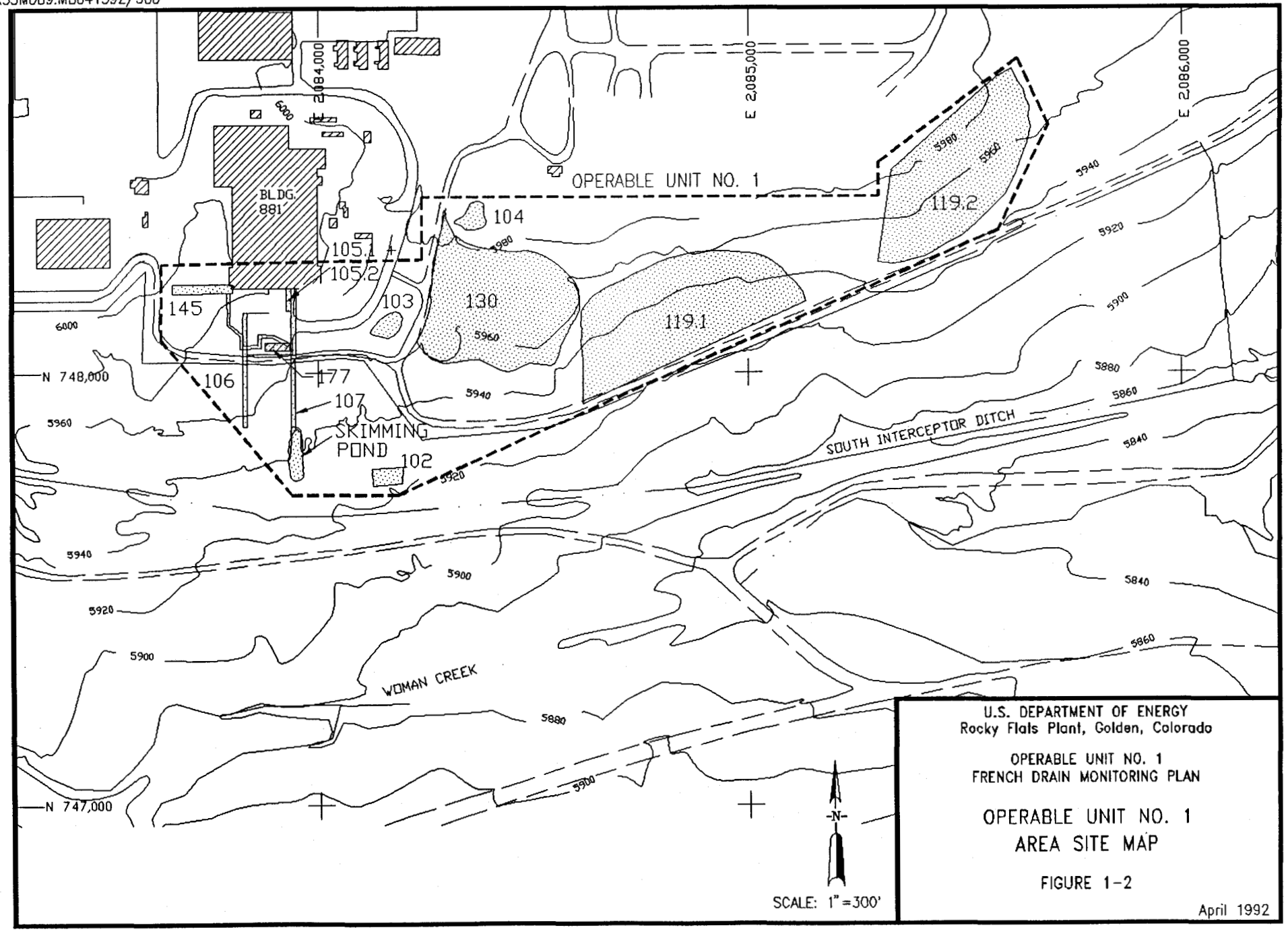
OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN

GENERAL LOCATION OF
ROCKY FLATS PLANT

FIGURE 1-1

April, 1992

R33058.PJCW-071191


OPERABLE UNIT NO. 1
BLDG. 881
104
105.1
105.2
103
130
119.2
119.1
145
106
177
107
SKIMMING POND
102
SOUTH INTERCEPTOR DITCH
WOMAN CREEK
N 748,000
N 747,000
E 2084,000
E 2085,000
E 2086,000
6000
5980
5960
5940
5920
5900
5880
5860
5840
SCALE: 1"=300'
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado
OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN
OPERABLE UNIT NO. 1
AREA SITE MAP
FIGURE 1-2
April 1992

2. **Chemical Burial Site (IHSS 103)** — A small pit was used for disposal of liquid wastes southeast of Building 881 in the early 1960s.

3. **Liquid Dumping (IHSS 104)** — An area east of Building 881 was reportedly used for disposal of unknown liquids prior to 1969. This was not substantiated by results of drilling the area in 1987.

4,5. **No. 6 Fuel Oil Tanks (IHSSs 1051. & 105.2)** — Two fuel oil tanks are located south of Building 881; they are out of service and filled with concrete.

6. **Outfall Site (IHSS 106)** — An overflow line from the sanitary sewer sump south of Building 881 daylights on the slope below the building.

7. **Hillside Oil Leak (IHSS 107)** — Oil was discovered flowing from the Building 881 footing drain in early 1973. The source of the oil was never positively identified, but the oil was collected in a skimming pond and transported off site. There is an ongoing discharge of water from the footing drain.

8,9. **Multiple Solvent Spills (IHSSs 119.1 & 119.2)** — Two areas east of Building 881 were used for barrel storage between 1969 and 1972.

10. **Radioactive Site (IHSS 130)** — Soils contaminated with low levels of radionuclides were placed on the hillside east of Building 881 and covered with soil between 1969 and 1972.

11. **Sanitary Sewer Line Leak (IHSS 145)** — The sanitary sewer line leaked on the hillside southwest of Building 881 in early 1981.

12. **Drum Storage Area (IHSS 177)** — Building 885, located south of Building 881, is currently used for satellite collection and 90-day accumulation of RCRA-regulated wastes. The building will be closed and soil remediation addressed under RCRA Interim Status (6 CCR 1007-3).

1.4 IM/IRA OVERVIEW

The OU1 IM/IRA involves construction of a french drain (trench) to intercept contaminated alluvial/colluvial ground water from the 881 Hillside Area. The drain is located downgradient of the 881 Hillside IHSSs, is keyed into bedrock in order to fully penetrate the soils, and is 1,450 feet long (Figure 1-3). The downstream face of the french drain is covered with a synthetic membrane to limit flow from the clean side of the drain. The inclusion of the downstream synthetic membrane coupled with the continuity of the drain provides positive cutoff

of the alluvial ground water. A polyvinyl chloride (PVC) collection pipe inside the drain directs flow under gravity to a 6-foot wide collection gallery sump (Figure 1-3). The sump is equipped with a submersible sump pump to deliver the water from the drain to a new treatment plant.

The original design for the french drain specified an additional 500-ft segment of drain be added to the west terminus shown in Figure 1-3. However, this additional footage of drain was determined to be unnecessary to capture alluvial ground-water contaminants arising from OU1. Although ground-water sampling at well 0187, south of IHSS 145, (sanitary sewer line break) indicated above-background concentrations of TCE during several sampling rounds, ground-water modeling showed that ground water from this well would be intercepted by the french drain as shown in Figure 1-3. The modeling documentation and flow nets are included in Appendix A. The monitoring plan discussed in this document should confirm this determination. The west end of the french drain collection pipe has been capped; however, should there be a need to lengthen the french drain to the west, the cap can be easily removed for the expansion.

The eastern end of the french drain was located at Station 19 + 35, as existing wells east of this point have historically been dry. Continued construction would also have meant crossing a gas line.

Ground water is also collected from a collection well at the base of IHSS 119.1 ("source well"), and is pumped to the french drain collection sump (Figure 1-3). In addition, contaminated ground water discharged from the Building 881 footing drain is piped directly into the french drain (Figure 1-3). The source well and footing drain flows commingle with alluvial ground water collected by the french drain.

Flow/volume measuring devices will be installed on the source well and footing drain discharge lines to monitor flow contributions from these sources. Two flow meters will be installed at Sump #1 to measure flow entering from the east and west segments of the drain.

The ground water collected is treated using an ultraviolet/hydrogen peroxide (UV/H_2O_2) system (for organics removal) and an ion exchange system (for inorganics removal). The water

treatment system is enclosed in Building 891 to protect weather or temperature sensitive components.

Following treatment, the water is directed to an effluent storage tank sized for approximately 1-week's flow. Sufficient tankage is provided to allow the continued operation of the treatment facility while waiting for analytical results on effluent quality prior to discharging to the South Interceptor Ditch (SID). Effluent of unacceptable quality is returned to the influent storage tanks for additional treatment. Effluent will always be analyzed prior to discharge.

Water discharged from the treatment system passes through Pond C-2 and eventually into Woman Creek. This discharge is monitored according to the Rocky Flats Plant National Pollutant Discharge Elimination System (NPDES) Permit.

