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Document Subject:

TRANSMITTAL OF THE "DRAFT PROPOSED ACTION MEMORANDUM FOR THE EAST TRENCHES PLUME, RF/RMRS-98-258.UN" – JEL-156-98

KH-00003NS1A

September 10, 1998

Discussion and/or Comments:

Enclosed are eight (8) copies of the "*Draft Proposed Action Memorandum for the East Trenches Plume*" for Kaiser Hill and DOE RFFO review. Four copies are for your use and four copies should be transmitted to DOE RFFO. Please provide comments by close of business, September 23, 1998.

If you have any questions please contact Annette Primrose at extension 4385.

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DRAFT PROPOSED ACTION MEMORANDUM FOR THE EAST TRENCHES PLUME

RF/RMRS-98-258.UN

Environmental Restoration
Rocky Flats Environmental Technology Site

September 10, 1998

0002

1.0 PURPOSE 1

2.0 PROJECT DESCRIPTION AND OBJECTIVES 1
2.1 Background 3
2.2 Recent Investigation Results 4
2.3 Hydrogeologic Setting 6
2.3.1 Hydrogeology 8
2.4 East Trenches Plume Contamination Data Summary 11

3.0 PROJECT APPROACH 14
3.1 Proposed Action 15
3.1.1 Installation of Funnel and Gate System 17
3.1.2 Treatment and Discharge 17
3.1.3 Performance Monitoring System 21
3.1.3.1 Groundwater Monitoring 21
3.1.3.2 Treatment Monitoring 21
3.1.3.3 Laboratory Methods 22
3.1.4 Site Reclamation 22
3.2 Worker Health and Safety 22
3.3 Waste Management 23

4.0 ENVIRONMENTAL EVALUATION 24
4.1 Soils and Geology 24
4.2 Air Quality 25
4.3 Water Quality 26
4.4 Human Health and Safety 27
4.5 Ecological Resources 27
4.6 Historic Resources 28
4.7 Visual Resources 28
4.8 Noise 29
4.9 Cumulative Effects 29
4.10 Unavoidable Adverse Effects 29
4.11 Short-term Uses Versus Long-term Productivity 30
4.12 Irreversible and Irretrievable Commitments of Resources 30

5.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS 30
5.1 Chemical-Specific Requirements and Considerations 31
5.1.1 Colorado Water Quality Standards 31
5.1.2 National Emissions Standards for Hazardous Air Pollutants 31
5.2 Action-Specific Requirements and Considerations 32
5.2.1 Remediation Waste 32
5.2.2 Identification and Listing of Hazardous Wastes 33
5.2.3 Wastewater Treatment Unit 33
5.2.4 Land Disposal Restrictions 33

5.2.5 Construction Waters 33
5.2.6 Soil Staging 34
5.2.7 Temporary Unit Tank and Container Storage 34
5.2.8 Particulate, VOC and Hazardous Air Pollution Emissions 35
5.2.9 Debris Treatment 37
5.3 Location Specific Requirements and Considerations 37
5.3.1 Endangered Species Act 37
5.3.2 Fish and Wildlife Coordination Act 38
5.3.3 Wetland Assessment 38

6.0 IMPLEMENTATION SCHEDULE 38

7.0 REFERENCES 38

Appendix

Appendix A Alternatives Analysis A-1

Tables

Table 1. Depth to Groundwater and Bedrock 11
Table 2. Groundwater Volatile Organic Compound Concentrations 13
Table 3. Soil Sample Results by Borehole 14
Table 4. Results of ETI Bench Scale Testing 19
Table 5. Schedule for Water Quality Sampling and Water Table Measurements 21
Table 6 Big Dry Creek Segment 5 Surface Water Quality Standards 31

Figures

Figure 1. East Trenches Plume Study Area 2
Figure 2. East Trenches Plume Monitoring Wells 5
Figure 3. Top of Bedrock Map 7
Figure 4. Water Table Elevation Map 9
Figure 5. Generalized Hydrogeologic Cross Section for East Trenches Plume 10
Figure 6. VOCs in Groundwater – East Trenches Plume Study Area 12
Figure 7. Location and Proposed Depth of Collection System 16
Figure 8 Collection Trench Details 18
Figure 9. Schematic Treatment Cell 20

1.0 PURPOSE

This Proposed Action Memorandum (PAM) outlines the selected strategy, applicable requirements and implementation schedule for the collection and treatment of contaminated groundwater from the distal end of the East Trenches Plume. The East Trenches Plume is ranked thirteenth on the current Environmental Restoration (ER) Ranking (RFCA Attachment 4, DOE 1996) and ranks sixth of the remaining sites that have not undergone remediation.

The East Trenches Plume contains chlorinated organic compound contamination in excess of Action Level and Standards Framework (ALF) Tier II level concentrations defined in Attachment 5 to the Rocky Flats Cleanup Agreement (RFCA)(DOE 1996). The proposed action will consist of constructing a subsurface groundwater collection system coupled with a reactive metals treatment system. This system will collect and treat contaminated groundwater from the East Trenches Plume to the surface water action levels specified in RFCA (DOE 1996).

The project will be conducted in accordance with RFCA, DOE Orders and Rocky Flats Environmental Technology Site (RFETS) policies and procedures. The project will utilize lessons learned from the Mound Site Plume project and will remediate one of the top ten remaining ER sites at RFETS. Remedial activities performed under this PAM will be consistent with and contribute to the efficient performance of anticipated long-term remedial action for the buffer zone and will be conducted in a manner which is protective of site workers, the public, and the environment.

2.0 PROJECT DESCRIPTION AND OBJECTIVES

The East Trenches Groundwater Plume is located north of Central Avenue, and east of the East Perimeter Road (Figure 1). This plume of volatile organic compound (VOC) contaminated groundwater is believed to originate from the East Trenches and 903 Pad sites, and extends northward to where the plume discharges as seeps and subsurface flow into the South Walnut Creek Drainage (RMRS 1996a). Recent exceedances of RFCA standards in a designated Tier II well near South Walnut Creek, and recent detections of VOCs in the ice-covered B-series ponds at locations where groundwater enters the surface water system, indicate that this contaminated groundwater plume is reaching surface water. Therefore, a downgradient capture system will be installed near South Walnut Creek to capture the contaminated groundwater to the extent

practicable, and to minimize contaminant impacts to surface water. The groundwater will be collected and treated at a centralized treatment location to meet surface water action levels from the ALF (DOE 1996), then discharged into surface water downgradient of the capture system. The downgradient capture system was chosen based on evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a) and experience in the design of the Mound Site Plume collection and treatment system.

This project has the following objectives:

- Intercept and treat VOC-contaminated groundwater at the distal end of the East Trenches Plume consistent with the ALF.
- To the extent practicable, protect surface water and reduce the VOC-contaminant mass loading in surface water consistent with the ALF.
- Installation of an easily accessible system to reduce operation and maintenance costs, and for ease in media replacement or final removal. The system will be designed to be similar to the Mound Site Plume collection and treatment system.
- Minimize the impacts to the Prebles Meadow Jumping Mouse during construction by installing silt fences between the construction area and South Walnut Creek to prevent downstream sedimentation of habitat.
- Avoid depletion of waters to South Walnut Creek.

2.1 Background

Most of the groundwater contamination is believed to be derived from the East Trenches area (Figure 1), primarily associated with the trenches on the north side of the East Access Road which include Trenches T-3 (IHSS 110) and T-4 (IHSS 111.1). A component of the plume is also believed to be derived from the VOC contamination at the 903 Pad (RMRS 1996a).

Trenches T-3 and T-4 were used between 1964 and 1967 for disposal of sanitary sewage sludge contaminated with low levels of uranium and plutonium. The trenches are also known to have contained VOCs, crushed drums, and miscellaneous waste. In 1996, these trenches were excavated as part of an accelerated source removal action. The removed soil and debris were treated by thermal desorption to remove the VOCs, primarily carbon tetrachloride, trichlorethene, and tetracloroethene. The treated soil below Tier II action levels was returned to the trench

excavation and the area was revegetated. Some radiologically contaminated soils between Tier I and Tier II levels were wrapped in geotextile material for ease of future identification, and returned to the T-4 excavation (RMRS 1996b).

Over 5,000 drums containing plutonium and uranium contaminated oils and VOCs were stored at the 903 Pad and Lip Area from the summer of 1958 to January 1967. The stored liquids included lathe coolant and carbon tetrachloride in varying proportions, hydraulic oils, vacuum pump oils, trichloroethene, tetrachloroethene, silicone oils, and acetone still bottoms. The drums were removed in 1967. Remedial activities occurred from 1968 through 1969 and consisted of removing some of the radiologically contaminated material, regrading the surrounding area, and capping a portion of area (RMRS 1997a). A remedial action is planned to begin in 2001 to remediate the radiological and VOC contaminated soils associated with this area.

2.2 Recent Investigation Results

Pre-remedial investigations were conducted in the Fall 1997 and Spring 1998 to determine the extent and configuration of the East Trenches Plume near South Walnut Creek. Geoprobe borings were advanced at the East Trenches plume as part of the RFETS FY97 Well Abandonment and Replacement Program (WARP). The geoprobe borings were located at 100-foot intervals along a southwest-northeast alignment immediately north of the road on the south bank of South Walnut Creek, above Ponds B-1 and B-2. Follow-on work was conducted in Spring 1998 to define the contaminated groundwater plume sufficiently to design a remedial action.

As a result of the combined investigation, thirty-two geoprobe holes were pushed at approximately 100-foot spacing perpendicular to the path of the East Trenches plume to define the nature and extent of contamination in groundwater in the distal end of the plume (Figure 2). Steep topography and wetland areas resulted in some variation of the 100-foot spacing. In addition, two locations were selected off the primary alignment, to address issues of bedrock elevation and lithology and contaminant chemistry in locations along potential flow paths between the source areas and the primary alignment.

Twenty-five temporary wells were installed to define the nature and extent of contamination in groundwater in the distal end of the plume. For all wells containing sufficient water, water levels were measured and groundwater samples were collected and submitted for both radiological screening and VOC analyses. Soil samples were collected from several boreholes and submitted for VOC and other analyses.

2.3 Hydrogeologic Setting

The hydrogeologic setting of the East Trenches Plume area is described in several reports (DOE 1995, RMRS 1996, IT 1998). The following description was derived from these reports and the results of the recent investigations. Trench T-3 and T-4 are located at the northern edge of the pediment (Figure 1) where up to 18 feet of Rocky Flats Alluvium overlies weathered claystone and the No. 1 Sandstone of the Arapahoe Formation. Beyond the plume source area, the hillside slopes steeply to the north towards South Walnut Creek. Both the alluvium and the Arapahoe No. 1 Sandstone are truncated by the South Walnut Creek drainage, and subcrop beneath the thin cover of colluvium. Numerous slump features are also found on the hillside.

The bedrock surface slopes to the north, generally conforming to the surficial topography (Figure 3). In the source area, the northeast extensions of the bedrock ridge and medial paleoscour further control groundwater flow. Recent borings (including 02597, 02697, and 02797) suggest that although the ridge extends toward the south trending drainage which enters South Walnut Creek below the B-ponds, the paleoscour is not well developed in this area (Figure 3). An attempt to further define the extension of these features was not successful due to refusal of the drilling equipment.

The uppermost bedrock is dominated by fine to medium grained sandstones, often silty or clayey, along the western half of the alignment of borings, from 22597 through 23497. At boreholes 22597, 22697, and 22997 and 23097, the Arapahoe No. 1 Sandstone is present, generally overlying less permeable sandstones. The finer grained sandstones are tentatively identified as less permeable units of the Laramie Formation. Claystone was encountered beneath the sandstone units, and is present at the top of bedrock at locations where sandstone was not present.

At boring 03098 a black carbonaceous material was encountered and sampled in claystone at a depth of 13.0 and 13.5 feet. Two additional wells (03598 and 03698) were completed in this vicinity, and this material was observed at similar depths. The occurrence, and associated soil

and groundwater chemistry, is consistent with a naturally occurring carbonaceous material, which is common in the Laramie Formation.

2.3.1 Hydrogeology

Groundwater flow is to the north and northeast with discharge primarily as seeps, springs, and evapotranspiration in the area near South Walnut Creek, particularly where the water bearing units are truncated. At a spring and seep complex on the south bank of South Walnut Creek, above Ponds B-1 and B-2, where the Arapahoe No. 1 Sandstone subcrops, concentrations of VOCs above Tier I action levels have been detected by a recent sampling program. The presence of VOCs in the seep complex indicates that contaminants from the groundwater plume have reached South Walnut Creek.

During the February 1997 sampling event, tetrachloroethene was detected at the B-1 Pond at a concentration of 8 µg/l. At the B-2 Pond, the following compounds were detected above the laboratory detection limits. Trichloroethene was detected at 400 to 420 µg/l (dilution), vinyl chloride was detected at 2-3 µg/l, 1-1-dichloroethene at 0.8 to 0.9 µg/l, cis-1,2-dichlorothene at 94 to 100 µg/l, trans-1,2-dichloroethene at 1 µg/l, chloroform at 12 to 14 µg/l, 1,1,1-trichloroethane at 0.8 to 1 µg/l, tetrachloroethene at 16 µg/l, and carbon tetrachloride at 16 to 19 µg/l. At the culvert along the south side of the B-series ponds where surface water is diverted around ponds B-1 and B-2, detects were seen of trichloroethene at 52 µg/l, cis-1,2-dichlorothene at 1 µg/l, chloroform at 2 µg/l, and carbon tetrachloride at 8 µg/l.

