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FINAL
CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER - RAILYARD AND ADMINISTRATION AREA
VERSION 3.2

August 1988
Contract No. DAAK11-84-D-0017
TASK NO. 10

DTIC
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EBASCO SERVICES INCORPORATED

R. L. Stollar and Associates
California Analytical Laboratories, Inc.
DataChem, Inc. Geraghty & Miller, Inc.

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LITIGATION TECHNICAL SUPPORT AND SERVICES
ROCKY MOUNTAIN ARSENAL

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Prepared by:

EBASCO SERVICES INCORPORATED
R.L. STOLLAR AND ASSOCIATES
CALIFORNIA ANALYTICAL LABORATORIES, INC.
DATACHEM, INC. GERAGHTY & MILLER, INC.

Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

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13. ABSTRACT (Maximum 200 words) THIS FINAL REPORT DOCUMENTS THE CONTAMINATION SURVEY OF THE SANITARY SEWER IN THE RAILYARD AND ADMINISTRATIVE AREAS. THE SEWER COLLECTS DOMESTIC SEWAGE FROM BUILDINGS IN SECTIONS 2, 3, 4, 34, AND 35. 10 SAMPLES FROM 5 BORINGS AND 5 SEDIMENT GRAB SAMPLES FROM INSIDE MANHOLES WERE ANALYZED FOR VOLATILE AND SEMIVOLATILE ORGANICS AND METALS WITH SEPARATE ANALYSES FOR AS, HG, AND TDGCL. DBCP, CLC2A, CD, CR, CU, ZN, PB, AS, AND HG WERE DETECTED ABOVE THEIR RESPECTIVE INDICATOR RANGES. BASED ON THE RESULTS OF THE FIELD SURVEY, POTENTIAL CONTAMINANTS IN THIS S'STEM ARE CONTAINED IN SEDIMENTS WITHIN THE SEWERS AND IN OVERFLOW DITCHES AT THE LIFT STATIONS. IF THE FEASIBILITY STUDY DETERMINES THAT ADDITIONAL INFORMATION IS NEEDED, THE ADDITIONAL WORK WILL CONSIST OF 1) EXCAVATION STUDY BETWEEN MANHOLES 60 AND 61, 2) BORINGS IN THIS AREA, AND 3) NUMBER OF SAMPLES FROM THESE BORINGS FOR DBCP AND CLC2A. THE VOLUME OF POTENTIALLY CONTAMINATED MATERIAL PRESENT IS ESTIMATED AT 640 CUBIC YARDS.				
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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
<u>EXECUTIVE SUMMARY</u>	
1.0 <u>PHYSICAL SETTING</u>	1
1.1 LOCATION AND DESCRIPTION	1
1.2 GEOLOGY	6
1.3 HYDROLOGY	10
2.0 <u>HISTORY</u>	11
3.0 <u>FIELD INVESTIGATION</u>	12
3.1 PREVIOUS INVESTIGATIONS	12
3.2 FIELD SURVEY	15
3.2.1 <u>Field Program</u>	15
3.2.2 <u>Field Observation</u>	21
3.2.3 <u>Geophysical Exploration</u>	21
3.2.4 <u>Analyte Levels and Distribution</u>	21
3.2.5 <u>Contamination Assessment</u>	29
3.3 FOLLOW-ON INVESTIGATIONS	32
3.4 QUANTITY OF POTENTIALLY CONTAMINATED MATERIAL	35
4.0 <u>REFERENCES CITED</u>	37
Appendix SS-RA-A Chemical Names and Abbreviations	
Appendix SS-RA-B Chemical Data	
Appendix SS-RA-C Comments and Responses	

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
SS-RA-1	Location Map for the Sanitary Sewer System	2
SS-RA-2a	Location Map for Buildings Connected to Sanitary Sewer in Railyard Area	4
SS-RA-2b	Location Map for Buildings Connected to Sanitary Sewer in Administration Area	5
SS-RA-3	Typical Manhole Configuration	7
SS-RA-4a	Field Boring Profile for Well 04035.	8
SS-RA-4b	Field Boring Profile for Well 35051.	9
SS-RA-5	Proposed Follow-on Boring Locations.	34

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LIST OF PLATES

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Plate

- SS-RA-1 Vicinity Map Showing Manhole and Sampling Locations
- SS-RA-2 Topography and Surface Drainage
- SS-RA-3 Water Table Elevations and Generalized Groundwater Flow Direction
- SS-RA-4 Analytes Detected Within or Above Indicator Levels