1.5 OBJECTIVES

The specific objectives to be met by implementation of this Performance Monitoring Plan are as follows:

- Confirm that the termination of the drain on the west end meets the objectives of the IM/IRA.
- Characterize ground-water flow and contaminant migration along the entire length of the french drain to evaluate the effectiveness of this interim action.
- Characterize ground-water quality and flow intercepted by the french drain.
- Characterize footing drain water quality and flow.
- Characterize flow and water quality in the SID downgradient of the french drain.
- Characterize flow of runoff from the Building 850 west parking lot (Figure 1-4).

The last objective is a specific request of the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) to determine the contribution of flow and any contamination arising from the Building 850 parking lot runoff that enters the SID upstream of the french drain. This area is not a part of OU1.

SECTION 2
FRENCH DRAIN PERFORMANCE MONITORING PLAN

This plan provides the framework for monitoring the effectiveness of the french drain constructed at the 881 Hillside to intercept alluvial ground water. The monitoring program is designed to provide information on the ground water intercepted by the french drain, determine the potential for migration of contaminated ground water around or under the french drain, and characterize the flow and water quality of the SID downgradient of the french drain. Sampling stations for the monitoring program are shown in Table 2-1.

2.1 GROUND-WATER MONITORING

A network of monitoring wells will be installed to aid in the evaluation of the effectiveness of the french drain. The following sections describe the proposed sampling locations, procedures for the drilling and installation of the monitoring wells, and the methodologies for the collection of the ground-water samples and the proposed analytical plan.

2.1.1 Monitor Well Locations

Twelve monitoring wells will be installed along the french drain alignment, between the french drain and the SID, to evaluate the potential for contaminated ground-water flow around or beneath the system. The proposed well locations are presented in Figure 2-1.

As illustrated in the figure, one monitoring well (FD01A) will be installed approximately 75 feet east of the eastern truncation of the french drain to monitor alluvial ground-water levels and quality at this end of the drain. Existing alluvial well MW-1 is located below the Building 881 footing drain outfall. This is an area that historically has had saturated alluvium. The outfall no longer exists as this flow is now transferred directly to the french drain. Permeability tests were not performed in the bedrock at this location during construction of the french drain to determine that the base of the trench was in bedrock (taken as 10^{-8} cm/s hydraulic conductivity) rather than alluvial material. Therefore, wells FD02A, FD03A, and FD06A will be installed to confirm capture of any potential alluvial ground water at this segment of the drain.

Table 2-1
French Drain Monitoring Program
Sampling Stations

GROUND WATER

Alluvial Wells	Paired Bedrock Wells[1]
FD01A (Proposed)	
FD02A (Proposed)	FD02B
FD03A (Proposed)	FD03B
FD04A (Proposed)	
FD05A (Proposed)	
FD06A (Proposed)	FD06B,C
MW01 (Existing)	FD07B
MW02 (Existing)	FD08B

SURFACE WATER

SW-35
SW-36
SW-38
SW-70
Building 850 Parking Lot East End
Building 850 Parking Lot West End

FRENCH DRAIN

Building 881 Footing Drain Sump
Valve Vault
Sump #1

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1 The "B" Bedrock wells indicate the zone of interest is a claystone slump block exhibiting glide planes. FD06C will be installed to monitor ground-water quality in a bedrock sandstone encountered during french drain construction (see text).

(Hydraulic conductivity values in bedrock for stations along the trench are presented in Appendix B.) Wells FD04A and FD05A are located beyond the western terminus of the french drain in order to characterize alluvial ground-water flow and any contamination that is not intercepted by the drain.

This number of wells in the western area has been proposed because the major portion of ground water intercepted during the french drain construction was encountered in this area. In addition, the regulatory agency approval for the west-end termination of the french drain as depicted in Figure 1-3 requires that this well field be installed to monitor ground-water conditions at this end of the drain. This information will be used to determine if an extension of the existing french drain system may be required in the future.

Bedrock wells will be paired with the alluvial wells that are immediately downgradient of the french drain to monitor for the presence of ground water in glide planes that were intersected by the drain. The "bedrock" wells will actually be screened in the claystone slump blocks. Although there should be no transmission of water in the glide planes past the french drain (they either flow into the french drain or have been sealed with grout if below the drain), these wells will be installed to monitor for contamination in ground water that may occur in the glide planes. The bedrock wells are listed in Table 2-2 along with the anticipated depths to the glide planes.

Well FD06C will be installed in a sandstone that was encountered during excavation of the drain. The vertical and horizontal extent of the sandstone is unknown, therefore, the well may not be installed if the sandstone is not encountered during drilling. The wells that are installed will be screened 2 feet above and 3- feet below the glide planes (or sandstone).

2.1.2 Monitor Well Drilling and Installation

Each of the proposed french drain monitoring wells will be installed using drilling equipment capable of obtaining continuous samples. The boreholes for well installation will be drilled to various depths as described in Section 2.1.1. The core retrieved during the drilling will be screened for total organic vapors using appropriate field instrumentation and then detailed lithologic descriptions of each sample will be recorded by the field geologist in the project-

Table 2-2

Depth to Potential Water-Bearing Zones

Bedrock Well	Approximate Depth to Glide Planes (ft)
FD02B	22.6
FD03B	23.2
FD06B,C	23.7[1], 36 (sandstone)[2]
FD07B	25
FD08B	6.1[3]

Notes: The Bedrock "B" wells indicate the zone of interest is a claystone slump block that contains glide planes. All "B" wells will be screened across a glide plane.

FD07B and FD08B are bedrock wells for MW-1 and MW-2, respectively.

[1] Minor glide planes also exist at depths of approximately 8.2, 14.5, 16.8, and 29.8 feet. The well will be screened across the glide plane at 23.7 feet which was noted to be water bearing.

[2] FD06C will be a well screened in a sandstone lense at approximately 36 feet.

[3] No glide planes were observed at this location during construction of the drain.

specific field logbook. All drilling and logging procedures will be performed in accordance with the applicable Environmental Management Division (EMD) Operating Procedures (OP) (EG&G, 1991a, 1991b, 1992a, and 1992b).

Alluvial and bedrock monitoring wells will be installed in accordance with the designs presented in OP GT.6 (EG&G, 1992a). Following installation, each of the monitoring wells will be developed to ensure proper hydraulic connection between the screened interval and the monitored formation. Well development procedures will follow the methods presented in OP GW.02 (EG&G, 1991b).

2.1.3 Sample Collection

Ground-water samples will be collected from each of the french drain monitoring wells subsequent to development. The wells will be sampled quarterly throughout the duration of the IM/IRA. Water level measurements will be obtained weekly at all new wells; at MW-1 and MW-2; at upgradient wells 4887 and 35691; and at 31491 and 4787, downgradient of the drain. Measurements will continue for two quarters or until water measurements stabilize. Readings will be taken using an electric sounding device before sampling commences to determine the volume of water in each well and to provide the information necessary to map the potentiometric surface to illustrate the effects of the french drain on the ground-water flow system. Water level measurements will follow the procedures outlined in OP GW.01 (EG&G, 1991b).

Prior to sampling, at least three casing volumes of water will be removed from the well to ensure that representative formation water is sampled. Field water quality parameters of temperature, conductivity, and pH will be measured during the presample purging. Sampling will take place when these parameters are observed to stabilize (OP GW.05) (EG&G, 1991b). All ground-water sampling procedures will be performed in accordance with OP GW.06 (EG&G, 1991b).

In addition to the investigative samples, quality assurance/quality control (QA/QC) samples will be collected during each sampling event. The frequency and type of QA/QC samples collected

are specified in the Quality Assurance Project Plan (QAPjP) (EG&G, 1990a) and are discussed further in Section 2.4.

2.2 FRENCH DRAIN COLLECTION SYSTEM

The french drain collection system will be monitored to determine the quality of the ground water being intercepted by the structure. Ground-water quality and quantity will be monitored for the Building 881 footing drain discharge, the source well discharge, and the french drain discharge. The french drain discharge represents the sum of the above noted flows and the alluvial ground water directly intercepted by the drain. Flows from the source well and the french drain will be measured using totalizing meters. Flow from the Building 881 footing drain will be measured by a weir installed at the outlet of the footing drain sump. Continuously recorded water level measurements in the vault will be used to establish the flow and volume of water discharged from the footing drain.

2.2.1 Sample Locations

Water quality samples will be collected from the Building 881 footing drain, the source well, and the french drain discharges. The source well sample will be collected from the sample hydrant located at the collection well (Figure 1-3). The french drain discharge sample will be collected from the hydrant located at the french drain gallery collection sump (Sump #1) and the footing drain discharge sample will be collected from the footing drain sump. Special attachments including ¼-inch tubing will be fixed to the outlet of the hydrants in order to prevent aerating the samples for volatile organic analysis.

2.2.2 Sample Collection

Grab samples from the footing drain vault will be collected by lowering a bailer attached by a rope. Samples will be collected from the hydrant located at the collection well and the collection well sump via the existing valve system.

2.3 SURFACE WATER MONITORING

Surface water monitoring of the SID and the Building 850 west parking lot will be conducted to evaluate the quality of the surface water system immediately downgradient of the french drain and to investigate the quantity and quality of water exiting the Building 850 west parking lot that discharges to the SID upstream of OU1.