Groundwater was encountered in most of the wells installed in 1997 and 1998 along the alignment (Figure 4). Where present, groundwater was found in the colluvium, in the weathered bedrock just below the colluvial/bedrock contact or in the bedrock sandstones. Water levels ranged from 4 feet to 17 feet below ground surface as shown in Table 1. The groundwater flow rate for this plume was calculated at approximately 2.5 feet per day, with 2 feet per day flow attributed to the subcropping Arapahoe No. 1 Sandstone.

Four wells along the alignment were dry. Three wells, 23697, 03698 and 02498 were installed in the claystone bedrock (Figure 5). Well 02398 was also dry. It is located approximately 200 feet southeast of well 23097, up the slope of the south flank of the South Walnut Creek valley, where bedrock consists of weathered, fine-grained, clayey sandstone overlying silty claystone (Figure 2). However, the well was installed at a shallow depth due to refusal of the drilling equipment, and it is probable that at this location, groundwater occurs at a greater depth.

Figure 5. Generalized Hydrogeologic Cross Section for the East Trenches Plume

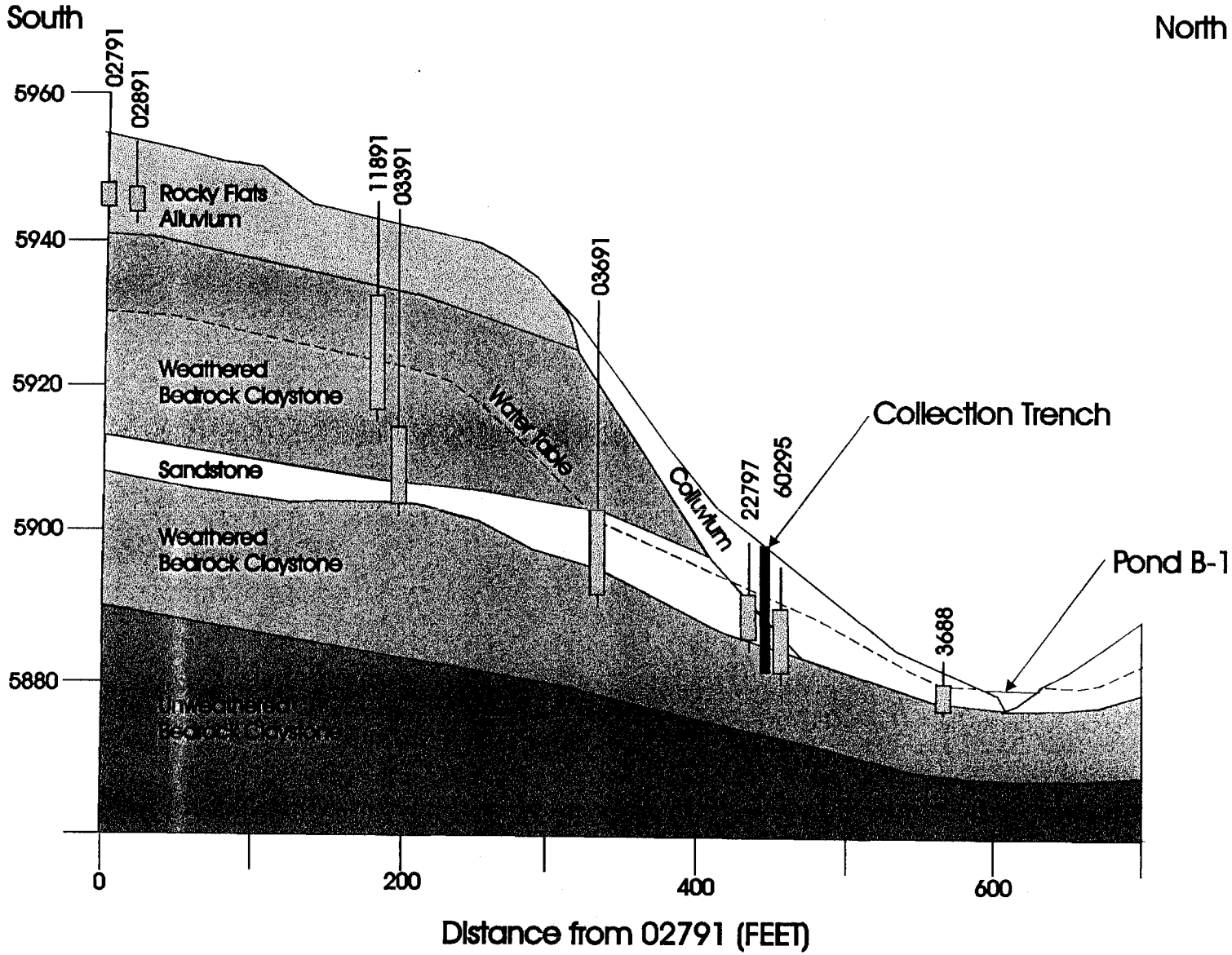


Table 1. Depth to Groundwater and Bedrock (in feet)

1997 Boreholes	Ground Surface Elevation	Depth to Water	Depth to Top of Bedrock	Total Depth	1998 Boreholes	Ground Surface Elevation	Depth to Water	Depth to Top of Bedrock	Total Depth
22597	5914.0	11.9	0.8	26.2	02398	5909.5	Dry	4.2	10.7
22697	5907.0	8.1	1.9	18.0	02498	5863.5	Dry	12.0	22.0*
22797	5899.0	3.9	8.0	13.8	02598	5855.8	15.3	5.8	22.3*
22897	5897.0	10.3	1.0	24.2	02698	5861.5	16.5	3.4	18.2
22997	5891.0	5.3	5.8	16.1	02798	5865.1	6.8	2.6	14.6*
23097	5887.0	4.9	6.2	13.8	02898	5865.3	8.6	2.0	13.9
23197	5885.0	5.6	4.3	17.3	02998	5926.1	NWI	NA	18.0
23297	5881.0	10.8	9.1	13.3	03098	5875.4	NWI	6.0	14.0
23397	5879.0	10.4	5.5	14.2	03598	5877.9	9.8	4.0	16.2*
23497	5876.0	11.9	2.4	12.4	03698	5879.8	Dry	4.6	15.0
23597	5873.0	11.4	1.6	19.4	03798	5909.0	NWI	4.4	9.7
23697	5871.0	Dry	5.7	11.1	03898	5908.8	NWI	4.0	10.2
23797	5867.0	15.9	17.0	20.2					
23897	5862.0	11.4	12.5	18.3					
23997	5861.0	13.1	8.9	18.1					
24097	5859.0	14.5	5.5	18.2					
24197	5857.0	13.0	8.0	16.1					
24397	5925.0	4.2	4.3	18.5					
24497	5917.0	8.6	5.2	17.1					

* Borehole was backfilled prior to well construction
NWI No well installed at this location

The following ranges and geometric means of hydrogeologic units, derived from sitewide data (EG&G, 1995) are considered representative of the hydrogeology of the East Trenches plume study area:

- Colluvium - 4.0×10^{-6} to 9.3×10^{-4} cm/sec, geometric mean of $9.3 \times 10\ 10^{-5}$ cm/sec.
- Weathered Arapahoe/Laramie claystone - 3.0×10^{-8} to 5.6×10^{-4} cm/sec, geometric mean of 9.98×10^{-7} cm/sec.
- Weathered Arapahoe/Laramie sandstones other than Arapahoe No. 1 sandstone - 5.7×10^{-6} to 2.1×10^{-4} cm/sec, geometric mean of 3.9×10^{-5}.
- Weathered Arapahoe No. 1 Sandstone - 4.0×10^{-5} to 9.3×10^{-3} cm/sec, with a geometric mean of 7.9×10^{-4} cm/sec.

The horizontal hydraulic gradient in the vicinity of the well alignment is approximately 0.14 in a northerly direction.

2.4 East Trenches Plume Contamination Data Summary

Investigation results indicate that trichloroethene is the predominant contaminant found in groundwater at the distal end of the East Trenches Plume with the highest concentration of 6,800 µg/l in Well 23197 (Figure 6). The highest concentration of carbon tetrachloride found was 460 µg/l with 1,1,-trichloroethane at 730 µg/l in wells 23197, 22997 and 22697 respectively. Table 2 and Figure 6 summarize the groundwater results of this investigation. In the source area,

semivolatiles, petroleum compounds, and uranium-238 (at concentrations up to 3,240 pCi/g) were also detected (RMRS, 1996b).

Table 2. Groundwater Volatile Organic Compound Concentrations

Well	Trichloro-ethene	Tetrachloro-ethene	Carbon Tetrachloride	1,1-Dichloro-ethene	Toluene	Chloro-form	Methylene chloride
22597	1	250	12	<1	<1	<1	<1
22697	41	730	71	<1	<1	<1	<1
22797	36	580	95	<1	<1	<1	<1
22897	11	83	20	<1	<1	<1	<1
22997	280	440	460	9	<1	<1	<1
23097	2600	320	280	<1	<1	<1	<1
23197	6800	190	140	<1	<1	<1	<1
23297	N/A	N/A	N/A	N/A	<1	<1	<1
23397	560	37	69	<1	<1	<1	<1
23497	N/A	N/A	N/A	N/A	<1	<1	<1
23597	370	17	64	<1	<1	<1	<1
23697	N/A	N/A	N/A	N/A	<1	<1	<1
23797	N/A	N/A	N/A	N/A	<1	<1	<1
23897	1	1	8	<1	<1	<1	<1
23997	0.7	0.4	4	<1	<1	<1	<1
24097	N/A	N/A	N/A	N/A	<1	<1	<1
24197	N/A	N/A	N/A	N/A	<1	<1	<1
24297	22	210	110	<1	<1	<1	<1
24397	<1	31	<1	<1	<1	<1	<1
24497	0.6	17	0.7	<1	<1	<1	<1
02598	< 5	< 5	< 5	< 5	<5	1 J	6
02698	< 5	< 5	< 5	< 5	<5	1 J	3 J
02798	< 5	< 5	< 5	< 5	< 5	<5	<5
02898	< 5	< 5	< 5	< 5	<5	<5	<5
03598	< 5	< 5	< 5	< 5	2 J	<5	<5

Table includes only compounds which were detected in one or more of the samples
Blank spaces indicate that the compound was not detected at or above the reporting limit.
N/A indicates that the well was dry or had insufficient water for analysis of VOCs.
ND indicates that the contaminant was not detected at the detection limit
J indicates that the contaminant was detected below the detection limit

Subsurface soil samples were collected and analyzed for VOCs, metals and radionuclides to determine whether materials excavated from the collection trench or treatment area would be required to be dispositioned as waste. With the exception of two detects of acetone at 9 µg/l at 02598 and 02798, all VOC analyses were below the detection limits. All soil samples were well below the RFCA action levels for subsurface soils. Metal and radionuclide analytical results are presented by location in Table 3 , and the locations are shown on Figure 1.

Table 3. Soil Sample Results by Borehole (in mg/kg unless otherwise indicated)

	02398	02498	02598	02698	02798	02898	03098	03598	03698
Silver	<0.11	<0.14	<0.05	<0.05	<0.05	<0.06	<1.0	<0.11	<0.10
Aluminum	2,730	9,880	8,950	7,810	4,400	6,640	6,560	3,260	4,740
Arsenic	11.0	3.1	6.7	3.2	7.1	3.4	11.6	9.4	2.7
Barium	36.9	82.1	38.1	81.6	51.4	71.4	53.2	32.8	43.9
Beryllium	0.26	0.88	0.61	1.2	0.78	0.42	0.59	0.47	0.95
Calcium	1,490	5,720	1,950	3,300	2,260	4,450	2,410	176,000	3,780
Cadmium	0.13	0.42	0.15	1.7	0.52	0.15	0.34	3.6	0.32
Cobalt	3.1	5.6	4.2	12.4	22.5	3.9	12.0	28.9	5.7
Chromium	3.6	11.7	8.9	8.8	5.1	8.8	8.4	2.5	5.4
Copper	6.8	24	8.2	18.3	7.5	7.1	17.9	6.1	12.2
Iron	5,930	11,100	10,600	41,300	6,910	8,370	14,500	6,340	2,750
Potassium	537	1,670	1,090	1,090	568	845	1,010	435	674
Lithium	<1.3	12.6	4.9	6.5	5.7	4.7	NA	2.0	2.5
Magnesium	617	3,220	1,670	1,820	899	1,290	1,510	1,670	1,230
Manganese	38.7	81.3	130	664	338	173	100	527	17.7
Molybdenum	0.71	1.4	1.4	0.83	1.1	0.84	0.66	0.52	0.29
Sodium	43	300	904	782	828	617	859	62.7	73.3
Nickel	6.1	16.3	9.7	53.8	26.6	9.6	17.5	8.9	9.4
Lead	6.4	21.2	9.2	12.7	8.7	7.0	15.8	8.9	13.5
Antimony	<0.39	<0.51	<0.15	<0.14	0.44	<0.17	<0.17	<0.41	<0.36
Selenium	<0.39	0.82	0.30	0.83	<0.14	<0.17	0.42	<0.41	<0.36
Tin	<0.44	1.6	1.4	1.7	1.2	1.5	1.6	<0.45	0.87
Strontium	17.6	101	32.5	63.4	30.1	30.1	55.1	58.7	29.5
Thallium	<0.48	1.5	0.46	0.74	0.22	<0.16	0.43	0.57	<0.44
Vanadium	10.2	30.6	20.3	29.4	21.9	18.2	25.3	6.4	8.5
Zinc	21.4	59.6	33.7	93.7	31.5	25.2	68.2	49	44.9
Uranium 233/234 pCi/g	<3.9*	<5.1*	NA	NA	NA	0.465	0.877	5.6*	3.6*
Uranium 235 pCi/g		NA	NA	NA	NA	0.014	0.063	NA	NA
Uranium 238 pCi/g		NA	NA	NA	NA	0.591	0.998	NA	NA
Plutonium 239/240 pCi/g		NA	NA	NA	NA	0.003	0.012	NA	NA
Americium 241 pCi/g		NA	NA	NA	NA	0.008	0.469	NA	NA

NA indicates the sample was not analyzed for the specified parameter
< indicates that the analyte was not detected at the indicated reporting limit
* Uranium (total) in mg/kg

3.0 PROJECT APPROACH

A downgradient capture system will be installed near South Walnut Creek to intercept contaminated groundwater and to minimize impacts to surface water. A subsurface groundwater collection system will be coupled with a passive reactive metals treatment system to treat the VOC-contaminated groundwater from the East Trenches Plume to the appropriate surface water action level specified in the ALF (DOE 1996). The downgradient capture system was chosen as

the best remediation method following an evaluation of other more traditional options in the Groundwater Conceptual Plan (RMRS 1996a). The passive treatment system was selected because it effectively treats the existing VOCs to below action levels at lower life-cycle cost than other treatment options.