LIST OF TABLES

<u>Table</u>	<u>Page</u>
SS-RA-1 Railyard and Administration Area Buildings Connected to the Sanitary Sewer	3
SS-RA-2 Manhole Reconnaissance Survey Observations	17
SS-RA-3 Summary of Analytical Results for Railyard and Administration Area Sanitary Sewer System	22
SS-RA-4 Results of Field Study.	23
SS-RA-5 Tentative Identification of Nontarget Compounds	27

EXECUTIVE SUMMARY

SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

The sanitary sewer system in the railyard and administration areas is located in the southwestern part of the Rocky Mountain Arsenal in Sections 2, 3, 4, 34, and 35. The sewer system collects domestic sewage from the buildings in these areas and transports it to Manhole 46 in Section 35 where it connects with the sanitary interceptor line. Buildings in the railyard and administration areas have been used primarily by the Army and other federal agencies. This portion of the sanitary sewer system was investigated under Task 10 in the winter and spring of 1986-1987. Twenty manholes were visually inspected to assess the condition of the system and to select sampling sites. A total of 5 borings (3 in manholes and 2 in lift station overflow ditches), yielding 10 samples, were drilled to depths ranging from 5 to 13.5 ft. In addition, 5 sediment grab samples were collected from inside manholes.

The following target analytes were detected within or above their indicator levels: methylene chloride, dibromochloropropane, chloroacetic acid, cadmium, chromium, copper, lead, zinc, arsenic, and mercury. The detection of methylene chloride is attributed to solvent contamination in the laboratory. Lead and arsenic were each detected once within their indicator ranges in the manhole borings and were considered to be consistent with natural levels found in the soils being analyzed. Copper was detected once and mercury was detected twice at elevated levels in borings at the lift station overflow ditches. The sediment grab samples contained low levels of dibromochloropropane and concentrations of chromium, copper, lead, zinc, mercury, and chloroacetic acid above their indicator levels.

Based upon the results of the field survey, potential contaminants in this system are contained in sediments within the sewers and in the overflow ditches at the lift stations; therefore, no follow-on investigation is planned. The estimated volume of potentially contaminated material is 640 cubic yards.