2.3.1 South Interceptor Ditch

The SID intercepts surface water runoff from the plant and diverts the water around retention Pond C-1 for discharge into Pond C-2. There is currently a site wide surface water monitoring program underway at the site and several stations along the SID are included as sample locations for this program.

2.3.1.1 Sample Locations

Existing surface water stations along the SID will be used to investigate the water quality conditions down- and up-stream of the french drain. Stations SW38, SW36, and SW35 are located upgradient of the french drain within pooling areas in the SID (Figure 2-1). Station SW70 is located downgradient of the french drain and will provide information on the effect of the french drain on the SID water quality by comparing this data with information collected from the upgradient locations.

It is not proposed that flow rates be measured in the SID downstream of the french drain. The SID is an ephemeral system that exhibits flow only during storm events. Permanent surface water flow measuring weirs were proposed in the SID; however, due to the potential that it is a good habitat of the endangered plant species *Spiranthes* in the SID, such measuring devices have not been installed. The SID has also become silted-in and overgrown with vegetation in several stretches and, therefore, water ponds in several areas during times of low flow. Actual flow only occurs in the SID during storm events and periods of runoff and snowmelt. The proposed sampling locations are located in these ponding areas to ensure that sufficient water will be available for water quality sampling. However, in order to gauge the flow exiting the

SID, a gauging station is located above Pond C-2. Automatic flow monitors and water samplers have been installed to continuously monitor the flow and water quality of the SID during storm events resulting in discharge to Pond C-2.

2.3.1.2 Sample Collection

Surface water samples will be collected from each of the surface water stations described above on a quarterly basis as part of the site-wide surface water sampling program. The chemical data gathered from this program for each of these stations, along with the water quality and flow data collected from the SID gauging station at Pond C-2, will be used to evaluate SID water quality and flow relative to the operation of the french drain. Surface water sampling procedures will be performed in accordance with the appropriate OPs (SOP SW3, SW10, SW11, and SW14 (EG&G, 1992b)).

2.3.2 West Parking Lot

According to EG&G personnel, there is runoff exiting the west parking lot of Building 850. Discharge from the parking lot is from two V-shaped concrete channels that spill over the south border of the terrace where the Plant is situated. In conjunction with the proposed french drain monitoring program, EPA has requested that the flow and water quality of the runoff leaving the parking lot be monitored. A gauging station and automatic sampler will be installed in each of the channels to continuously collect the requested data.

2.4 ANALYSIS PLAN

The samples collected from the french drain monitoring wells and collection system will be analyzed for Contract Laboratory Program (CLP) Target Compound List (TCL) organics including volatiles, semi-volatile, and pesticide/PCBs. In addition, samples for analysis of CLP Target Analyte List (TAL) metals, radionuclides, and other inorganics will be collected during this monitoring program. Water samples will be analyzed in the field for pH, specific conductivity, and temperature. Surface water samples will be analyzed for the same parameters and will also be tested in the field for the dissolved oxygen content. The field and analytical

parameters are presented in Table 2-3. All samples requiring filtration will be filtered in the field and all samples will be preserved in the field.

All analytical methods will follow the General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (EG&G, 1990b). The CLP methods for CLP analytes are based on the EPA SW846 methods for analyzing wastewaters and solid wastes (EPA, 1986). Methods for anions and indicator parameters are based on EPA-developed or EPA-reviewed and approved methods sufficient to meet the data quality objectives. Radionuclide analytical methods have been either developed or reviewed and approved by EPA.

Quality control samples will be collected in conjunction with the investigative samples to provide information on data quality. Field (rinsate) blanks, trip blanks, field duplicates, laboratory blanks, laboratory replicates, and laboratory matrix spike and matrix spike duplicates are the commonly collected QC samples. Table 2-4 presents the suggested guidelines for collection of field QC samples (EPA, 1987) that are consistent with the guidelines listed in the QAPjP.

Trip blanks are prepared by the analytical laboratory and consist of sample containers filled with deionized water. The trip blanks are transported along with the sample containers to the organization performing the field investigation and are constantly kept with the investigative samples until the samples are analyzed. The purpose of trip blanks is to investigate the sample container integrity and the potential for samples becoming contaminated during transport to and from the laboratory. Trip blanks generally pertain to volatile organic analysis.

Field blanks (rinsate blanks) will be collected by pouring distilled/deionized water through decontaminated sample collection equipment and submitting the sample for the analysis of the same parameters as the investigative samples. Field (rinsate) blanks monitor the effectiveness of decontamination procedures. Field replicates will be collected and analyzed to provide information regarding the natural variability of the sampled media as well as evaluate analytical precision.

Laboratory blanks and replicates test analytical procedures and conditions. Laboratory matrix spikes and matrix spike duplicates measure analytical accuracy by providing data on matrix

Table 2-3

Proposed French Drain Performance Monitoring Plan Sampling Parameters

Metals* Target Analyte List	Other
Aluminum Antimony Arsenic Barium Beryllium Cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Mercury Nickel Potassium Selenium Silver Sodium Thallium Vanadium Zinc	**Field Parameters** pH Specific Conductance Temperature Dissolved Oxygen (Surface Water Only) **Indicators** Total Dissolved Solids Total Suspended Solids (Surface Water only) **Anions** Carbonate Bicarbonate Chloride Sulfate Nitrate (as N) Cyanide
Other Metals	Radionuclides*
Molybdenum Strontium Cesium Lithium Tin	Gross Alpha Gross Beta Uranium - 233, 234, 235, and 238 Plutonium - 239, 240 Tritium Strontium - 89, 90

Table 2-3 (Continued)

Proposed French Drain Performance Monitoring Plan Sampling Parameters

Organics: Volatiles Target Compound List	Organics: Semi-Volatiles Target Compound List
Chloromethane Bromomethane Vinyl Chloride Chloroethane Methylene Chloride Acetone Carbon Disulfide 1,1-Dichloroethene 1,1-Dichloroethane total 1,2-Dichloroethene Chloroform 1,2-Dichloroethane 2-Butanone 1,1,1-Trichloroethane Carbon Tetrachloride Vinyl Acetate Bromodichloromethane 1,1,2,2-Tetrachloroethane 1,2-Dichloropropane trans-1,3-Dichloropropane Trichloroethene Dibromochloromethane 1,1,2-Trichloroethane Benzene cis-1,3-Dichloropropene Bromoform 2-Hexanone 4-Methyl-2-pentanone Tetrachloroethene Toluene Chlorobenzene Ethyl Benzene Styrene Total Xylenes	Phenol bis(2-chloroethyl)ether 2-Chlorophenol 1,3-Dichlorobenzene 1,4-Dichlorobenzene Benzyl Alcohol 1,2-Dichlorobenzene 2-Methylphenol bis(2-Chloroisopropyl)ether 4-Methylphenol N-Nitroso-Dipropylamine hexachloroethane Nitrobenzene Isophorone 2-Nitrophenol 2,4-Dimethylphenol Benzoic Acid bis(2-Chloroethoxy)methane 2,4-Dichlorophenol 1,2,4-Trichlorobenzene Naphthalene 4-Chloroaniline Hexachlorobutadine 4-Chloro-3-methylphenol(para-chloro-meta-cresol) 2-Methylnaphthalene Hexachlorocyclopentadiene 2,4,6-Trichlorophenol 2,4,5-Trichlorophenol 2-Chloronaphthalene 2-Nitroaniline Dimethylphthalate Acenaphthylene 3-Nitroaniline Acenaphthene 2,4-Dinitrophenol 4-Nitrophenol Dibenzofuran

Table 2-3 (Continued)

Proposed French Drain Performance Monitoring Plan Sampling Parameters

Organics: Pesticides/PCBs Target Compound List	Organics: Semi-Volatiles Target Compound List (Continued)
alpha-BHC	2,4-Dinitrotoluene
Beta-BHC	2,6-Dinitrotoluene
delta-BHC	Diethylphthalate
gamma-BHC (Lindane)	4-Chlorophenyl Phenyl ether
Heptachlor	Fluorene
Aldrin	4-Nitroaniline
Heptachlor Epoxide	4,6-Dinitro-2-methylphenol
Endosulfan I	N-nitrosodiphenylamine
Dieldrin	4-Bromophenyl Phenly ether
4,4-DDE	Hexachlorobenzene
Endrin	Pentachlorophenol
Endosulfan II	Phenanthrene
4,4-DDD	Anthracene
Endosulfan Sulfate	Di-n-butylphthalate
4,4-DDT	Fluoranthene
Endrin Ketone	Pyrene
methoxychlor	Butyl Benzylphthalate
alpha-Chlordane	3,3[1]-Dichlorobenzidine
gamma-Chlordane	Benzo(a)anthracene
Toxaphene	bis(2-ethylhexyl)phthalate
AROCLOR-1016	Chrysene
AROCLOR-1221	Di-n-octyl Phthalate
AROCLOR-1232	Benzo(b)fluoranthene
AROCLOR-1242	Benzo(k)fluoranthene
AROCLOR-1248	Benzo(a)pyrene
AROCLOR-1254	Indeno(1,2,3-cd)pyrene
AROCLOR-1260	Dibenz(a,h)anthracene
	Benzo(g,h,i)perylene

* Dissolved metals and radionuclides for ground water; total and dissolved metals and radionuclides for surface water.