3.1 Proposed Action

The East Trenches Plume contains chlorinated organic compound contamination in excess of ALF Tier I level concentrations defined in RFCA. An impermeable barrier groundwater collection system will be keyed into the underlying claystone for flow cut-off, and the collected groundwater will be treated in a separate treatment system (Figure 7). Based on the available data, to capture the contaminant plume, a groundwater collection system will be installed that extends from well 24497 approximately 1,100 feet to the east (Figures 6 and 7). An analysis of the alternatives considered prior to selection of this remedy is found in Appendix A.

The variable elevation of the bedrock surface and the similarity between the clay-rich colluvium and bedrock makes it difficult to install a collection system keyed a certain depth into bedrock. However, because the clay-rich colluvium and bedrock have similar hydrogeologic properties, effective collection of the contaminated groundwater is not dependent on being keyed into bedrock. Therefore, the collection system will be installed at a variable depth of approximately 16 to 26 feet across the site, at least 6 inches, and on average, 3 feet into claystone, without regard to whether this is colluvium or bedrock (Figure 7). The contaminated groundwater will be treated in a series of cells containing reactive iron filings to remove VOCs. Under normal operations, the treated water is expected to be discharged to groundwater using an infiltration galley located adjacent to South Walnut Creek. However, the system will be designed to allow discharge directly to surface water in South Walnut Creek.

After installation of the funnel and gate system, reclamation of the collection/treatment area will be performed.

3.1.1 Installation of the Collection and Treatment System

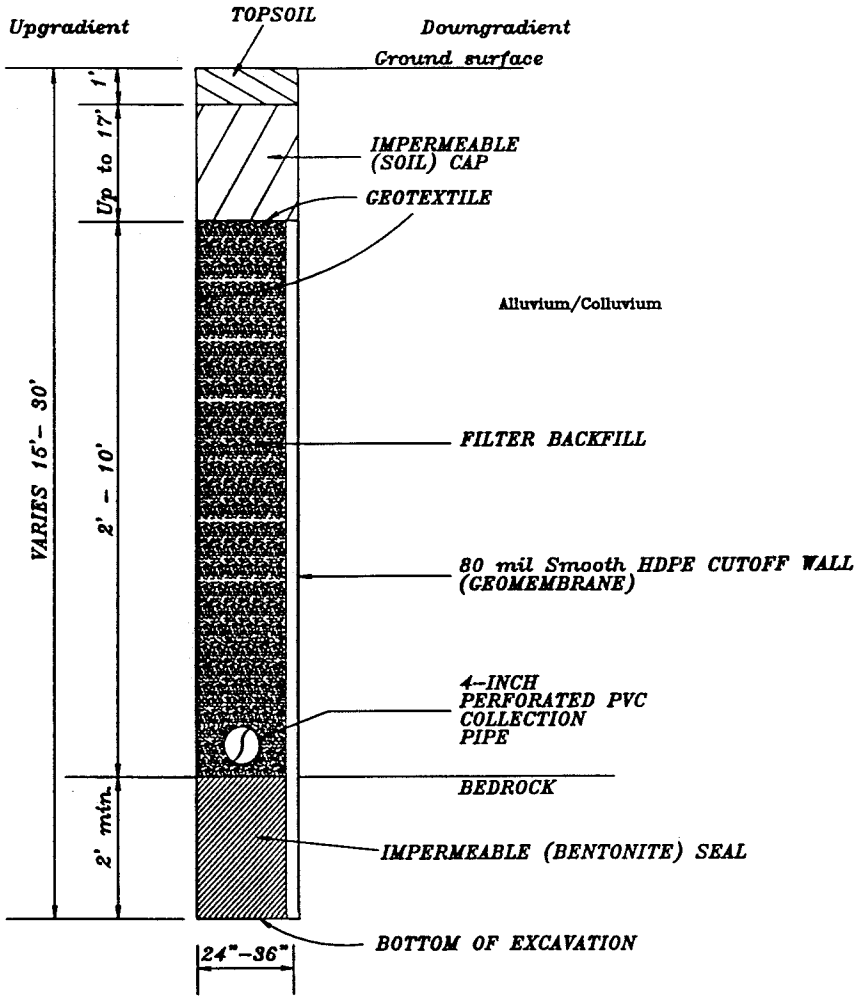
Conventional excavation and/or trenching techniques or a continuous trencher will be used to install the funnel and gate system. Silt fences will be installed downgradient of the excavation to control potential release of sediment to the drainages. During trench construction, the material removed from the trench will be stockpiled adjacent to the trench. A horizontal groundwater-collection line will be installed on the upgradient side of the impermeable barrier. Filter pack will surround the horizontal collection line, and extend upwards several feet. The trench will then be backfilled and excess fill will be spread over the top of the collection system. Figure 8 shows the details of the trench construction.

During soil handling activities that result in dust generation, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. In addition, excavation operations will not be conducted during periods of sustained high winds. The RFETS Environmental Restoration Field Operations Procedure FO.01, Air Monitoring and Dust Control, will be incorporated into the project. Air monitoring for VOCs, particulates, and radioisotopes will be performed during excavation and backfill activities.

As the East Trenches Plume area is not radiologically contaminated, radiological monitoring of the soil will not be performed unless required to protect workers, the public, and the environment in accordance with 10 CFR 835 and the RFETS Radiological Controls Manual (K-H, 1996). If unexpected hazards or conditions are encountered during remediation, work will be halted in order to re-evaluate the existing procedures to ensure that these are adequate to prevent spread of contamination and minimize exposure to workers.

3.1.2 Treatment and Discharge

A reactive metals treatment system will be used to degrade dissolved VOCs from groundwater. The reactive metal media works by inducing conditions that cause substitution of hydrogen for chlorine in the chlorinated VOCs. The end products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end-products of chlorinated VOCs degraded by this process are ethene, ethane, and chloride ions.



TYPICAL TRENCH CROSS SECTION

NOT TO SCALE

Figure 8
Collection Trench Details

The treatment system will be designed based on the results of laboratory treatability studies conducted by Envirometal Technologies, Inc. (ETI), the patent holder for the reactive iron filings technology. The flow rate of 2.5 feet per day was used along with a total calculated VOC contaminant flux to surface water of 13.3 grams per day. ETI's recommendations on the volume of reactive media and retention times required to meet the surface water action levels will be incorporated into the final design of the treatment system. A schematic of the treatment system is shown on Figure 9.

The laboratory treatability study used uncontaminated groundwater from RFETS spiked with the maximum contaminants levels expected for the Mound Site, 903 Pad/Ryan's Pit and East Trenches Plumes. Initial concentrations used in the column testing and concentrations in the treated effluent are shown in Table 4.

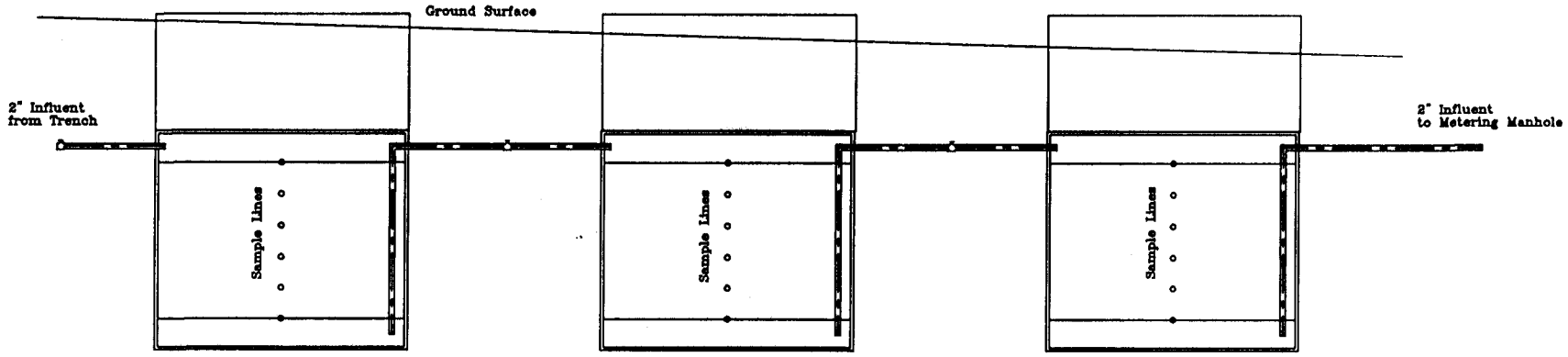
All VOCs, with the exception of methylene chloride, were removed to below surface water action levels (Table 4). The concentrations of methylene chloride in the East Trenches Plume (Table 2) are already not detectable or low level, and surface water action levels would be met.

Table 4. Results of ETI Bench Scale Testing - Connelly Iron

Compound	Influent Concentration (µg/l)	Effluent Concentration (µg/l)	Surface Water Action Level (µg/l)
Carbon Tetrachloride	1,004	nd	5
Trichloromethane	110	nd	8
Methylene Chloride	111	105	5
Tetrachloroethene	5,496	nd	5
Trichloroethene	5,250	nd	5
Cis-1,2-dichloroethene	64	nd	70
1,1-Dichloroethene	318	nd	7
Vinyl Chloride	102	nd	2
1,1,1-Trichloroethane	37	nd	200

nd = non detect

The treated groundwater will be discharged to groundwater using an infiltration galley located adjacent to South Walnut Creek. However, the system will be designed to allow discharge directly to surface water in South Walnut Creek.



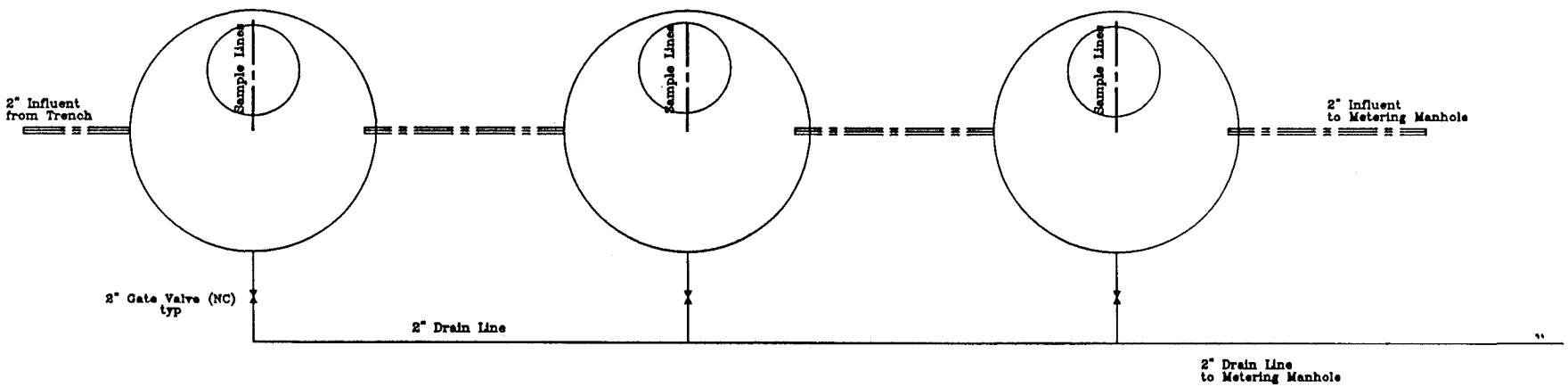
Treatment System Profile

SCALE: 1/4 INCH = 1 FOOT

Notes:
Reactors contain a one foot flooded headspace, five feet of iron media, and a one foot drainage layer.

Sample ports originate at the center of the reactor and are spaced at one foot intervals throughout the bed depth.

Sample lines will extend up and terminate within the access manway



Treatment System Plan View

SCALE: 1/4 INCH = 1 FOOT

Notes:
Two inch drain lines provide a means to initially fill the reactors from teh bottom as well as allow draining of the units for media replacement

ROCKY FLATS COLORADO

MOUND SITE PLUME

Figure 9 Schematic Treatment Cell

0024

3.1.3 Performance Monitoring System

The objective of performance monitoring of the groundwater collection/treatment system is to provide an indication of the effectiveness of the system in meeting the project objectives. Monitoring consists of two parts: 1) monitoring the effectiveness of the groundwater interception system, and 2) monitoring the effectiveness of the treatment system.