CONTAMINATION ASSESSMENT REPORT

SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

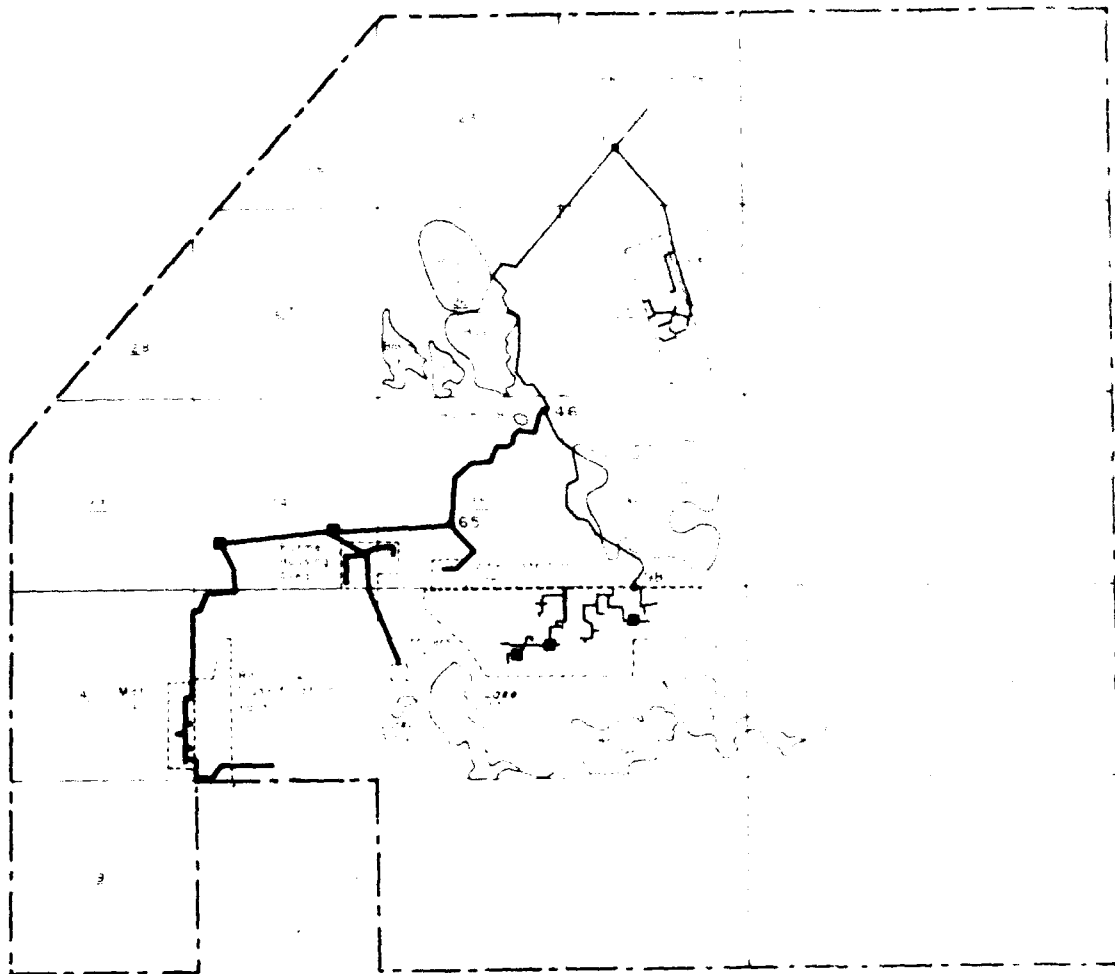
1.0 PHYSICAL SETTING

1.1 LOCATION AND DESCRIPTION

The sanitary sewer system for the railyard and administration areas is located in the southwestern part of the Rocky Mountain Arsenal (RMA) in Sections 2, 3, 4, 34, and 35. The railyard includes two areas known as the motor pool and the rail classification yard. The administration area includes three areas known as the officers' club, the former housing area, and the administration area. The buildings in the administration area were used for administrative purposes and were not associated with chemical activities. In the railyard area, the entomology and plant laboratory was previously shared by Shell and the Army. A map showing the location of these areas and the connecting sewer lines is presented in Figure SS-RA-1. The buildings that are connected to this system are listed in Table SS-RA-1 and are shown in Figures SS-RA-2a and SS-RA-2b. A detailed layout showing the location of field work activities is included as Plate SS-RA-1.

The railyard and administration areas sanitary sewer system includes approximately 37,700 feet (ft) of pipe. The specifications of the pipe used, as shown on the Rocky Mountain Arsenal basic information maps (COE, 1984), are presented below:

<u>Diameter (inches)</u>	<u>Material</u>	<u>Type</u>	<u>Length (ft)</u>
12	Vitrified Clay	Gravity	4,900
8	Vitrified Clay	Gravity	20,500
6	Vitrified Clay	Gravity	3,100
4	Vitrified Clay	Gravity	2,500
8	Steel	Pressure	3,600
6	Steel	Pressure	3,100



Legend

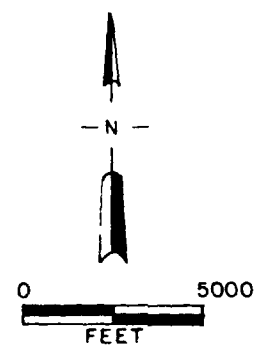
31 Section Number

— Sanitary Sewer System

■ Lift Station

●⁴⁶ Manhole with Number

⌏ Study Area for Railyard and Administration Area
Portion of Sanitary Sewer System