Table 2-4

Guidelines for Field Quality Control Sample Collection Frequency

Analytical Parameter	Trip Blank	Field (rinsate) Blank	Field Replicate
Volatile Organics	1 in 20	1 in 20	1 in 20
Metals	NA	1 in 20	1 in 20
Radionuclides	NA	1 in 20	1 in 20
TCL semi-volatiles	NA	1 in 20	1 in 20
TCL Pesticide/PCBs	NA	1 in 20	1 in 20
Other	NA	1 in 20	1 in 20

NA - Not applicable

interferences and components interfering with instrument responses. The frequency of collection and analysis of laboratory QC samples is dictated by the prescribed analytical method as noted in the GRRASP.

The new wells and MW-1 and MW-2 will be sampled for two quarters for the full suite of analytes, and the same wells, excluding MW-2, will be sampled monthly for two quarters for total organic halogens. Upon the completion of two quarterly sampling events and receipt and validation of the analytical results, the data will be evaluated to determine if classes of compounds can be deleted from the analytical suite in future sampling events. Deletion of specific compounds from the monitoring program will not occur without the prior approval of EPA and CDH.

SECTION 3
DATA MANAGEMENT AND REPORTING

Field and laboratory data collected during implementation of this monitoring program will be incorporated into the Rocky Flats Environmental Database System (RFEDS). Field data sheets will be completed in the field and a diskette containing the field information will be transmitted to the EG&G RFEDS Department for input. Analytical data from the EG&G contract laboratories will also be transmitted to EG&G via electronic file. A hard copy of the data will be submitted to the EG&G contract consultant (Quantalex, Inc.) for validation. Upon completion of the validation process, the data along with the appropriate validation codes will be input into RFEDS. Hard copy reports will then be generated from the system for data interpretation and evaluation.

Letter reports summarizing the data collected during each quarterly sampling event will be prepared and submitted to EPA and CDH for review and comment. In accordance with a request from EPA, this data will be submitted to the EPA Rocky Flats Ground-Water Team, as well as the OU1 Project Manager. Preparation of the reports will be initiated upon receipt of the validated data from Quantalex. The reports will include a brief description of the field activities, tables summarizing the field and laboratory data, diskettes of data, and a discussion of the data. Figures will be included, as appropriate.

SECTION 4

REFERENCES

EG&G. 1991a. Environmental Management Division Operating Procedures, Manual No. 5-21000-OPS-FO, Volume I: Field Operations, August 1991.

EG&G. 1991b. Environmental Management Division Operating Procedures, Manual No. 5-21000-OPS-GW, Volume II: Ground Water, August 1991.

EG&G. 1992a. Environmental Management Division Operating Procedures, Manual No. 5-21000-OPS-GT, Volume III: Geotechnical, February 1992.

EG&G. 1992b. Environmental Management Division Operating Procedures, Manual No. 5-21000-OPS-SW, Volume IV: Surface Water, February 1992.

EG&G. 1990a. Draft Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigations/Feasibility Studies Activities, ER Program, Rocky Flats Plant, Golden, Colorado. August 1990.

EG&G. 1990b. General Radiochemistry and Routine Analytical Services Protocol (GRRASP), ER Program, Rocky Flats Plant, Golden, Colorado, September 1990.

EG&G. 1992c. Final Work Plan Manual for the Startup, Operation, and Maintenance of the Interim Measure/Interim Remedial Action for the 881 Hillside Operable Unit No. 1, Environmental Restoration Program. February 1992.

EPA. 1986. Methods for Chemical Analysis of Water and Wastes, SW 846 SOW.

EPA. 1987. Data Quality Objectives for Remedial Response Activities; EPA 154-IG-871003, OSWER Directive 9355.0-7B, March 1987.

APPENDIX A

DOCUMENTATION OF GROUND-WATER MODELING FOR THE FRENCH DRAIN

881 HILLSIDE - FRENCH DRAIN

Preliminary Drawdown Model For West End of Drain

Model Used

USGS MODFLOW

Model Parameters

k 2.5 ft/day colluvial materials
2.5×10^{-3} ft/day drain liner

s 0.3

Dx 15 ft (60 columns)

Dy 15 ft nominal, 7.5 ft at drain liner (41 rows)

Boundary Conditions: constant head (5 ft) along max. and min. rows
no-flow along max. and min. columns