3.1.3.1 Groundwater Monitoring

The effectiveness of the groundwater collection system will be assessed by monitoring the elevation of the water table in piezometers and downgradient wells. Piezometers will be installed upgradient and downgradient of the containment wall to measure water levels. Placement of piezometers will be detailed in design drawings. The Site's Integrated Monitoring Program will be amended to add four downgradient monitoring wells to evaluate the effectiveness of the collection system at capturing the contaminated groundwater plume. These wells are shown on Figure 6, and the sampling frequencies are listed in Table 5.

Table 5. Schedule for Water Quality Sampling and Water Table Measurements

Task	Month 1	Months 2-6	Months 7-12	Subsequent Years
Treatment System Influent	Monthly	Monthly	Monthly	Semi-Annually
Treatment System Effluent	Weekly	Monthly	Quarterly	Semi-Annually
Downgradient Water Quality	Quarterly	Quarterly	Quarterly	Semi-Annually
Hydraulic Head	Weekly	Monthly	Quarterly	Semi-Annually

Note: Water levels will be taken for each sampling event

After sufficient data are gathered that indicate stable conditions, the monitoring requirements in subsequent years may be changed to annual or less frequent monitoring.

3.1.3.2 Treatment Monitoring

The effectiveness of dehalogenating chlorinated VOCs in groundwater using iron filings will be evaluated by comparing VOC concentrations in water entering and leaving the treatment system. One access point will be installed to allow sampling inflow to the treatment system. A second

access point will be installed to allow sampling of the treatment system effluent. A flow indicating device will also be installed in the treatment system discharge line to monitor the volume of treated water. Sampling type and frequency are listed in Table 5.

3.1.3.3 Laboratory Methods

VOC samples will be analyzed by EPA Method 8260. Data will be assessed for usability with respect to the PARCC parameters (precision, accuracy, reproducibility, completeness and comparability) prior to use. Data validation requirements will be met by the Site by validating at least 25% of the Site data. The validated data may or may not include project data. Data will be reported to the regulators quarterly the first year, then annually thereafter. However, reporting frequency may be reduced with the concurrence of the regulators if operating experience warrants.

3.1.4 Site Reclamation

At the completion of the installation of the collection and treatment system, the areas disturbed during construction will be revegetated. Radiological surveys of the equipment will be performed per the RFETS Radiological Control Manual (K-H 1996) prior to release from RFETS. Excavation equipment will be decontaminated. Typical decontamination methods include pressure washing and hand washing. Revegetation will be performed in accordance with guidance from Site ecologists using appropriate seed mixtures.

3.2 Worker Health and Safety

This project falls under the scope of the Occupational Safety and Health Administration construction standard for Hazardous Waste Operations and Emergency Response, 29 Code of Federal Regulations (CFR) 1926.65. To comply with this standard, a Site-Specific Health and Safety Plan (HASP) will be developed to address the safety and health hazards of each phase of project operations and to specify the requirements and procedures for employee protection. In addition, DOE Order 5480.9A, Construction Project Safety and Health Management, applies to this project. This order requires the preparation of Activity Hazard Analyses (AHAs) to identify

each task, hazards associated with each task, and controls necessary to eliminate or mitigate the hazards. The AHAs will be included in the HASP.

This project could expose workers to physical, chemical, and potentially to low levels of radiological hazards. The physical hazards include those associated with excavation activities, use of heavy equipment, noise, heat stress, cold stress, and work on uneven surfaces. Physical hazards will be mitigated by appropriate use of personal protective equipment (PPE), engineering, and administrative controls. Chemical hazards will be mitigated by the use of PPE and administrative controls. Appropriate skin and respiratory PPE will be worn throughout the project. Routine VOC monitoring will be conducted with an organic vapor monitor for any employees who must work near the contaminated soil (i.e. soil sampling or excavation personnel). Based on employee exposure evaluations, the Site Health and Safety Officer may downgrade personal protective equipment requirements, if appropriate.

Since this is not a radiological area, radiological controls will not be required. However, the HASP will include project "hold points", which will account for unanticipated hazards such as encountering unexpected contaminated debris. Radiation monitoring will be included as necessary in the HASP per the RFETS Radiological Controls Manual (Kaiser-Hill, 1996).

If field conditions vary from the planned approach, an AHA will be prepared for the existing conditions, and work will proceed according to the appropriate control measures. Data and controls will be continually evaluated. Field radiological screening will be conducted using radiological instruments appropriate to detect surface contamination and airborne radioactivity. As required by 10 CFR 835, Radiation Protection of Occupational Workers, applicable implementing procedures will be followed to insure protection of the workers, co-located workers, the public, and the environment. The HASP describes the air monitoring equipment to be used to monitor for VOCs, particulates, and radiation. Finally, dust minimization techniques will be used to minimize suspension of contaminated soils.

3.3 Waste Management

When the excavation for the placement of the impermeable barrier is performed, soil will be stockpiled adjacent to the trench for use as backfill or to regrade or revegetate the area. If water

accumulates in the trench during trench excavation and poses a threat to the excavation progress, the water will be collected and pumped to a tank or tanker truck for treatment in the Consolidated Water Treatment Facility. Any sediment trapped in the sump, tanks, or tanker truck will be segregated, mixed with backfill material to make it more manageable for handling, and returned to the trench.

The treatment system will contain reactive iron that has a limited life and will need replacement during the operation life of the system. When the treatment capacity of the media is exceeded, the material will be removed, stored as necessary, managed as a hazardous waste pending analysis of the material. Spent iron may be recycled and sold as scrap metal. It is anticipated that the iron filings will require replacement every five to ten years.

4.0 ENVIRONMENTAL EVALUATION

Incorporation of environmental evaluation into Site decision documents is mandated in RFCA (DOE 1996). Decision documents, such as this Proposed Action Memorandum, are included in that requirement by RFCA. Accordingly, this section provides a description of potential environmental impacts which may be associated with the remediation of groundwater associated with the East Trenches Plume Site.

4.1 Soils and Geology

Conventional excavation and or trenching techniques are to be used to install the funnel and gate system. The collection system could be as long as 1,100 feet. The width of the collection system would be 24"-36". The collection system would be installed at a variable depth of 16'-26' across the site, and would extend an average of 3 feet into claystone colluvium or bedrock. The collection system would be placed parallel to, and beneath, the access road to the B-Series Ponds. Construction of the treatment system would disturb surface and subsurface soils in an area approximately 64 feet long, by 16 feet wide and 16 feet deep. The treatment system would be located between Ponds B-3 and B-4.

Surface and subsurface soils would be disturbed for the length and width of the excavation sites. The natural soil profile would be eliminated and replaced by a more homogenous soil mixture when the excavated material is backfilled into the trench. Backfilling of the excavations could

affect the ability of the disturbed area to support revegetation unless suitable topsoil is used. Topsoil would be imported and improved by Site ecologists, if necessary, in accordance with Site revegetation procedures.

The construction area contains slump features that may be easily eroded during construction. Excavated and in-place soils could also be carried off by storm water during the project. However, best management practices, such as the downgradient installation of silt fences and hay bales, would be used at the work site to prevent the transport of sediment during construction. Revegetation would provide erosion control after installation is complete.

Analysis of subsurface soil samples in the proposed construction area revealed VOCs, metals, and radionuclides below detection limits, with the exception of two detects of acetone. Radiological monitoring of the soil would not be performed unless it is required to protect workers, the public, and the environment in accordance with 10 CFR 835 and the RFETS Radiological Controls Manual. During excavation, soils would be stockpiled adjacent to the trench or benched within the excavation for eventual use as backfill.

4.2 Air Quality

Project activities could generate criteria air pollutants and radionuclides. The criteria pollutant of greatest concern is dust, specifically particulate matter less than ten microns in size (PM10). An air quality analysis would be performed to assure compliance with applicable air quality regulations and, together with other information, to identify appropriate measures to take to protect the health of workers and public, such as wearing appropriate personal protective equipment. Such measures, if necessary, would be identified in the project's HASP.

Dust from construction would be the primary non-radiological air emission. The Colorado Air Quality Control Commission requires that practical, economically reasonable, and technologically feasible work practices be used to control emissions. Techniques such as using water sprays and stopping work during high wind periods (typically winds exceeding 15 mph) would be used. If fossil-fuel fired generators or other portable equipment would be needed, opacity standards (20 percent) must be met, and fuel usage tracked for the duration of the project. Heavy equipment (e.g., trenchers, bulldozers, front-end loaders and dump trucks) would be used, and would be equipped with air emissions control equipment. The impacts from these pieces of

equipment, and from the construction of the trench itself, are short-term, and with the use of proper dust suppression techniques, controllable.

Radiological concerns would also be associated with dust emissions generated during soil disturbances. An application for approval would be filed with the U.S. EPA and Colorado Department of Public Health if emissions would cause the most impacted member of the public to receive an effective dose equivalent (EDE) of 0.1 millirem per year (mrem/yr). Based on sampling, the soils to be excavated contain very low concentrations of radionuclides. Using conservative assumptions (i.e., soils are assumed to contain the maximum concentration of radionuclides), the total uncontrolled EDE to the most impacted member of the public would be 9.0E-06 mrem/yr, and would not exceed the 0.1 mrem/yr EDE during the construction of the trench. Due to the low potential radionuclide emissions, monitoring thresholds would not be exceeded.

Because regulatory requirements and health-based standards would be met, no adverse effects to air quality are expected. There would be no impact to workers or the public from project-related air emissions.

4.3 Water Quality

The objective of the project is to improve water quality by removing VOCs from the groundwater. The groundwater flow would be collected and then directed to a separate treatment system. The treatment system would be used to degrade dissolved VOCs from groundwater through the substitution of hydrogen for chlorine in the chlorinated VOCs, leaving only dehalogenated hydrocarbons and nontoxic salts to be discharged to groundwater. Laboratory treatability studies indicate that VOCs, with the exception of methylene chloride, would be removed to below surface water action levels. Methylene chloride in the East Trenches Plume is already below surface water standards. Treated water would be discharged to groundwater, using an infiltration galley located adjacent to South Walnut Creek. However, the system is also designed to allow discharge directly to surface water in South Walnut Creek (surface water action levels would be met). The discharge rate is about two gallons per minute.

The collection of groundwater and its subsequent treatment has the potential to reduce the amount of water reaching South Walnut Creek. Site personnel would monitor water volumes and stream flows to maintain flows as close to normal as possible.

During construction of this project, the installation of silt fences between the construction site and South Walnut Creek would prevent soil displacement and subsequent downstream siltation.

4.4 Human Health and Safety

The implementation of this project could expose workers to physical and chemical hazards, and potentially to low levels of radiological hazards. Potential physical hazards include noise, heat, cold, stress, and the hazards associated with excavation activities and work on uneven surfaces. The HASP would be revised to address the hazards associated with each phase of the project to make the project as safe as possible for workers, including the use of PPE as applicable, administrative controls and VOC monitoring. In addition, contingency procedures would be developed to accommodate unanticipated hazards.

Since this is not a radiological area, radionuclides would not be expected, and should not present an issue for human health and safety. As a precaution, and consistent with the RFETS Radiological Control Manual, excavation equipment would be decontaminated, and wastes would be treated as F001 hazardous wastes until analyzed.

As required by 10 CFR 835, Radiation Protection of Occupational Workers, applicable procedures would be followed to ensure the protection of the workers, collocated workers, the public, and the environment. Data and safety controls would be continually evaluated throughout the project. If unexpected hazards or conditions are encountered during remediation, work would be halted. The existing procedures would be reevaluated to ensure that procedures are adequate to prevent spread of contamination and minimize exposure to workers.

4.5 Ecological Resources

The project would adversely affect up to 4,324 square feet, or about one tenth of an acre, during construction of the collection and treatment system. Three quarters of the disturbed area lies under, or adjacent to, the Series B Pond access road, which is already heavily disturbed. The

remaining 1,024 square feet is reclaimed grassland. The impact of project construction would be temporary, and the majority of the disturbed area would be reestablished as roadway. Disturbances in the reclaimed grassland area would be revegetated with native vegetation, as directed by Site ecologists.

None of the area to be disturbed by the remediation activities supports or provides habitat for threatened or endangered plant or animal species, or species of concern, nor does it contain unique or unusual biological resources. The area is 400 feet from known habitat of the Preble's meadow jumping mouse, a species listed as threatened by the U.S. Fish and Wildlife Service, and is outside of the protected buffer zone surrounding the known habitat. Use of silt fencing and Site procedures related to excavation would minimize the possibility of adverse downgradient effects to the habitat. To further protect the habitat, construction activities would take place during the Preble's meadow jumping mouse hibernation period. Construction would begin with the treatment facility, which is closest to the habitat site, and continue away from the site. As a result of these protective planning procedures, no impacts on downgradient plants or animals are expected.

4.6 Historic Resources

The Rocky Flats Plant site was placed on the National Register of Historic Places as a Historic District (5JF1227) on May 19, 1997. Historic District designation mandates compliance with the Historic Preservation Act of 1966 and with the terms of the agreement established with the Colorado State Historical Preservation Office. The East Trenches Plume collection and treatment system project site lies in the RFETS buffer zone, which is outside of the boundaries of the Historic District. No impact is expected to occur to protected structures. In the unlikely event that potentially historic artifacts are encountered, appropriate site procedures would be followed.