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FIGURE SS-RA-1

**Location Map for the
Sanitary Sewer System**

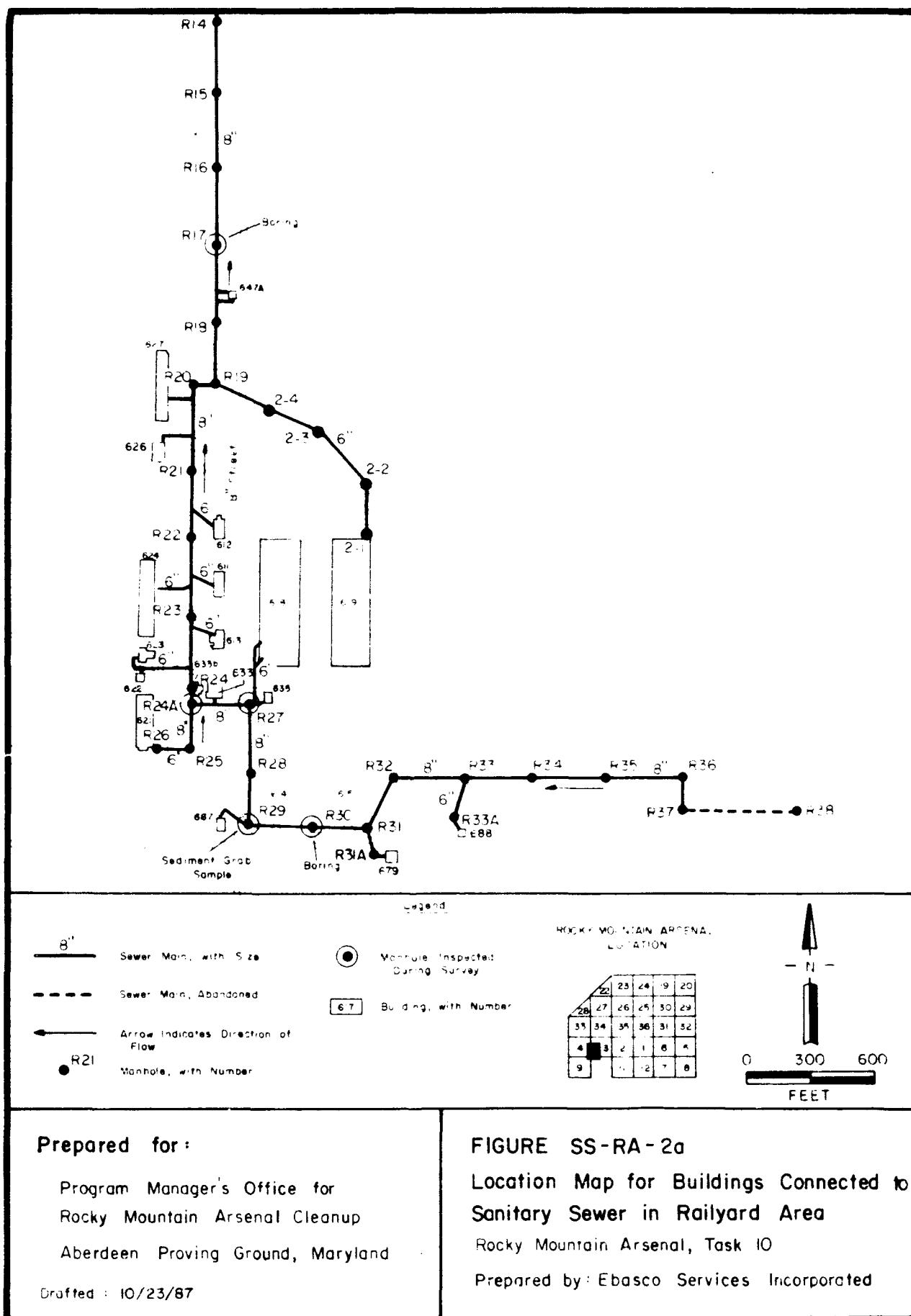
Rocky Mountain Arsenal, Task 10

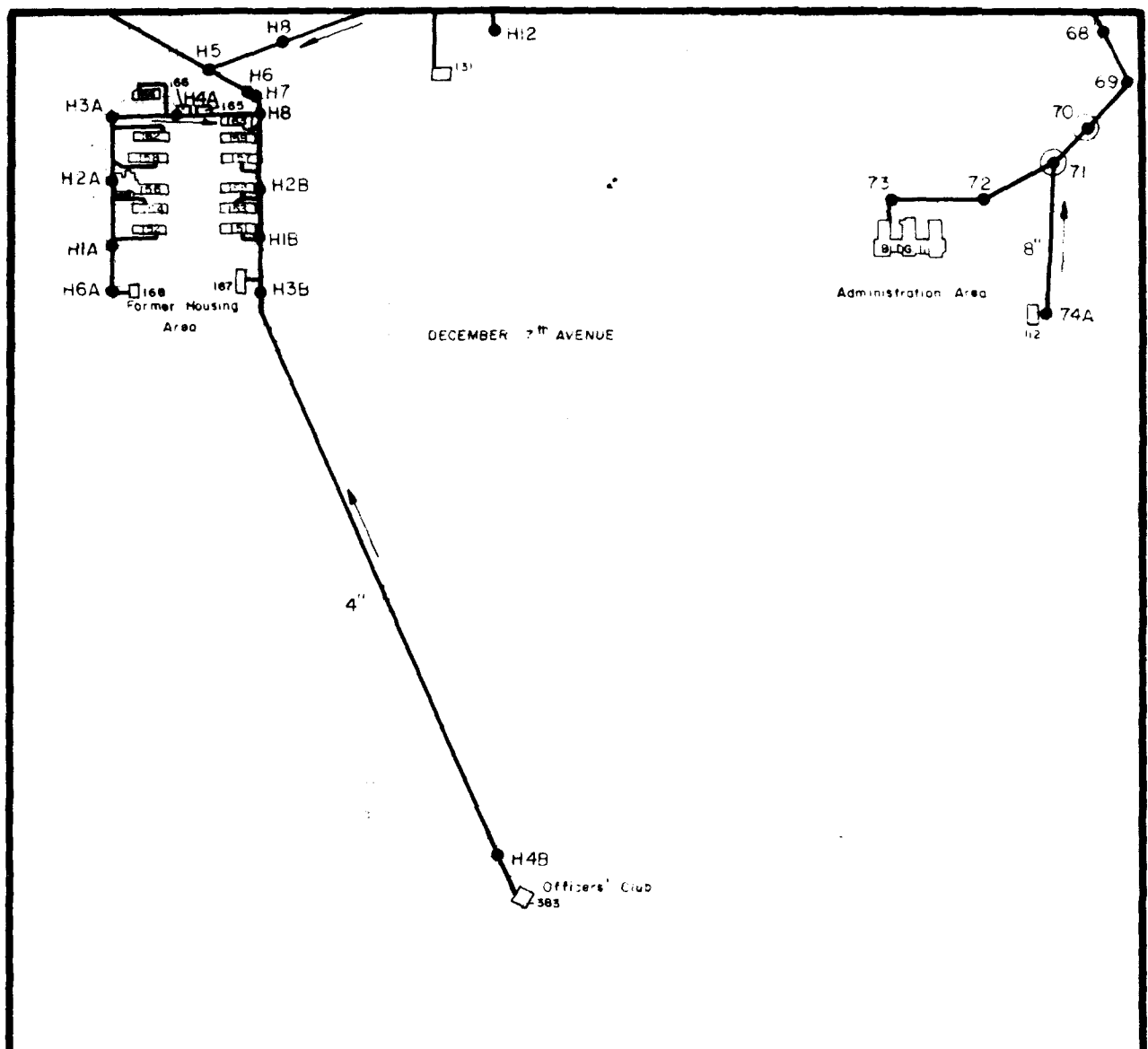
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TABLE SS-RA-1
 Railyard and Administration Area Buildings
 Connected to the Sanitary Sewer

Building No.	Section	Building Description and Use
111	35	Administration
112	35	Communication
131	35	Family Quarters
151	34	Barracks
152	34	Barracks
153	34	Barracks
154	34	Barracks
155	34	Barracks
156	34	Combined Mess Hall
157	34	Barracks
158	34	Barracks
159	34	Barracks
162	34	Barracks
163	34	Bowling Alley
164	34	Barracks
165	34	Supply Building
166	34	Vault Storage Building
167	34	Hobby Shop
168	34	Unknown
383	2	Officers' Club
392	34	Sewage Lift Station
393	34	Sewage Lift Station
611	4	Administration
612	4	Plans Office
613	4	Director of Logistics
618	3	Warehouse
619	3	Warehouse