Initial Saturated Thickness: 5 ft

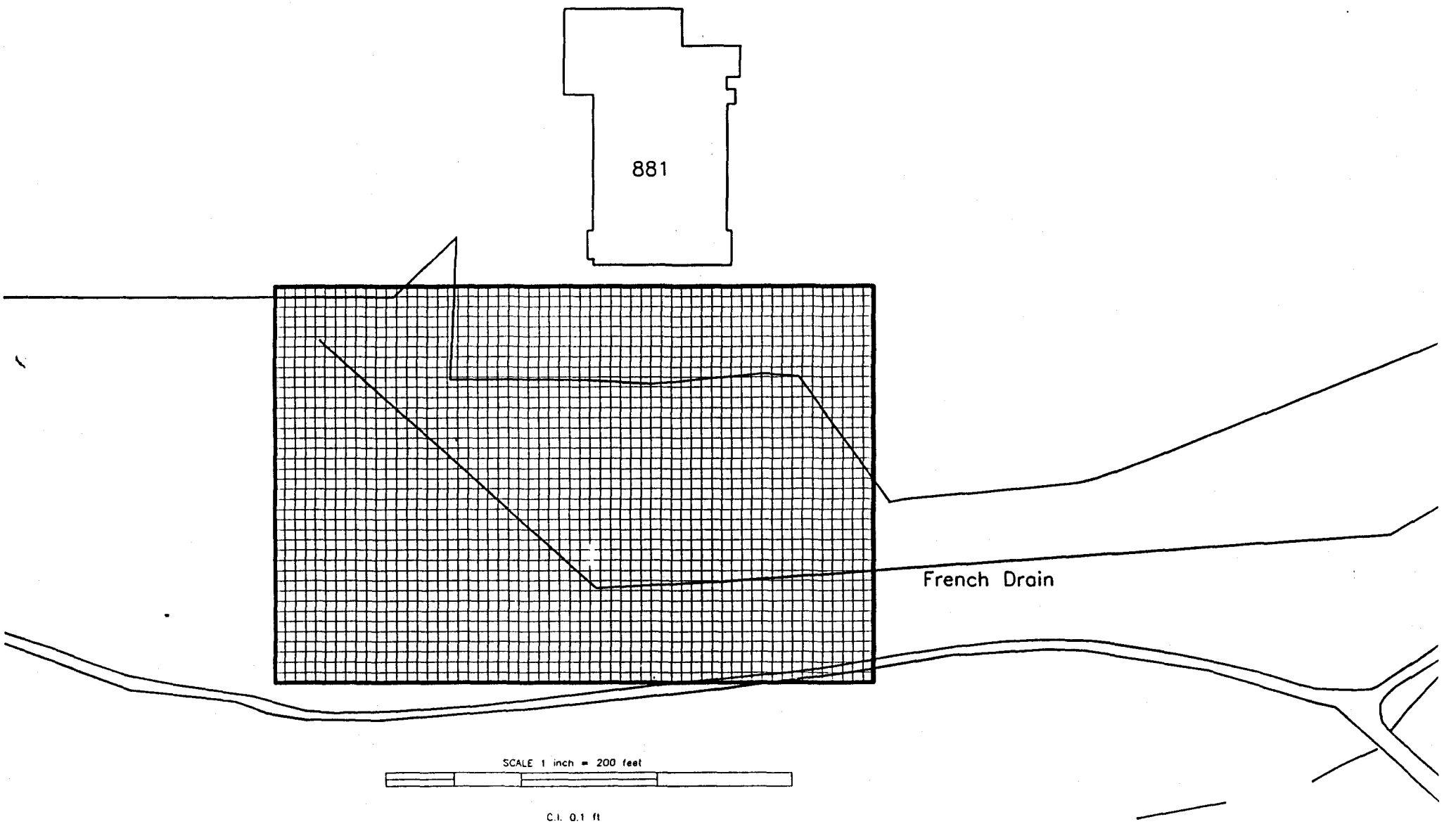
Drain Elevation: 1 ft above model base

Drain Conductance: 140 ft/day

Drain Location: row 31, columns 33-60

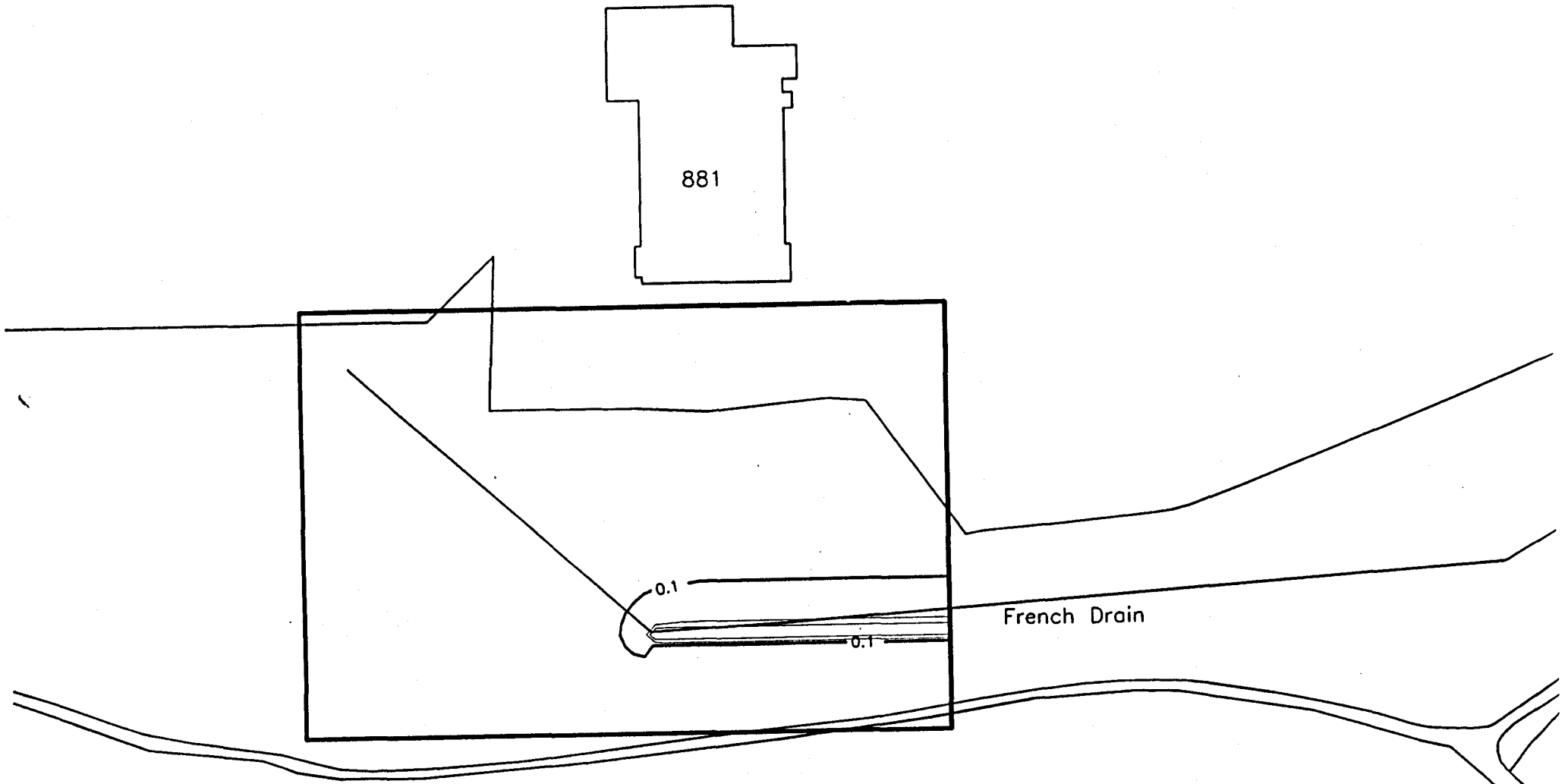
Time Step Length: 14 days

French Drain Model Domain



DRAFT

Modeled French Drain Drawdown at 14 Days



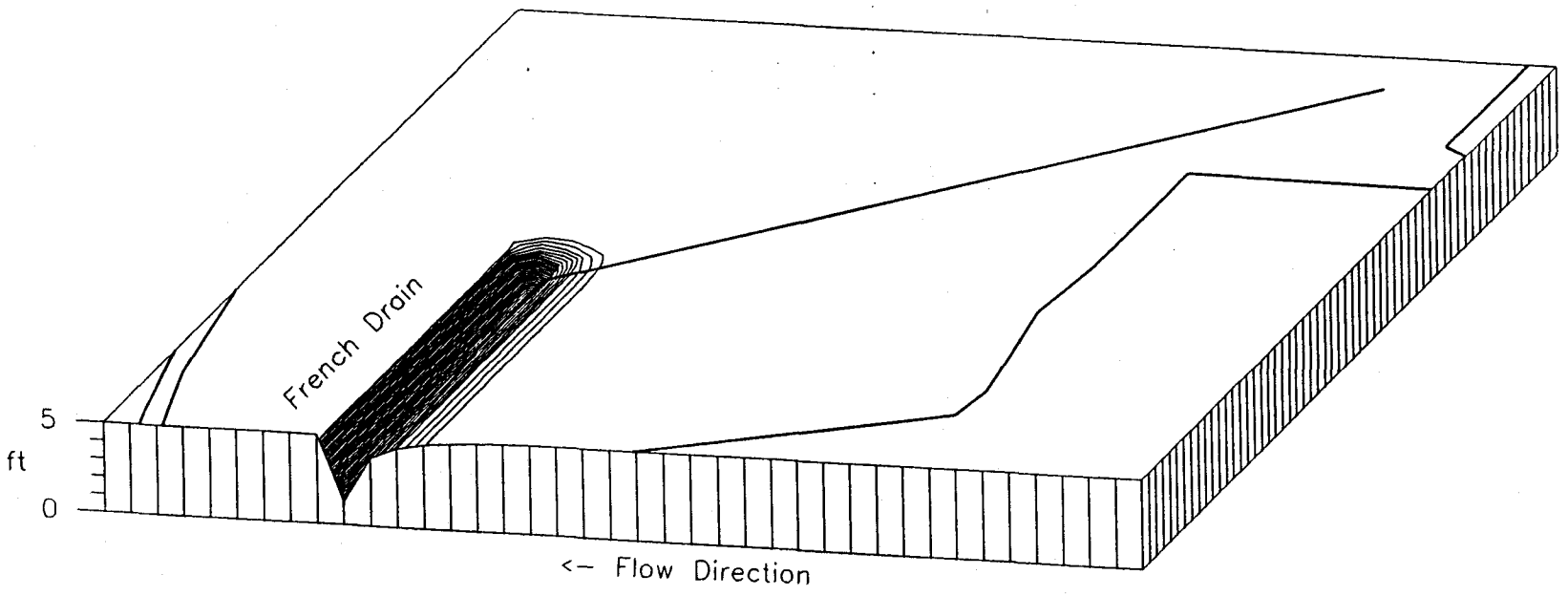
SCALE 1 inch = 200 feet

C.I. 0.1 ft

DRAFT

3/24/92

Modeled French Drain Water Table 14 Days

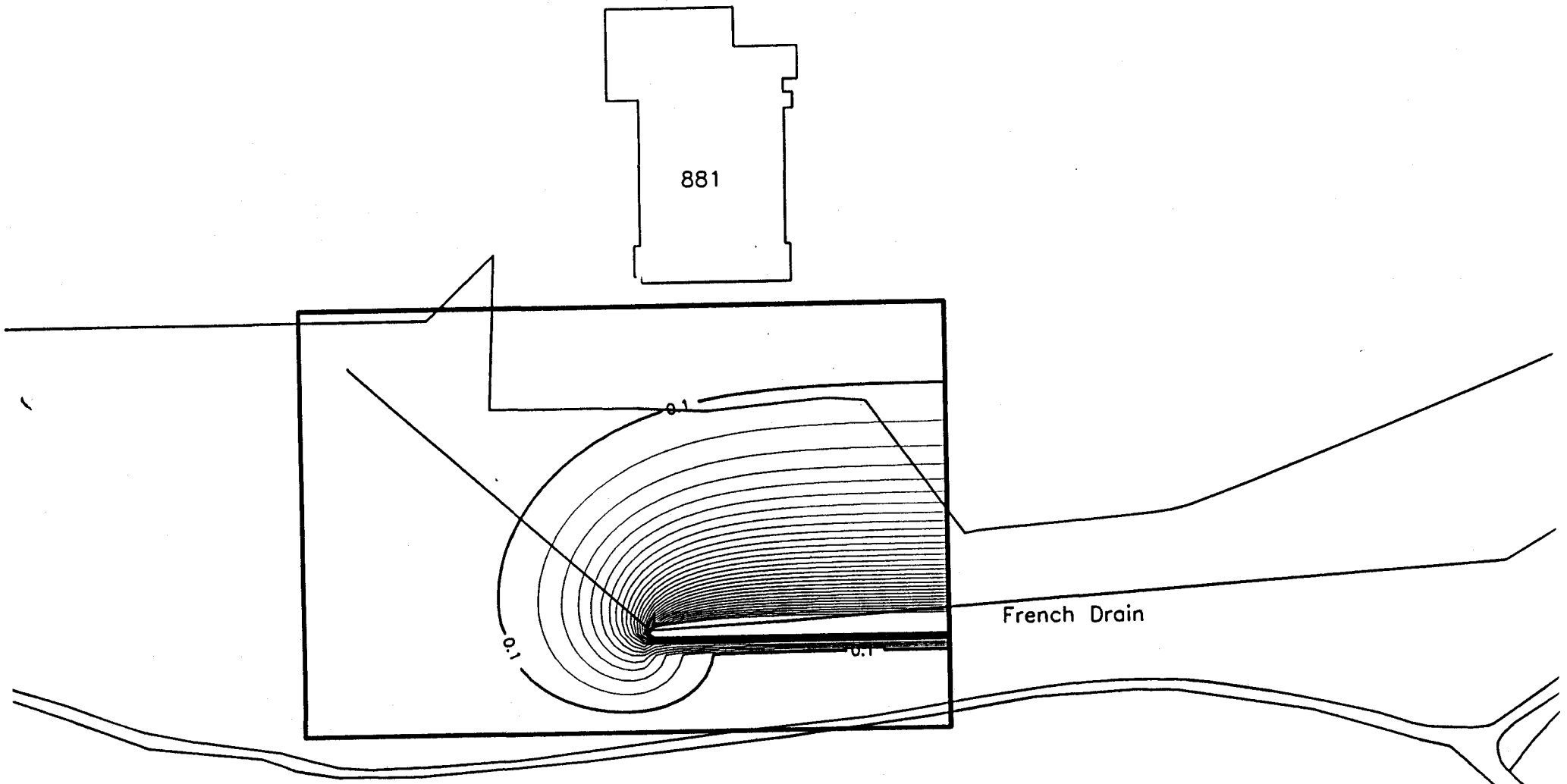


C.I. 0.1 ft

3/24/92

DRAFT

Modeled French Drain Drawdown at 1 Year



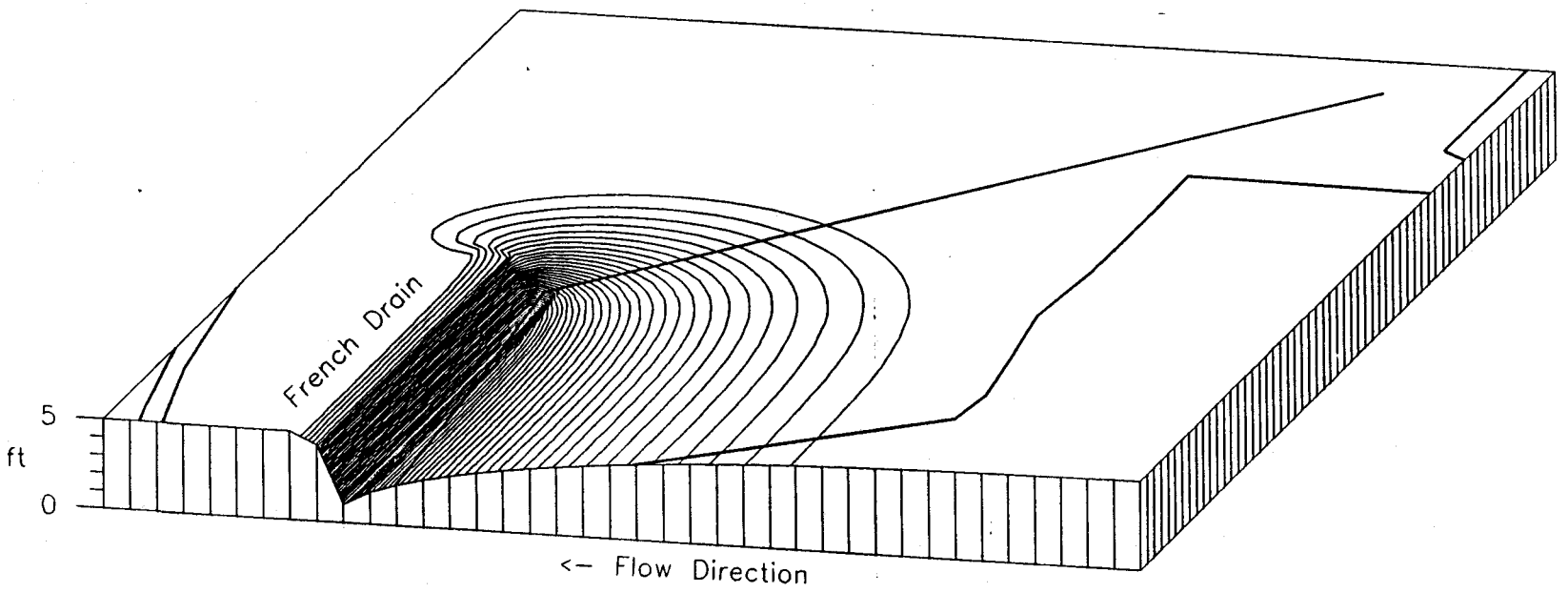
SCALE 1 inch = 200 feet

C.I. 0.1 ft

DRAFT

3/24/92

Modeled French Drain Water Table at 1 Year

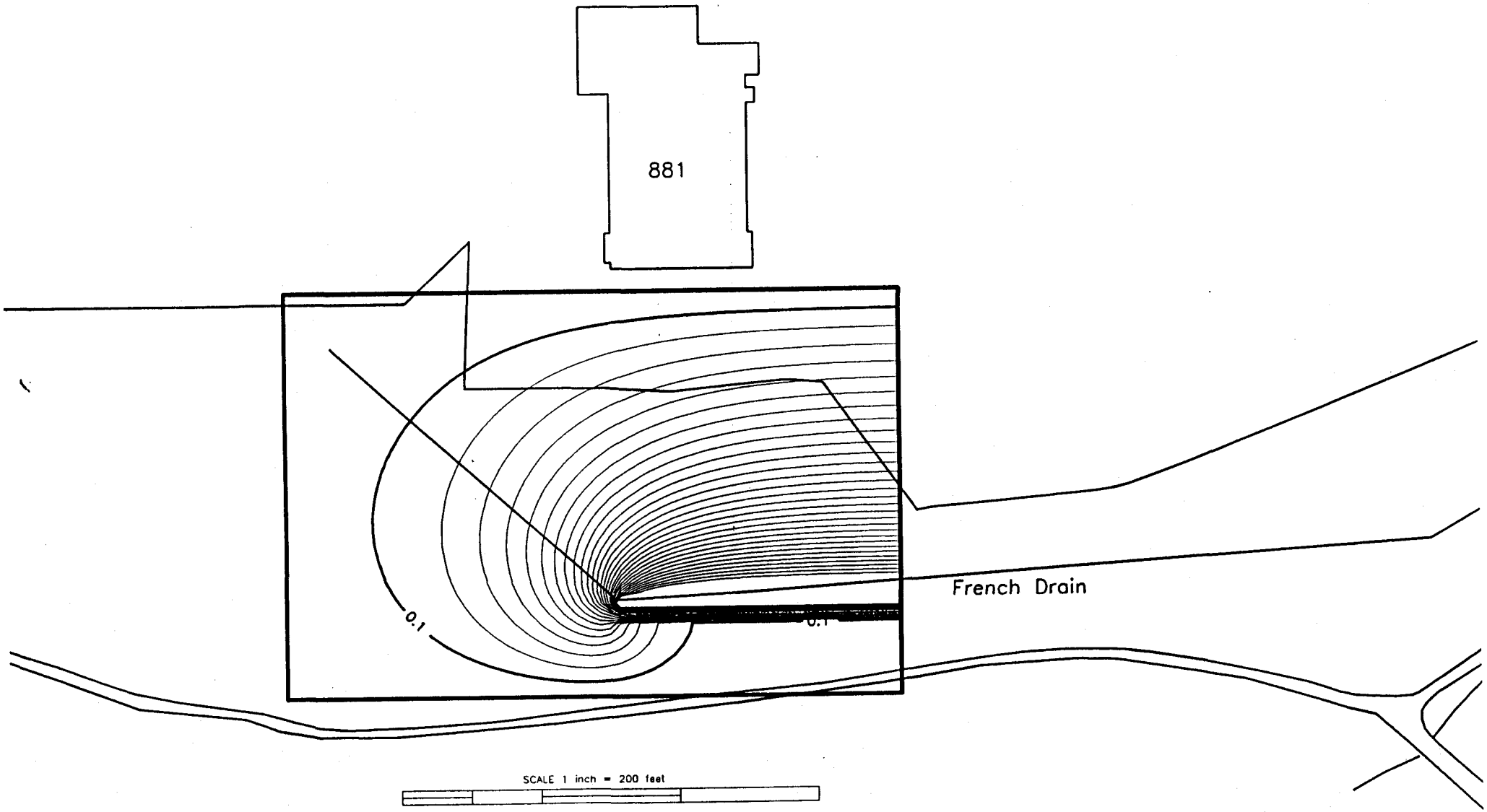


C.I. 0.1 ft

3/24/92

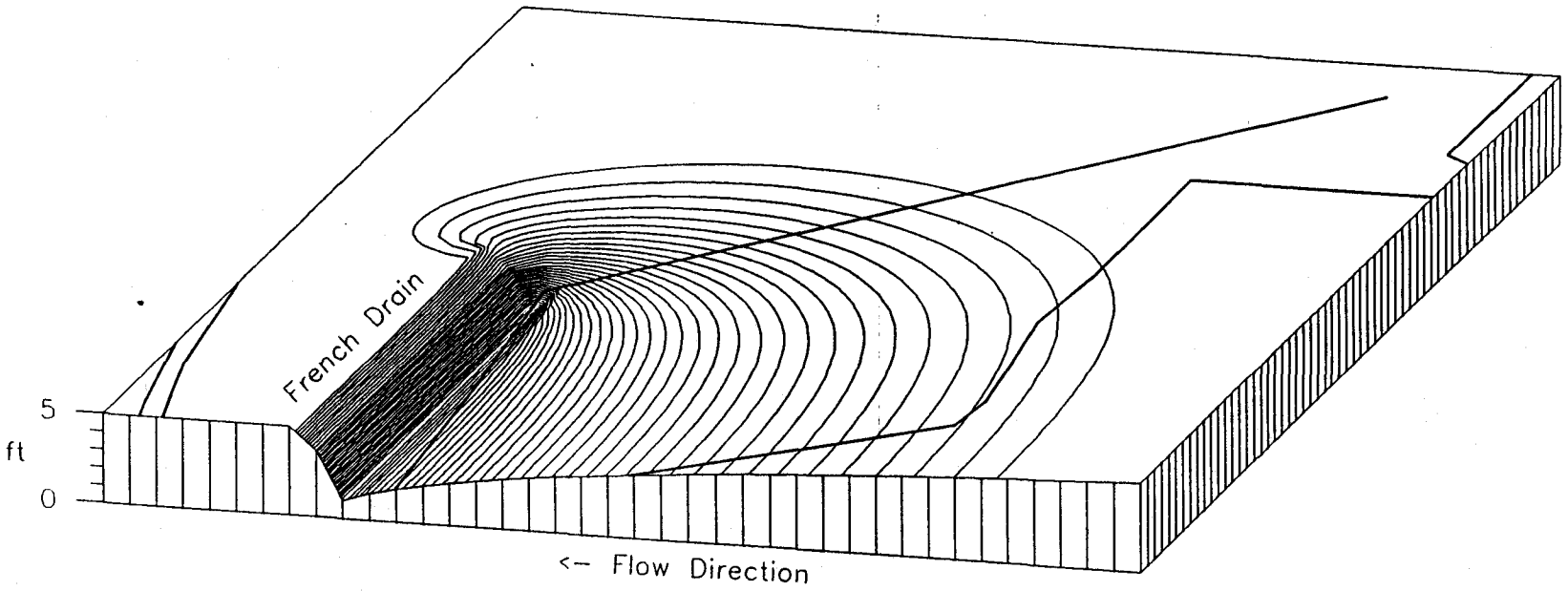
DRAFT

Modeled French Drain Drawdown at 3 Years



DRAFT

Modeled French Drain Water Table 3 Years



C.I. 0.1 ft

3/24/92

DRAFT

APPENDIX B

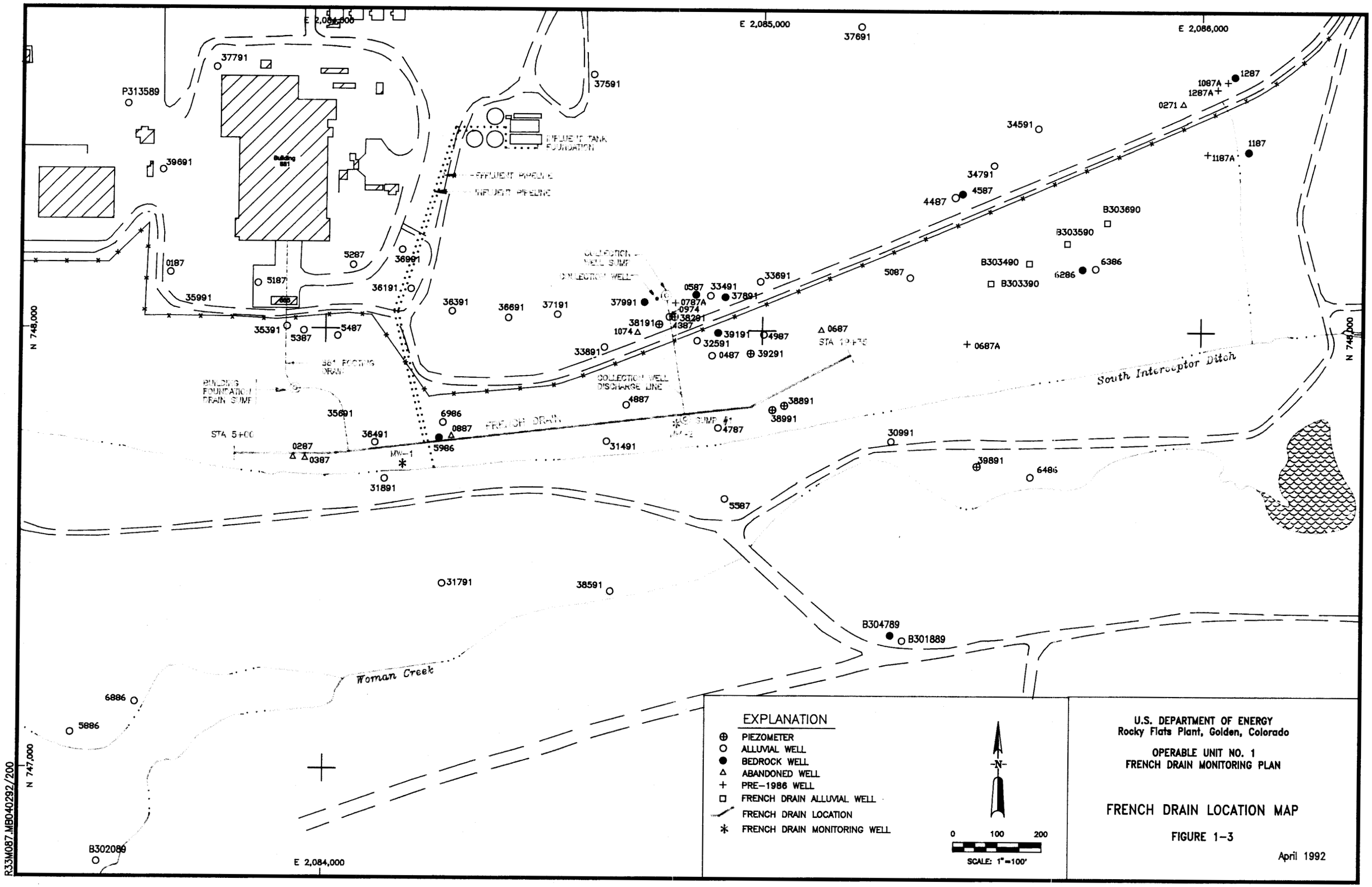
HYDRAULIC CONDUCTIVITY OF BEDROCK – BOTTOM OF TRENCH