4.7 Visual Resources

Project activities would result in temporary, moderate visual impacts while construction of the project is in progress. This appearance would not, however, be in sharp contrast to the industrial buildings and activities at the RFETS. Furthermore, construction activities are expected to last only about 12 weeks. Following revegetation, the majority of the area would return to its former

appearance as an access road. In the area of the treatment cells, the visual appearance of the surface would be altered for the duration of the treatment system's existence. The tops of the three treatment cells would extend above the surface of the ground by as much as 24 inches. The tanks would not be visible from public roadways, and visibility from publicly accessible areas would be minimal.

4.8 Noise

Construction and remediation activities would result in a minor increase in local noise levels consistent with highway construction and excavation activities. Such impacts would be minor and temporary, consistent with other noise levels at the Site. Noise generated by the project would not be noticeable more than more than a few hundred yards from the area, and would be confined to the Site. Appropriate hearing protection would be supplied for project personnel as identified in the project's HASP. No noise would emanate from either the collection or treatment systems during operation, and therefore the noise impacts of the project would be limited to the 12 week construction period.

4.9 Cumulative Effects

In general, the adverse effects of the East Trenches Plume groundwater remediation activities are expected to be minimal and temporary, while the beneficial effects, the prevention of further groundwater contamination and the reintroduction of native species during revegetation, would be long-term. Prevention of contamination to groundwater is part of the overall mission to clean up the Site and make it safe for future uses. The cumulative effects of this broader, Site-wide effort are described in the Cumulative Impacts Document, (DOE 1997). That document describes the short- and long-term effects from the overall site clean up mission.

4.10 Unavoidable Adverse Effects

Some temporary, adverse effects would necessarily occur because of the project activities. Some reclaimed grassland vegetation would be destroyed and some mammals or reptiles may be temporarily dislocated. Surface and subsurface soil conditions in excavated areas would be changed, and noise levels would increase slightly and temporarily. Fuels and other resources would be consumed and minor quantities of air pollutants would be released to the atmosphere.

However, no long-term irreversible or irretrievable commitment of resources is expected from this project.

4.11 Short-term Uses Versus Long-term Productivity

The project area consists of an access road and approximately 1,024 square feet of reclaimed grassland. Some surface area would be lost to the exposed portion of the treatment cells for the life of the treatment facility. Overall, project activities would improve water quality, which in turn would better support both wildlife and vegetation, and would create the potential for other, possibly more productive, uses after Site closure activities are completed.

4.12 Irreversible and Irretrievable Commitments of Resources

This project would irretrievably consume fuels, and small quantities of certain materials used in the treatment of water, money, and labor. None of these resources would be consumed in quantities that are significant relative to their consumption elsewhere across the Site.

5.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

RFETS accelerated actions performed under a PAM must attain, to the maximum extent practicable, federal and state applicable or relevant and appropriate requirements (ARARs). For that reason, the substantive attributes of the federal and state ARARs must be identified. In addition, RFCA recognizes section 121(e)(1) of Comprehensive Environmental Response Compensation and Liability Act (CERCLA), so that accelerated actions conducted in the buffer zone waive the procedural requirement to obtain federal, state, or local permits. (RFCA ¶16.a.).

The groundwater treatment unit and the point source discharge will be located in the buffer zone. For each permit waived, RFCA requires identification of the substantive requirements that would have been imposed in the permit process (RFCA ¶17). Further, the method used to attain the substantive permit requirements must be explained (RFCA ¶17.c.). The following discussion is intended to compliment other descriptions provided in this PAM in a manner that satisfies the RFCA permit waiver requirements.

5.1 Chemical-Specific Requirements and Considerations

5.1.1 Colorado Water Quality Standards

For the VOC contaminants of concern, the site-specific Colorado Water Quality Standards for Segment 5 of Big Dry Creek are applicable to the segment of South Walnut Creek that will receive the treated discharge. The site-specific water quality standards are identified in the RFCA ALF, Table 1. These water quality standards are also relevant and appropriate to developing a design that will capture, to the maximum extent practicable, the groundwater that exceeds the surface water action levels. (See 5 CCR 1002-8, Classification and Numeric Standards South Platte River Basin, Section 3.8.0, Segment 5, Big Dry Creek). The surface water quality standards for the VOC contaminants of concern are presented in Table 6.

Table 6. Big Dry Creek Segment 5 Surface Water Quality Standards

Carbon tetrachloride	5 µg/l[1]
Chloroform (trichloromethane)	100 µg/l[2]
1,1-Dichloroethene	7 µg/l[1]
cis-1,2-Dichloroethene	70 µg/l[2]
Methylene chloride (dichloromethane)	5 µg/l[2]
Tetrachloroethene	5 µg/l[1]
1,1,1-Trichloroethane	200 µg/l[2]
Trichloroethene	5 µg/l[1]
Vinyl chloride (Chloromethane)	2 µg/l[2]

[1] Temporary Modification, effective from 3/97 to 12/09
[2] Basic Standard

5.1.2 National Emissions Standards for Hazardous Air Pollutants (NESHAP)

Title 40 of the Code of Federal Regulations (CFR) Part 61, Subparts A and H (Colorado Code of Regulations (CCR) 5 1001-3, Regulation No. 8, Part A, Subparts A and H) are the applicable NESHAPs. This regulation requires limitation of RFETS radionuclide emissions to meet an annual public dose standard (to offsite member of the public) of 10 millirem (mrem); monitoring of significant emissions points; EPA/CDPHE notification and approval (state permit) prior to construction or modification of radionuclide sources with emissions exceeding a 0.1 mrem threshold; and annual reporting of the RFETS Effective Dose Equivalent for each calendar year to demonstrate compliance with the 10 mrem standard.

Due to low concentrations of radionuclides in groundwater, surface and subsurface soils, and because the proposed remediation is a CERCLA project, EPA/CDPHE notification and approval are not required. The estimated dose from the project is not expected to exceed the 0.1 mrem monitoring threshold. (See 40 CFR §61.93 (b)(4)(i)). Records will be kept, as needed, of project parameters sufficient to estimate the dose for annual compliance reporting.

5.2 Action-Specific Requirements and Considerations

The following action-specific requirements and considerations were evaluated specific to the East Trenches Plume Decision Document:

- Definition of Remediation Waste
- Identification and Listing of Hazardous Wastes
- Land Disposal Restrictions
- Construction Waters
- Soil Staging
- Temporary Unit Tank and Container Storage
- Particulate, VOC and Hazardous Air Pollution Emissions
- Debris Treatment
- Water Treatment Unit

5.2.1 Remediation Waste

In RFCA remediation waste is defined as all:

> *(1) Solid, hazardous, and mixed wastes;*
>
> *(2) All media and debris that contain hazardous substances, listed hazardous or mixed wastes or that exhibit a hazardous characteristic; and*
>
> *(3) All hazardous substances generated from activities regulated under this Agreement as ... CERCLA response action.... (See RFCA ¶25.bf.).*

A parallel definition is also found in 40 CFR §260.10. As such, the definition of remediation waste is applicable to all wastes, environmental media (soil, groundwater, surface water, storm water and air) and debris generated in conjunction with this action.

5.2.2 Identification and Listing of Hazardous Wastes

Requirements governing the identification and listing of hazardous wastes are applicable to this action. (See 40 CFR Part 261). Based upon process knowledge and characterization data from the East Trenches, the contaminated groundwater and soil that will be addressed during this action may contain F001 spent solvents or still bottoms from degreasing that were released from the drums during waste storage. For that reason, the F001 hazardous waste listing is applicable to any groundwater, soil, or debris that contains solvent constituents.

5.2.3 Wastewater Treatment Unit

The Clean Water Act, NPDES governs the discharge of pollutants from any point source into the waters of the United States. (See 40 CFR §122.1(b)). The establishment of a wastewater treatment unit requires an NPDES permit waiver. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA.

As noted earlier, the Table 6 surface water quality standards (see section 5.1.1) are relevant and appropriate to the wastewater treatment unit discharge. No NPDES action-specific ARARS addressing the design or operation were identified.

5.2.4 Land Disposal Restrictions

The Land Disposal Restriction (LDR) levels for wastewater or non-wastewaters are applicable to any remediation waste that exhibits a hazardous waste characteristic or contains listed hazardous waste if it is actively managed outside of the area of contamination.

5.2.5 Construction Waters

Wastewaters generated during construction activities will be collected, then transferred to the Consolidated Water Treatment Facility for treatment. If these remediation wastewaters contain listed RCRA hazardous wastes or if the remediation wastewaters exhibit a RCRA characteristic, the RCRA hazardous waste requirements would not be applicable or relevant and appropriate during treatment because these remediation wastewaters are CERCLA wastes being treated in a

CERCLA treatment unit. The Consolidated Water Treatment Facility will treat the remediation wastewater to meet applicable surface water quality standards under NPDES ARARs framework.

Any waste generated at the Consolidated Water Treatment Facility as the result of treatment of a listed remediation waste will be assigned the corresponding F001 hazardous waste code and managed in accordance with applicable RCRA ARARs. Wastes generated as a result of the treatment of remediation wastewater will also be evaluated to determine if they exhibit a hazardous characteristic.

5.2.6 Soil Staging

The movement, temporary staging and replacement of excavated soils that contain F001 listed hazardous wastes will not trigger LDRs (see 55 FR 8760) as long as these activities occur within the East Trenches Plume area of groundwater contamination.

As noted earlier, uncontaminated or marginally contaminated soils that are excavated when the system is installed will be stockpiled adjacent to or benched within the excavation. Consistent with the General Stormwater Permit for Constructions activities, Best Management Practices (BMPs) to control erosion have been considered and will be implemented. Common BMPs include silt fences or hay bales. (See 57 FR 41176). Deeper, more contaminated soils will be benched within the excavation. This will ensure that sediments and any chemical contamination are contained within the working area.

5.2.7 Temporary Unit (TU) Tank and Container Storage

Tanks and containers may be used during construction and startup to maintain groundwater that contains F001 hazardous wastes. The establishment of TUs may require a permit exemption if any of the tanks or containers are used for longer than 90 days. Therefore, the discussion in this section is provided to satisfy ¶17 of RFCA.

40 CFR §264.553 provides that temporary tanks and containers used for the storage or treatment of hazardous remediation wastes may be subject to alternative design, and operating and closure requirements as long as the requirements are protective of human health and the environment

(See 40 CFR §264.553(a)). The TU must be located within the facility boundary and may only be used for treatment or storage of remediation wastes (See 40 CFR §264.553(b)).

In establishing requirements for TUs seven factors must be considered: the length of time the unit operates; the type of unit; the volumes of remediation waste; the physical and chemical characteristics of the remediation waste; the potential for releases; the conditions at the site that will influence migration; and the potential for exposure if a release occurs. (See 40 CFR §264.553(c)).

All tanks and containers will be compatible with the waste and be in good condition. Where practicable, secondary containment will be provided when liquid wastes are stored or treated in tanks or containers. For closure of the TUs, if releases have been documented, then wastes and contaminated soil must be removed, if appropriate, and structures and equipment will be decontaminated or managed as waste.

5.2.8 Air Pollutant Emissions (Particulates, Volatile Organic Compounds, Hazardous Air Pollutants)

Soil excavation activities for this project have the potential to generate radioparticulate and fugitive dust emissions. Radionuclide air pollutant emissions are regulated by 40 CFR 61, Subpart H (Radionuclide-NESHAP) and 5 CCR 1001-3 Regulation No. 8. The regulatory reporting and monitoring requirements and radionuclide-standard limitations set forth in these regulations are discussed in Section 5.1.2.

Fugitive particulate emissions will be generated during construction activities. Estimated emissions are below air emission inventory reporting thresholds and are based on the volume of soil to be excavated, stockpiled, and backfilled. 5 CCR 1001-3, Regulation No. 1 requires the implementation of practical, economically reasonable, and technologically feasible work practices to control particulate emissions. During soil handling activities, dust minimization techniques such as water sprays, will be used to minimize suspension of particulates. In addition, earth moving operations will not be conducted during periods of high wind. The substantive requirements of a control plan (Regulation No. 1, Section III.D) will be included in project documentation. In addition, RFETS Environmental Restoration Field Operations Procedure FO.1, Air Monitoring and Particulate Control, is incorporated into project operations.

5 CCR 1001-3, Regulation No. 7, regulates VOC emissions. Regulation No. 7, Section II requires that new sources of VOC utilize Reasonably Available Control Technologies (RACT). VOCs may be emitted during soil excavation. Although significant VOC concentrations are not expected, a bounding assumption has been made that less than 1 ton of VOCs will be emitted from excavation and soil handling activities. Based on this assumption, RACT will be attained without implementing specific VOC controls for soil excavation, staging and replacement. (See Statement of Basis and Purpose, Regulation No. 3, Part D, July, 15, 1993).

Regulation No. 7, Section III governs the transfer and storage of VOCs and requires bottom or submerged fill for containers greater than 56 gallons. CDPHE has previously given guidance that any liquid containing any amount of an organic compound may be considered a VOC for purposes of this requirement. This requirement is applicable to containers and tanks larger than 56 gallons used to dewater the excavation or used to manage decontamination water. To the maximum extent practicable, storage tanks and related equipment must be maintained to prevent detectable vapor loss.