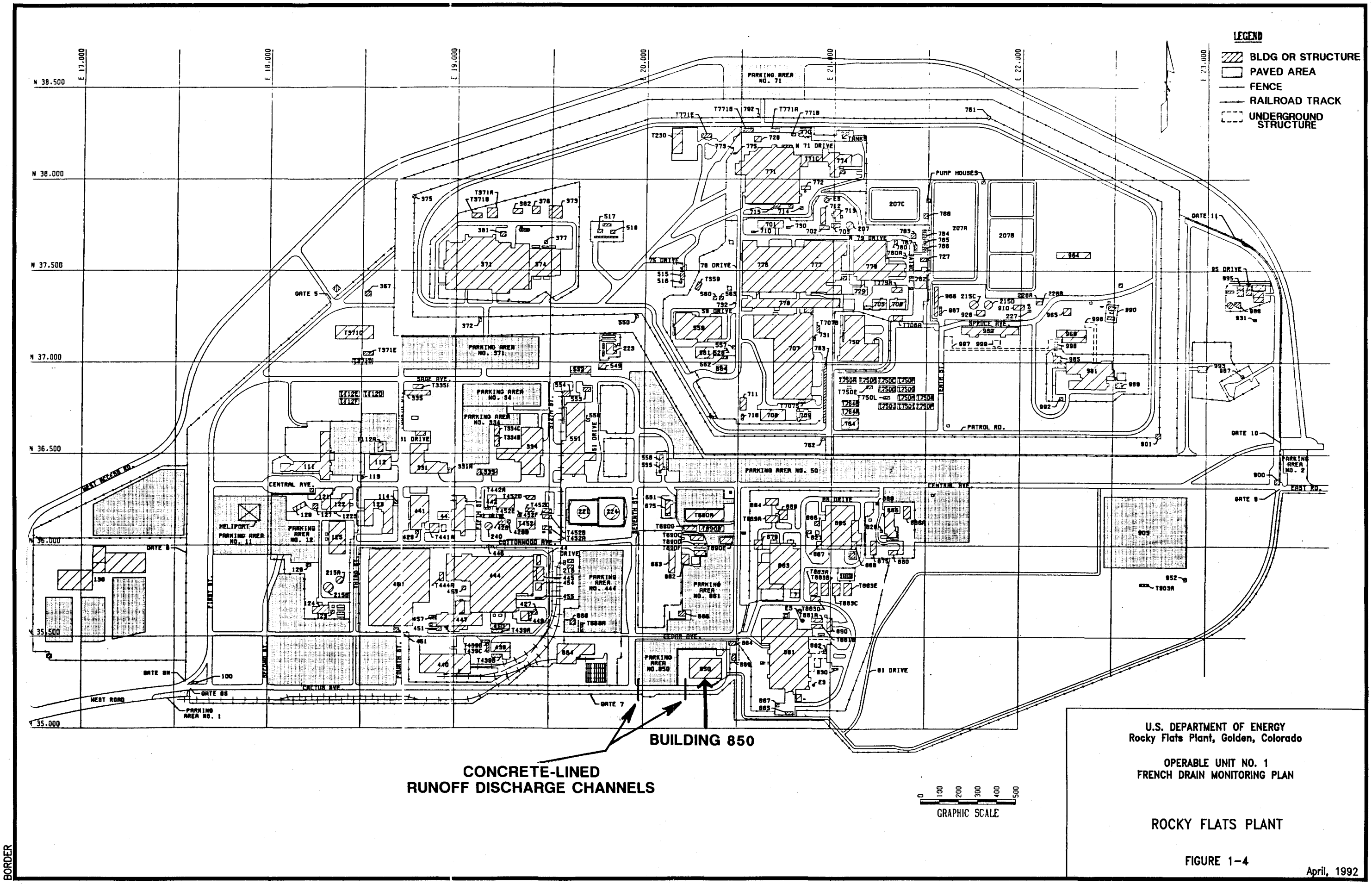
APPENDIX B

Hydraulic Conductivity of Bedrock—Bottom of Trench

Test Station	Test Date	K (cm/s)
10+45	01/20/92	7.084 E-07
11+35	NA	3.6412 E-08
12+35	01/03/92	1.36 E-07
13+50	12/31/91	5.48 E-08
14+30	12/30/91	4.84 E-08
15+40	12/16/91	3.42 E-08
15+70	11/22/91	2.55 E-08
16+70	11/25/91	1.07 E-07
18+50	12/12/91	2.55 E-08
18+60	12/16/91	8.73 E-08
19+28	12/16/91	1.34 E-07

cm/s = centimeters per second
K = Hydraulic conductivity
NA = Not available


E 2,084,000
E 2,085,000
E 2,086,000
N 748,000
N 747,000
37791
37691
37591
P313589
39691
Building 881
EFFLUENT TANK FOUNDATION
EFFLUENT PIPELINE
INFLUENT PIPELINE
0187
5187
5287
36991
36191
35991
35391
5387
5487
36391
36691
37191
37991
0787A
0974
38291
4387
38191
1074
33691
33491
37891
0587
32591
0487
39191
4987
39291
0687
STA 1+75
0687A
5087
34591
34791
4587
4487
1287
1087A
1287A
0271
1187
1187A
B303690
B303590
B303490
B303390
6386
6286
South Interceptor Ditch
BUILDING FOUNDATION DRAIN SUMP
881 FOOTING DRAIN
COLLECTION WELL SUMP