5 CCR 1001-3 Regulation No. 3, provides authority to CDPHE to inventory air pollutant emissions. Part A, Section II of this regulation requires the submittal of Air Pollution Emission Notices (APENs) to CDPHE prior to initiation of the East Trenches Plume project if regulatory inventory thresholds are exceeded. Based on conservative assumptions concerning soil-contaminant concentrations and project parameters, estimated potential emissions will not exceed inventory-reporting thresholds and APENs do not need to be submitted to CDPHE.

Project operations may require limited use of fossil-fuel fired generators or other portable equipment. The potential combustion-product emissions from temporary use of these units will not exceed APEN inventory reporting thresholds. All fossil-fueled fired units will meet the 20% opacity standard set forth in 5 CCR 1001-3, Section II.

5.2.9 Debris Treatment

Decommissioning of any equipment and/or utilities encountered during construction activities may generate debris that contains F001 listed hazardous wastes.

Where appropriate, tanks, the project decontamination pad or the Main Decontamination Facility may be configured to perform low level, hazardous or mixed waste debris treatment in accordance with 40 CFR §262.34, §268.7(a)(4) and §268.45. Specifically, 40 CFR §268.45 Table 1, A.1.e. provides for treatment using high pressure steam and water sprays and 40 CFR §268.45 Table 1, A.2.a. provides for water washing and spraying. Following treatment, as long as the debris does not exhibit a hazardous waste characteristic, the debris will no longer contain a listed hazardous waste and will no longer be subject to RCRA hazardous waste requirements. Solid residues from the treatment of debris containing listed hazardous wastes will be collected and managed in accordance with RCRA hazardous waste management ARARs. Any solid residues from debris treatment that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management requirements.

Liquid residues from the treatment of debris containing listed hazardous wastes will be collected and transferred to the Consolidated Water Treatment Facility. Residues that result from the treatment of listed debris will carry the same listing as the listed debris from which it originated. Any Consolidated Water Treatment Facility residues that exhibit a hazardous waste characteristic will also be managed in accordance with RCRA hazardous waste management ARARs.

5.3 Location Specific Requirements and Considerations

5.3.1 Endangered Species Act

The Endangered Species Act, 50 CFR Part 17, and the Colorado Nongame, Endangered, or Threatened Species Conservation Act, CRS 33-2-101, et seq. are relevant and appropriate because the action has the potential to jeopardize critical habitat for the Prebles Meadow Jumping Mouse. For that reason, applicable RFETS site procedures and DOE orders will be implemented to ensure attainment of these ARARs.

5.3.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, 16 USC §661 is applicable because the modification to the wetlands and the creation of a flowing stream has the potential to impact wildlife. Coordination and consideration of the applicable ecological values will be accomplished using site procedures.

5.3.3 Wetland Assessment

Pursuant to Executive Order 11990, and 40 CFR Part 6 Appendix A, federal agencies must prevent, to the extent possible, the adverse impacts of destroying or modifying wetlands and must prevent direct or indirect support of new construction in wetlands if there is a practicable alternative. These requirements are applicable to the East Trenches Plume action and will be implemented using site procedures.

6.0 IMPLEMENTATION SCHEDULE

Installation of the collection/treatment system for the East Trenches Plume is scheduled to commence during Spring 1999 and system startup is anticipated to begin within 12 weeks of start of construction. Any delays, scope, or budget changes may affect this schedule. The groundwater collection and treatment system is expected to be the long term remedy for the East Trenches Plume. The system is expected to operate as long as it is required to meet the original objectives.

7.0 REFERENCES

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DOE, 1992, *Historical Release Report for the Rocky Flats Plant*, Rocky Flats Plant, Golden, CO.

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IT, 1998, *Sampling and Analysis Plan, Characterization of the 903 Pad/Ryan's Pit and East Trenches Plumes*, IT-DNV/RMRS-98, March.

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RMRS, 1996a, *Final Revised Groundwater Conceptual Plan*, RF/ER-95-0121.UN, September.

RMRS, 1996b, *Completion Report for the Source Removal at Trenches T-3 and T-4 (IHSSs 110 and 111.1)*, RF/ER-96-0051, September.

RMRS, 1997a, *Sampling and Analysis Plan for the Site Characterization of the 903 Drum Storage Area (IHSS 112), 903 Lip Area (IHSS 155), and Americium Zone*, RF/RMRS-97-084, January 1998 Rev.0.

APPENDIX A - ALTERNATIVES ANALYSIS

A1.0 DESCRIPTION OF ALTERNATIVES

The following three alternatives were evaluated for remediation of the East Trenches Plume:

- No Further Action - Continue discharge of the VOC contaminated plume into surface water and shallow alluvial groundwater.
- Construct groundwater collection system and truck the collected water to the CWTF for treatment.
- Construct groundwater collection system and reactive metals treatment system and discharge treated water to South Walnut Creek.

This Appendix provides a comparison of those alternatives based on four considerations: effectiveness, implementability, cost and environmental effects. The environmental effects of Alternative 3, construction of a barrier and installation of a passive water treatment system, which is the proposed alternative, are described more fully in Section 4 of the main body of the Decision Document.

Operational requirements for the groundwater collection and treatment system must take into account that, even though the source of contamination at the East Trenches has been removed, groundwater from the source area could take up to 30 years to reach South Walnut Creek. The actual time will depend on flow rates. Water collection and treatment is expected to continue until the groundwater plume reaching South Walnut Creek is producing water with contaminants below Rocky Flats Cleanup Agreement (RFCA) action levels.

A1.1 Alternative 1 - No Further Action

Volatile organic compounds (VOCs) contaminated groundwater from the East Trenches Plume is currently entering the South Walnut Creek Drainage at concentrations above RFCA Action Levels. VOC contamination in surface water is noted at the point of groundwater discharge, and when the ponds are ice covered.

A1.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

A trench would be excavated north of the B Ponds Road but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the East Trenches to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier, pumped to a nearby storage tank and periodically trucked to the CWTF. VOCs in the groundwater would be removed in the CWTF UV/peroxide treatment unit and radionuclides would be removed by chemical precipitation and microfiltration. Treated water would be released to Woman Creek.

A1.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

A trench would be excavated north of the B Ponds Road but upgradient of South Walnut Creek and an impermeable barrier placed in it to divert groundwater flowing from the East Trenches to a collection point. Groundwater would be collected in a sump at the low point of the impermeable barrier and piped to a nearby reactive metals treatment system to remove VOCs and radionuclides prior to discharge to

South Walnut Creek. The iron filings in the treatment unit would have to be replaced every five to 10 years and, because they would hold the radionuclides collected from the treated water, would be considered low-level waste.

A2.0 ANALYSIS OF ALTERNATIVES

A2.1 Alternative 1 - No Further Action Alternative

Effectiveness

A decision to not collect contaminated from the East Trenches Plume would not meet the RFCA requirement for protection of surface water.

Implementability

This alternative is presently in-place and would not require additional effort to implement.

Cost

There is no additional cost to implement this alternative.

Environmental Effects

The No Further Action Alternative would result in no additional disturbance to natural conditions beyond those already in existence. Contaminated groundwater would continue to flow toward South Walnut Creek and discharge there. The cumulative effects of the No Action Alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document* (DOE,RFFO June 10, 1997).

No other effects, such as to flora, fauna, historic or cultural resources, or socioeconomics, would be expected.

A2.2 Alternative 2 - Construct New Groundwater Collection System and Treat Water in the CWTF

Effectiveness

The UV/peroxide system and the chemical oxidation/microfiltration systems have been demonstrated to consistently remove VOCs and radionuclides to levels below ARARS. However, the additional precautions must be taken to completely remove carbon tetrachloride. Residual management is required for the sludges produced in the precipitation step. Collecting the majority of the contaminated groundwater from the East Trenches plume, as would be done with the impermeable barrier, and treating it in the CWTF would meet the RFCA requirement for protection of surface water.

Implementability

Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

The CWTF is designed to treat 30 gallons per minute of contaminated water. The East Trenches Plume collection system is estimated to produce approximately 2 gallons per minute. The CWTF is used to treat contaminated groundwater from the 881 Hillside French Drain and water generated from environmental restoration cleanup projects. All environmental restoration projects (except for plume remediation projects) are scheduled for completion by FY2006 at which time the CWTF is scheduled for

demolition. The CWTF will not be available for treatment of contaminated water after FY2006 and would have to be replaced by a smaller facility designed to treat only water generated from plume remediation projects. Other existing water treatment facilities (*i.e.*, Buildings 374, 774, and 995) do not have the capability to treat VOCs and are also scheduled to be demolished by FY2006.

Cost

Estimated cost to construct the impermeable barrier is $1,100,000. The cost to truck water from the East Trenches Plume collection system and treat the water in the CWTF is approximately $1.50/gallon. Additional costs would be incurred to replace the CWTF and to maintain the groundwater collection system. Many of the equipment components in both the UV/peroxide and the chemical precipitation/ microfiltration system require replacement every 5 to 10 years. The next replacement is scheduled for 1999, so additional costs would be incurred at that time.

Environmental Effects

Construction of the impermeable barrier would involve digging a trench approximately three feet wide to bedrock for a distance of up to 1,100 feet upslope of South Walnut Creek. Excavation of the trench and temporary placement of excavated materials would destroy vegetation and the natural soil gradient in the excavated area, and temporarily damage vegetation under the area where the excavated materials were deposited. Total affected area is estimated at approximately 27,500 square feet. After construction was complete, the site would be revegetated as directed by Site ecologists. It is possible that small mammals and rodents in the project area would be dislocated. A portion of the East Trenches Plume treatment system installation project will occur within the bounds of an area mapped as suitable Preble's mouse habitat, and a short distance from the Pond B-4 Preble's mouse habitat. The project has designed an installation strategy that provides sufficient mitigation of impact to the downstream habitat while allowing the installation of this groundwater treatment system to proceed. A survey for nests of migratory birds would be completed within two weeks before the project's start to ensure compliance with the Migratory Bird Species Act. Construction of the trench would may damage or destroy wetlands by drying these up. Loss or damage of this wetland would be mitigated under the Agreement between DOE and EPA through construction of a replacement wetland at Standley Lake or other means as appropriate.

Construction activities would result in a negligible increase in air emissions from the exhaust of motor vehicles during construction activities. Dust control measures would be implemented to minimize release of particulates, and a silt fence or similar device would be installed to prevent stormwater runoff from carrying sediment off the project site. The groundwater table immediately down-gradient of the barrier would be lowered substantially. This would not affect vegetation, which is not dependent on water below the vadose zone. Approximately 0.5 gallon per minute of water would be diverted from the South Walnut Creek basin to the Woman Creek basin.

Installation of the barrier would consume labor, equipment, and material Operation of the barrier under this alternative would require electrical energy to pump collected water from the collection point to the holding tank. Installation of the collection system would not present any hazards to workers beyond those associated with similar construction projects. The project would have an approved health and safety plan before fieldwork begins.

The environmental effects of transporting the water to the CWTF and treating it there or in a successor facility would be minor air pollution (vehicle exhaust and other particulates) produced when the collected water is trucked to the CWTF. The resources (utilities, labor, equipment, supplies) necessary to operate the CWTF would continue to be consumed beyond the time that facility is scheduled to be

demolished, or additional resources would be required to construct and operate a new water treatment facility specifically to treat Mound Site and other contaminated groundwater. If a new facility were constructed, substantial construction resources would be required, but its annual operating resource needs would be smaller than those of the CWTF because it would have a smaller capacity. Environmental impacts associated with a new facility would depend on its size, design, and location.. The cumulative effects of the this alternative, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socioeconomics, would be expected.

A2.3 Alternative 3 - Construct New Groundwater Collection System and Reactive Metals Treatment System

Effectiveness

Bench-scale testing by Environmental Technologies, Inc. has demonstrated that a reactive metals treatment system will remove site-specific VOCs. The reactive metal media works by chemically reducing contaminants present in the groundwater. The end products of the process are completely dehalogenated hydrocarbons and non-toxic salts. Examples of end products of chlorinated VOCs degraded by this process are ethene, ethane, and chloride ions. Collecting the majority of the contaminated groundwater from the East Trenches Plume under this alternative, would meet the RFCA requirement for protection of surface water.

Implementability

Installation of the proposed groundwater collection system is based on use of readily available construction equipment. There are no facilities in the area of the proposed collection system that would have to be removed to construct the impermeable barrier wall. No issues have been identified that present special problems for implementation of this alternative.

Reactive metals treatment systems similar to the proposed design have been constructed at Rocky Flats and elsewhere in the United States. They require high-density polyethylene (or equivalent) tanks which are readily available, and reactive iron filings which are a byproduct of the automobile industry and available from at least three suppliers.

Cost

The cost to construct the groundwater collection system and the reactive metals treatment system is approximately $1,400,000.

Environmental Effects

Implementation of Alternative 3 would have the same environmental effects related to construction and operation of the impermeable barrier as Alternative 2, but would not have the environmental effects related to transporting collected water to the CWTF and treating it there or at a successor facility.

There would be an increase in affected area at the site due to construction of a pipe from the collection point in the barrier to the treatment facility, installation of the treatment facility, and installation of a pipe or other discharge facility from the treatment facility to South Walnut Creek. This additional affected area is estimated at 12,500 square feet bringing the total affected area to approximately 39,500 square feet. Wetland damage would increase slightly to include construction disturbance of a short stretch of wetlands along South Walnut Creek where the discharge pipe from the water treatment facility enters the

Creek. In addition, it would eliminate the need to incur the additional environmental (and other) impacts of possibly constructing a new water treatment facility for use after FY2006. Operation of the collection system would be passive, *i.e.*; gravity would be used to transport the water from the collection system to the treatment unit, through treatment and to the discharge line to South Walnut Creek. No supplied energy would be used by the system. Periodic maintenance of the system would be required, chiefly replacing the treatment media from time to time. The cumulative effects of Alternative 3, taken together with other foreseeable actions (cleaning up and closing the Site) are described in DOE's *Cumulative Impacts Document*, (DOE, RFFO June 10, 1997).

No other effects, such as to historic or cultural resources, or socioeconomics, would be expected.

A3.0 SUMMARY AND CONCLUSION

Alternative 3 was selected as the preferred alternative because the system will collect the majority of the contaminated groundwater from the East Trenches plume and will continue to remove VOCs to levels required for protection of surface water at the lowest cost and with the smallest environmental effects. The treatment system does not depend on the CWTF, which is scheduled to be removed by FY2006, and is a passive, low maintenance system.

Alternative 1 does not meet the RFCA requirements for protection of surface water. Alternative 2 is based on trucking contaminated groundwater from the East Trenches area for treatment in the CWTF which is scheduled for demolition in FY2006. Collection and treatment of contaminated groundwater is estimated to last for 10 to 20 years after the CWTF has been demolished. Therefore, selection of either of this alternative would require the design and construction of a new, smaller treatment facility to replace the CWTF after 2006. Due to the need to construct a replacement facility, the costs and environmental effects of Alternative 2 would be significantly greater than those of Alternative 3 with no offsetting benefits in effectiveness or implementability.

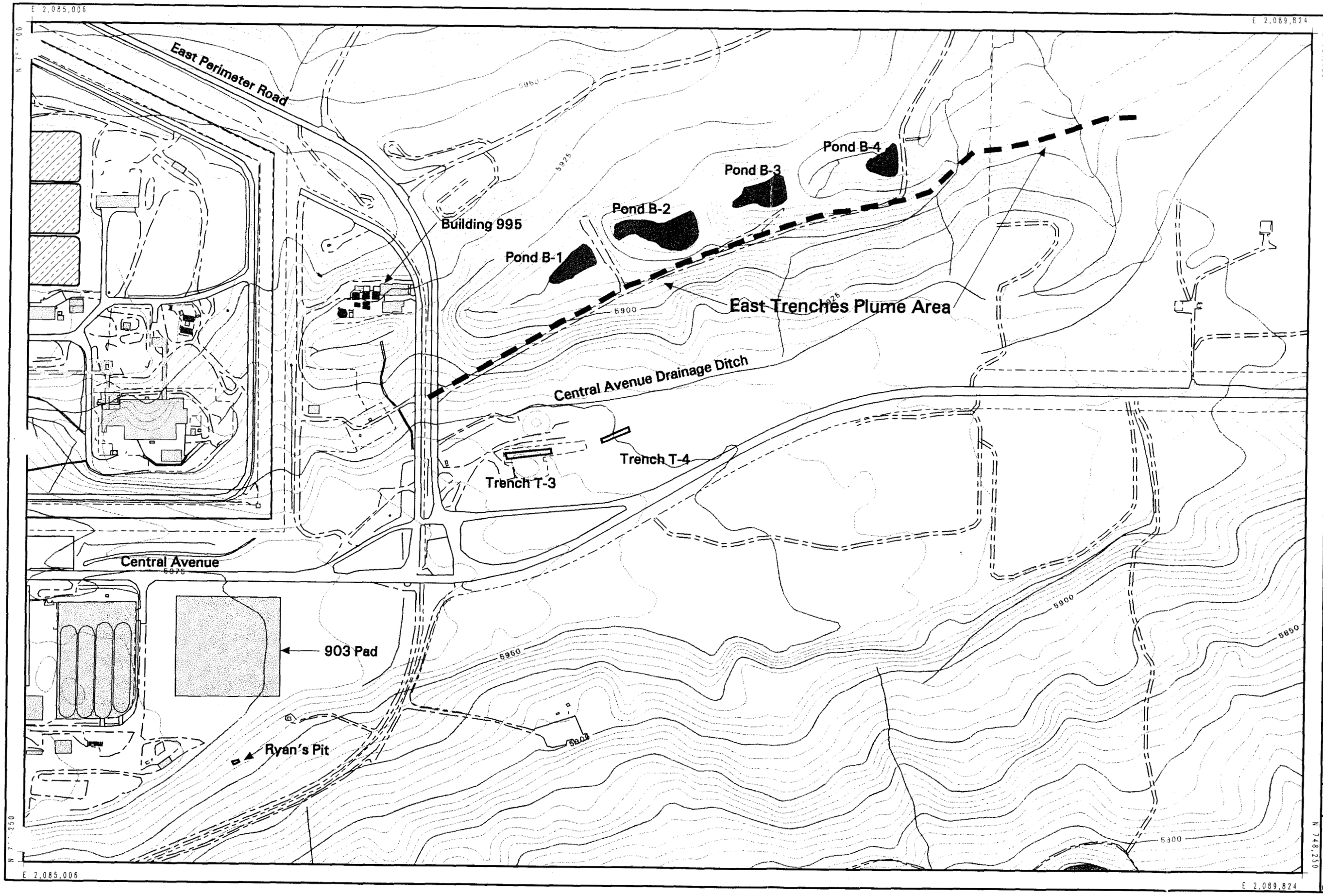

Figure 1
East Trenches Plume Study Area

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs. 1/96.
Topology (contours) were derived from digital elevation model (DEM) data by Morrison Knudson (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was capture by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~ 10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Scale = 1 : 4200
1 inch represents 350 feet

150 0 300ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
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MAP ID: 98-0246
August 14, 1998

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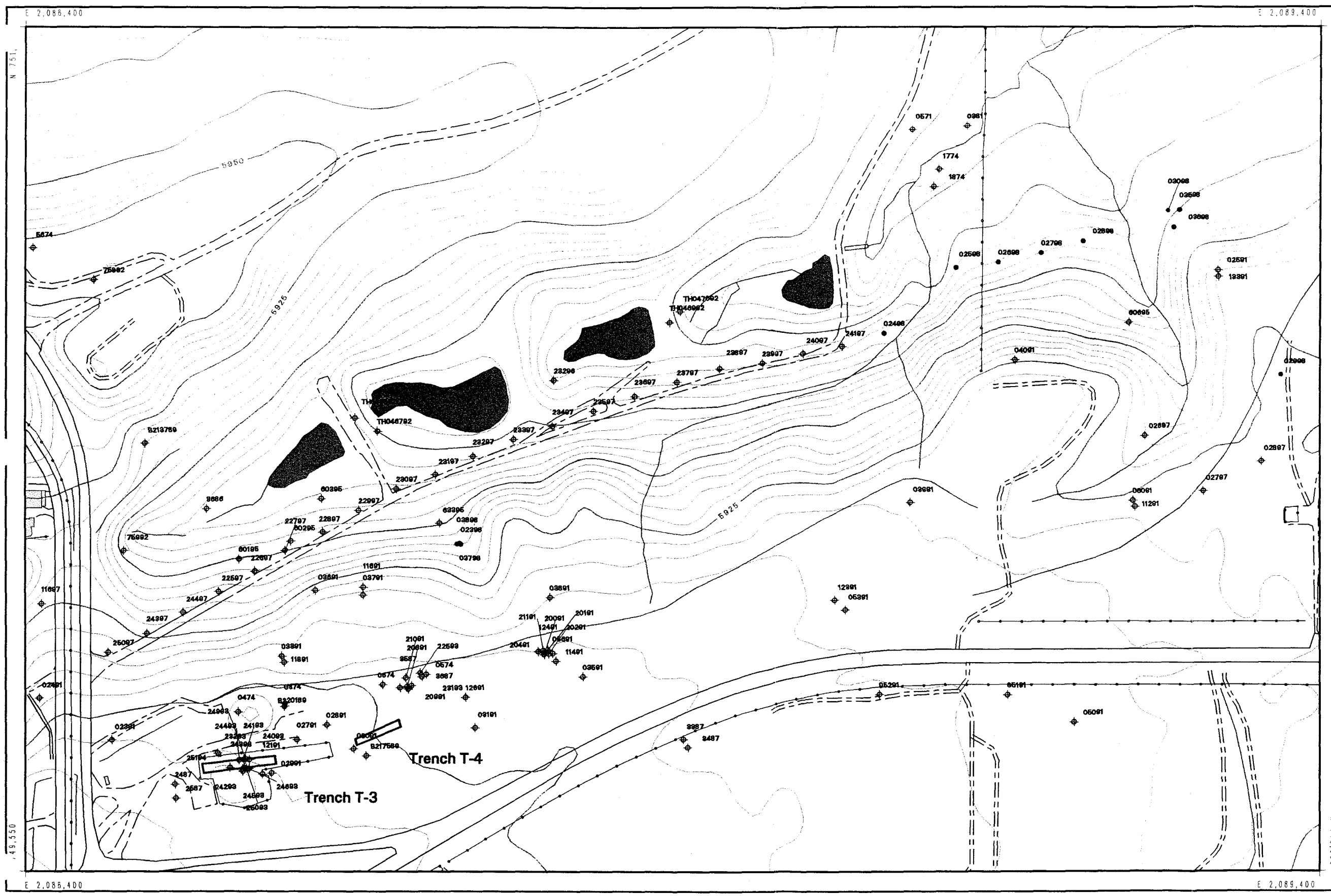

Figure 2
East Trenches
Plume Monitoring Wells

- Sampled Well Location (installed 1998)
- Borehole Location (1998) Not Completed As A Well
- Existing Data Location

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
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The DEM data was capture by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~ 10 meter resolution.
The DEM post-processing performed by MK, Winter 1997.

Scale = 1 : 2700
1 inch represents 225 feet

100 0 200ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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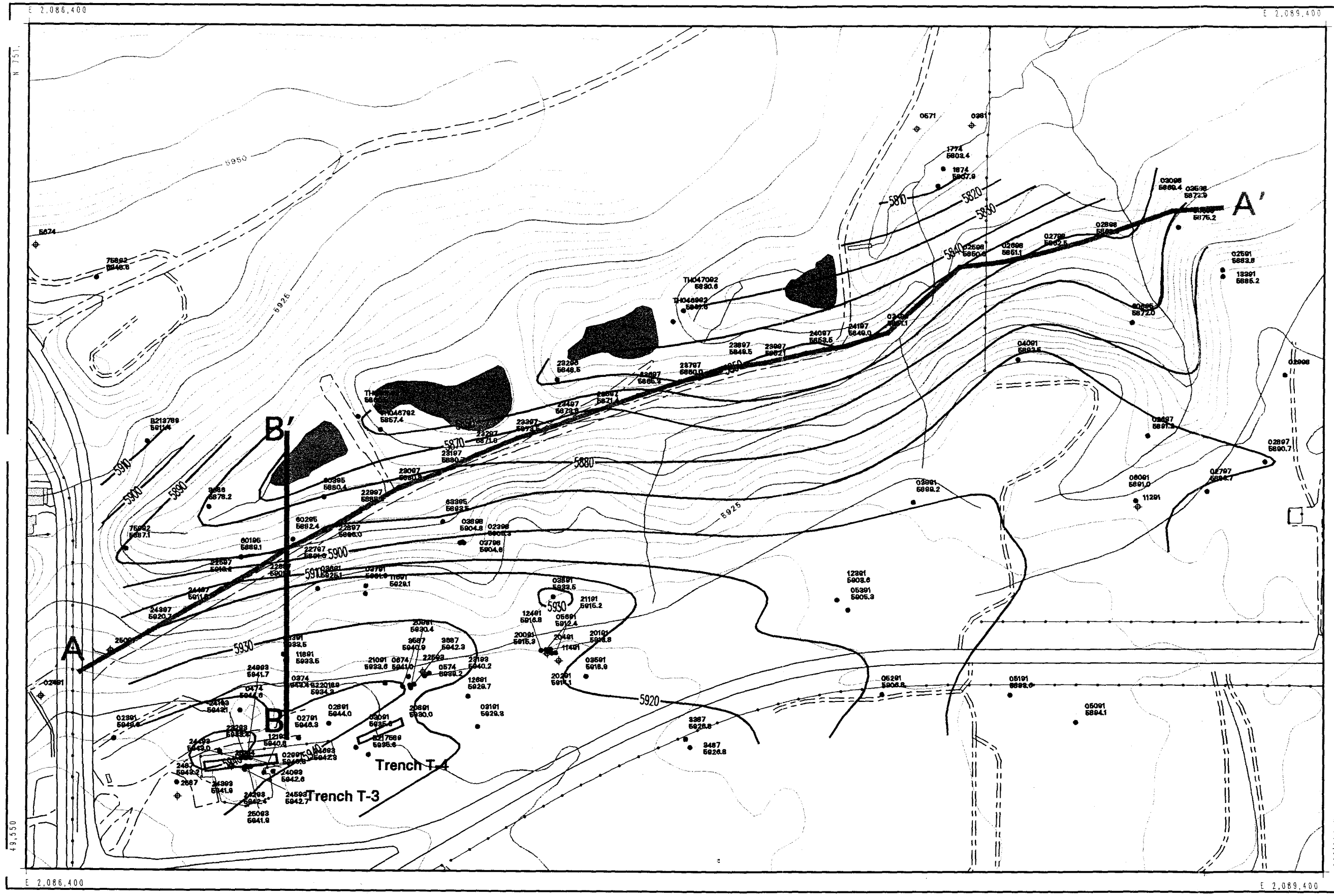

Figure 3
Top of Bedrock Map
East Trenches
Plume Study Area

- Well Location Showing Bedrock Elevation
- Existing Data Location
- Water Table Elevation Contour
- Hydrogeologic Cross Section Alignment (A----A')
- Hydrogeologic Cross Section Alignment (B----B')

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
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The DEM post-processing performed by MK, Winter 1997.