COLLECTION WELL
COLLECTION WELL DISCHARGE LINE
FRENCH DRAIN
STA 5+00
35691
6986
0887
5986
36491
0287
0387
MW-1
31891
31491
4887
4787
38891
38991
30991
39891
6486
5587
31791
38591
B304789
B301889
Woman Creek
6886
5886
B302089
EXPLANATION
PIEZOMETER
ALLUVIAL WELL
BEDROCK WELL
ABANDONED WELL
PRE-1986 WELL
FRENCH DRAIN ALLUVIAL WELL
FRENCH DRAIN LOCATION
FRENCH DRAIN MONITORING WELL
N
0
100
200
SCALE: 1"=100'
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado
OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN
FRENCH DRAIN LOCATION MAP
FIGURE 1-3
April 1992
R33M087.MB040292/200



BORDER

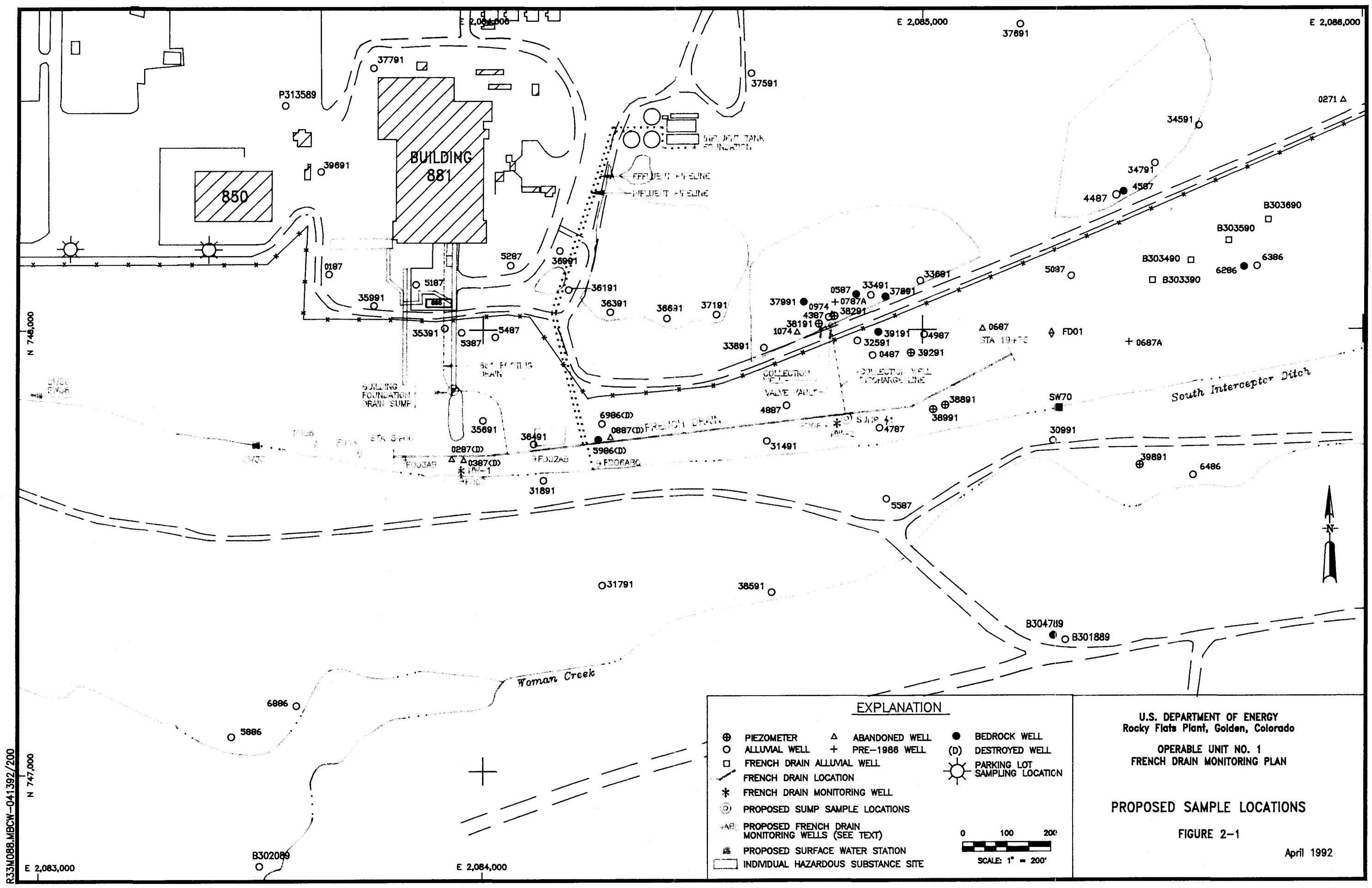
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN

ROCKY FLATS PLANT

FIGURE 1-4

April, 1992


E 2,085,000
E 2,086,000
37691
37791
37591
P313589
39691
BUILDING 881
850
INFLUENT TANK FOUNDATION
EFFLUENT PIPELINE
INFLUENT PIPELINE
0271 Δ
34591
34791
4587
4487
B303690
B303590
B303490
B303390
6386
6286
5037
0187
5187
5287
36991
36191
35991
36391
36691
37191
35391
5387
5487
33891
37991
0587
33491
37881
0974