Scale = 1 : 2700
1 inch represents 225 feet

100 0 200ft

State Plane Coordinate Projection
Colorado Central Zone
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MAP ID: 98-0246 August 14, 1998

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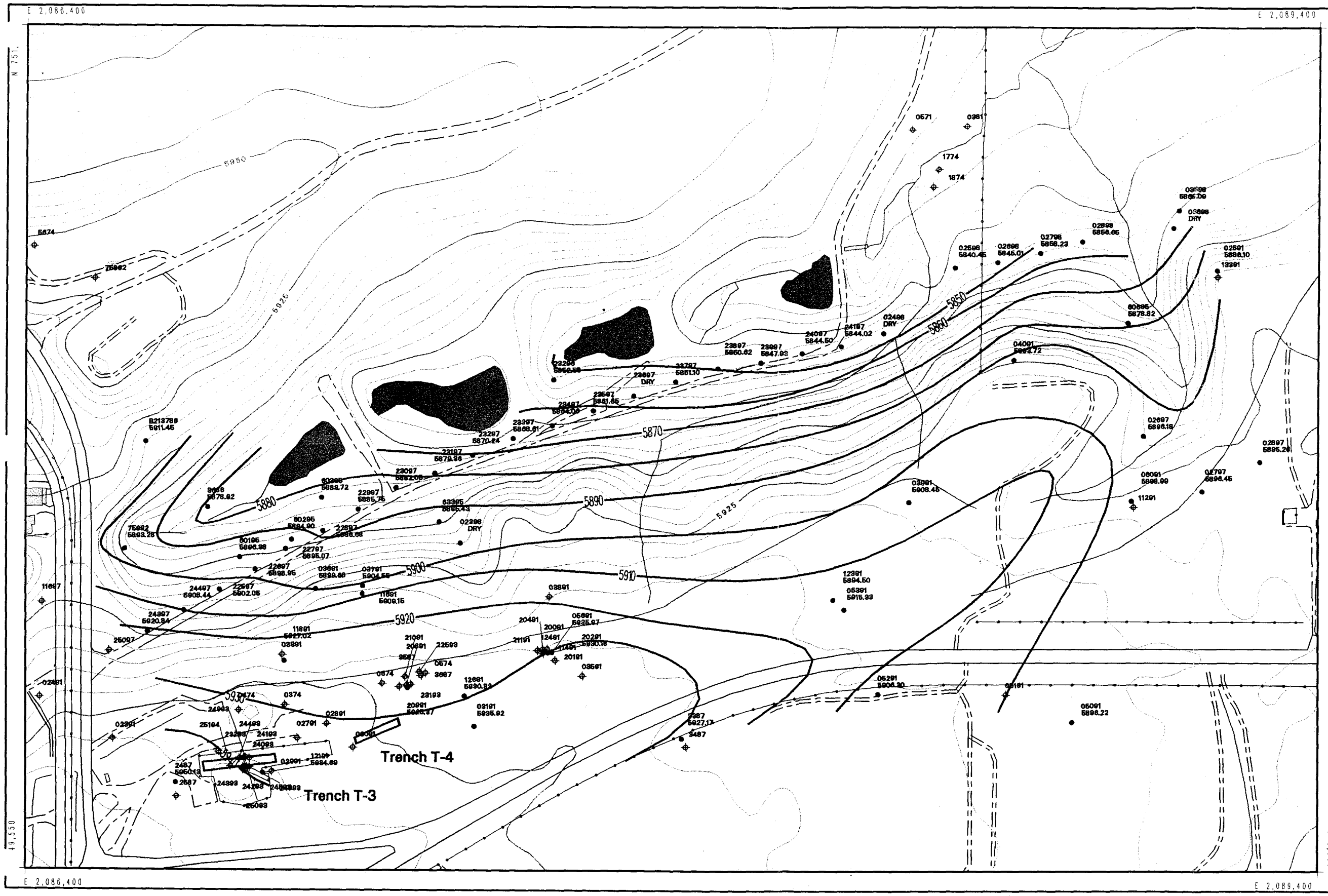

Figure 4
Water Table Elevation Map
East Trenches
Plume Study Area

- Well Location With Measured Water Table Elevation (April-June 1998)
- Existing Data Location (Not Measured)
- Water Table Elevation Contour

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
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100 0 200ft

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August 14, 1998

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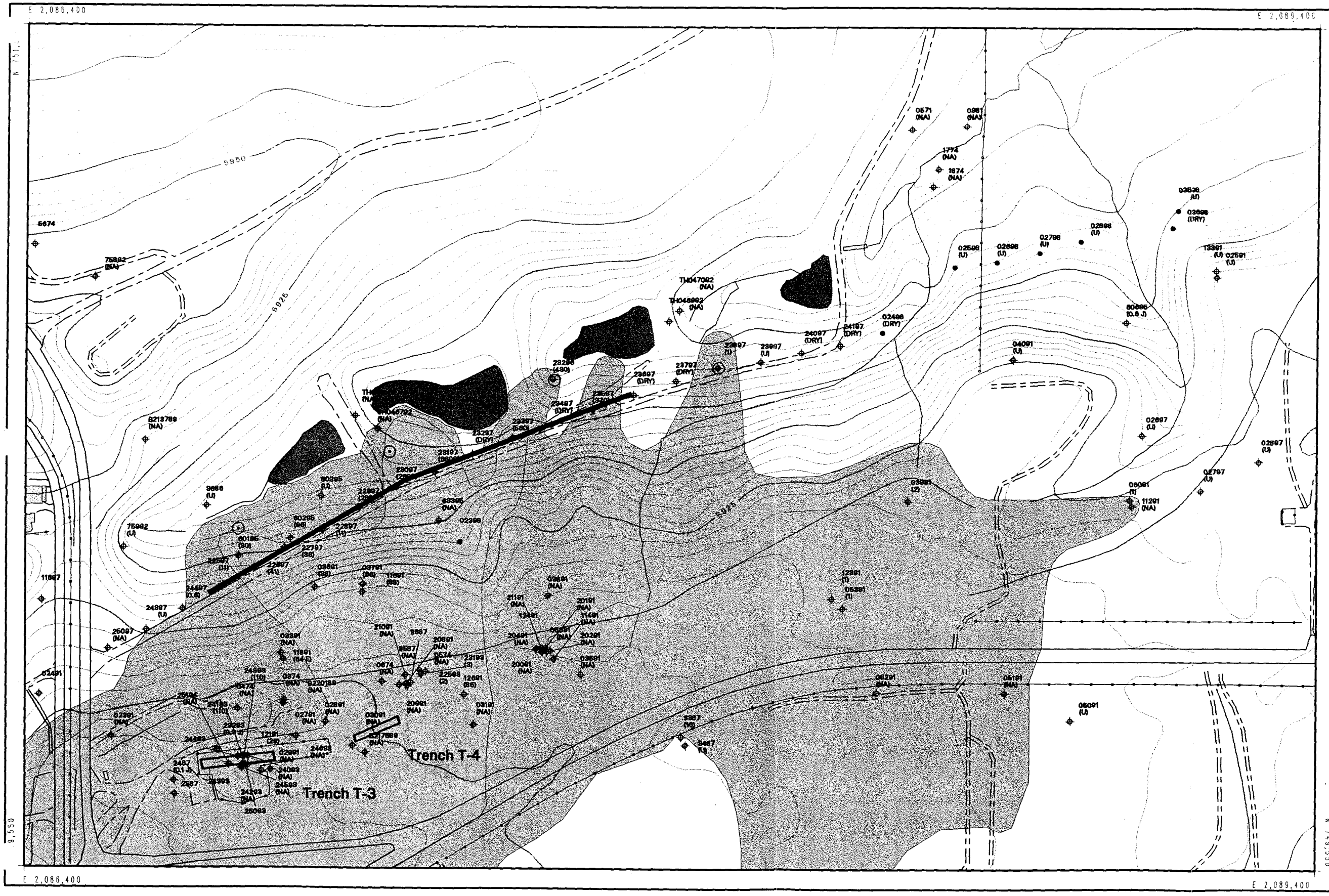

Figure 6
VOCs in Groundwater
East Trenches
Plume Study Area

- Composite VOC Groundwater Plume (100 X MCL)
- Composite VOC Groundwater Plume (concentration equal to MCL)
- Planned Location of Permeable Reactive Barrier
- Proposed Monitoring Wells
- Sampled Well Location (installed 1998)
- Existing Data Location

Note: Trichloroethene concentration in groundwater, 1997, 1996 maximum, or latest available analysis, ug/L.

U = Not detected, NA = No Analysis, DRY = Not Sampled (dry or insufficient water).

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Rocky Flats boundary
- Paved roads
- Dirt roads

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Scale = 1 : 2700
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100 0 200ft

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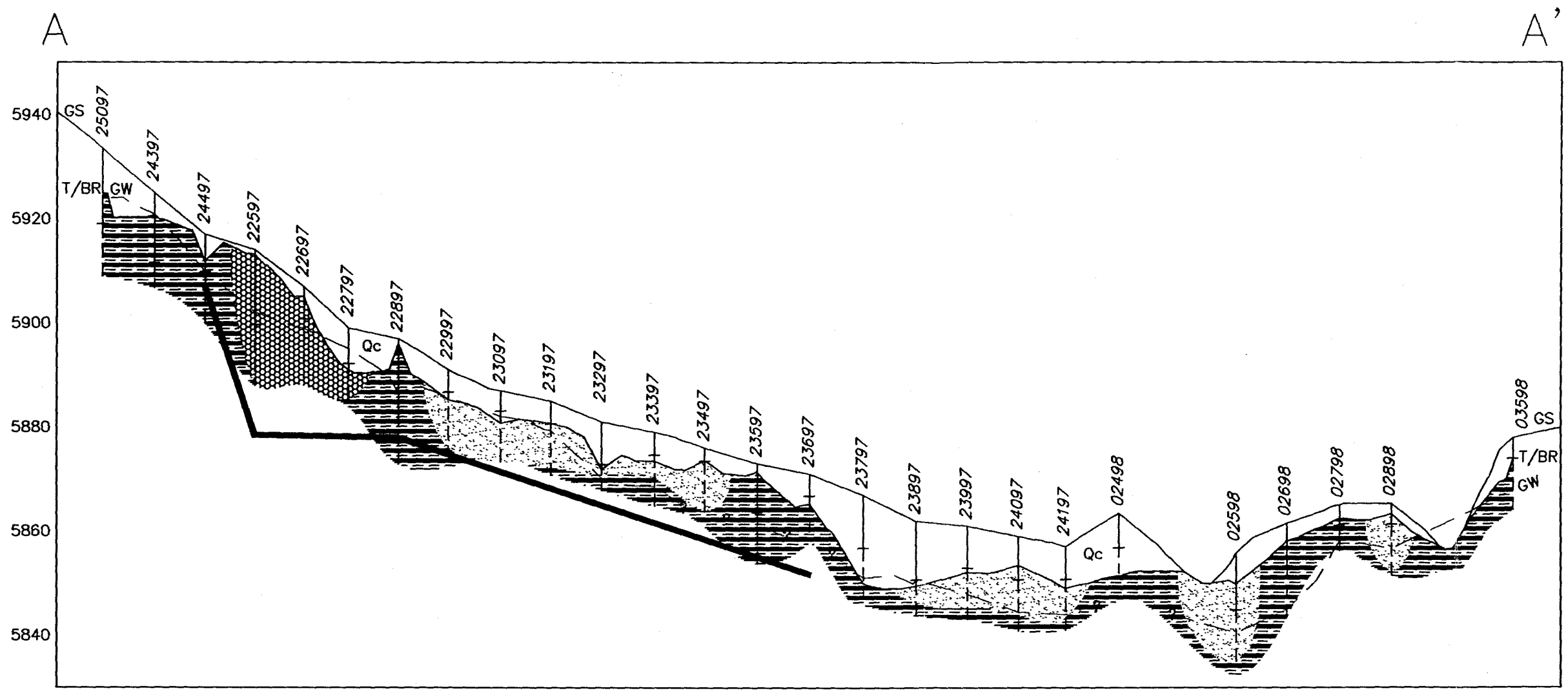

CROSS SECTION A-A'

LEGEND

23897 — MONITORING WELL OR PIEZOMETER

SCREENED INTERVAL

GS GROUND SURFACE
GW GROUND WATER SURFACE
T/BR TOP OF BEDROCK
QrF ROCKY FLATS ALLUVIUM
Qc COLLUVIUM

CLAYSTONE

SANDSTONE, UNDIFFERENTIATED ARAPAHOE/LARAMIE

ARAPAHOE NO. 1 SANDSTONE

GRAPHIC SCALE

0 50 100 200

(IN FEET)
1 inch = 200 ft.

VERTICAL SCALE
1 inch = 20 ft.

PREPARED FOR:
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
Golden, Colorado

FIGURE 7

TITLE: LOCATION AND PROPOSED DEPTH OF COLLECTION SYSTEM