0787A
4387
38291
38191
1074 Δ
39191
4987
32591
0487
39291
Δ 0687
STA 19+75
FD01
0687A
N 748,000
BUILDING FOUNDATION DRAIN SUMP
B61 FOOTING DRAIN
COLLECTION WELL VALVE VAULT
COLLECTION WELL DISCHARGE LINE
South Interceptor Ditch
SW70
6986(D)
0887(D)
FRENCH DRAIN
4887
38891
38991
4787
35691
36491
0287(D)
0387(D)
LINE 1
FD03AB
FD02AB
FD06ABC
5986(D)
31491
30991
39891
6486
31891
5587
31791
38591
B304789
B301889
Woman Creek
6886
5886
N 747,000
B302089
E 2,083,000
E 2,084,000
N
EXPLANATION
PIEZOMETER
ALLUVIAL WELL
FRENCH DRAIN ALLUVIAL WELL
FRENCH DRAIN LOCATION
FRENCH DRAIN MONITORING WELL
PROPOSED SUMP SAMPLE LOCATIONS
PROPOSED FRENCH DRAIN MONITORING WELLS (SEE TEXT)
PROPOSED SURFACE WATER STATION
INDIVIDUAL HAZARDOUS SUBSTANCE SITE
ABANDONED WELL
PRE-1986 WELL
BEDROCK WELL
(D) DESTROYED WELL
PARKING LOT SAMPLING LOCATION
0
100
200
SCALE: 1" = 200'
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant, Golden, Colorado
OPERABLE UNIT NO. 1
FRENCH DRAIN MONITORING PLAN
PROPOSED SAMPLE LOCATIONS
FIGURE 2-1
April 1992
R33M088.MBCW-041392/200