621	4	Property Disposal Warehouse
622	4	Paint Shop
623	4	Carpenter Shop
624	4	Field Equipment Repair Service
626	4	Machine and Welding Shop
627	4	Motor Pool
633	4	Cafeteria
633B	4	Entomology and Plant Laboratory
635	3	Changehouse
647A	4	Dispatcher's Office
679	10	Warehouse, Can-Scouring Facility
687	4	Unknown
688	9	Guard Tower

From: COE, 1984; WR & SK, 1942a, 1942b, 1942c.

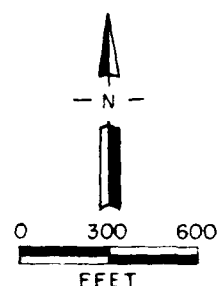




- Legend**
- 4" Sewer Main, with Size
 - Arrow Indicates Direction of Flow
 - H4 Manhole, with Number
 - Manhole Inspected During Survey
 - Life Station
 - Building, with Number

ROCKY MOUNTAIN ARSENAL LOCATION

	22	23	24	9	20
28	27	26	25	30	29
35	34	33	32	31	32
4	3	2	1	6	5
9		11	12	7	8



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Drafted - 10/23/87

FIGURE SS-RA-2b

Location Map for Buildings Connected to
Sanitary Sewer in Administration Area
Rocky Mountain Arsenal, Task 10

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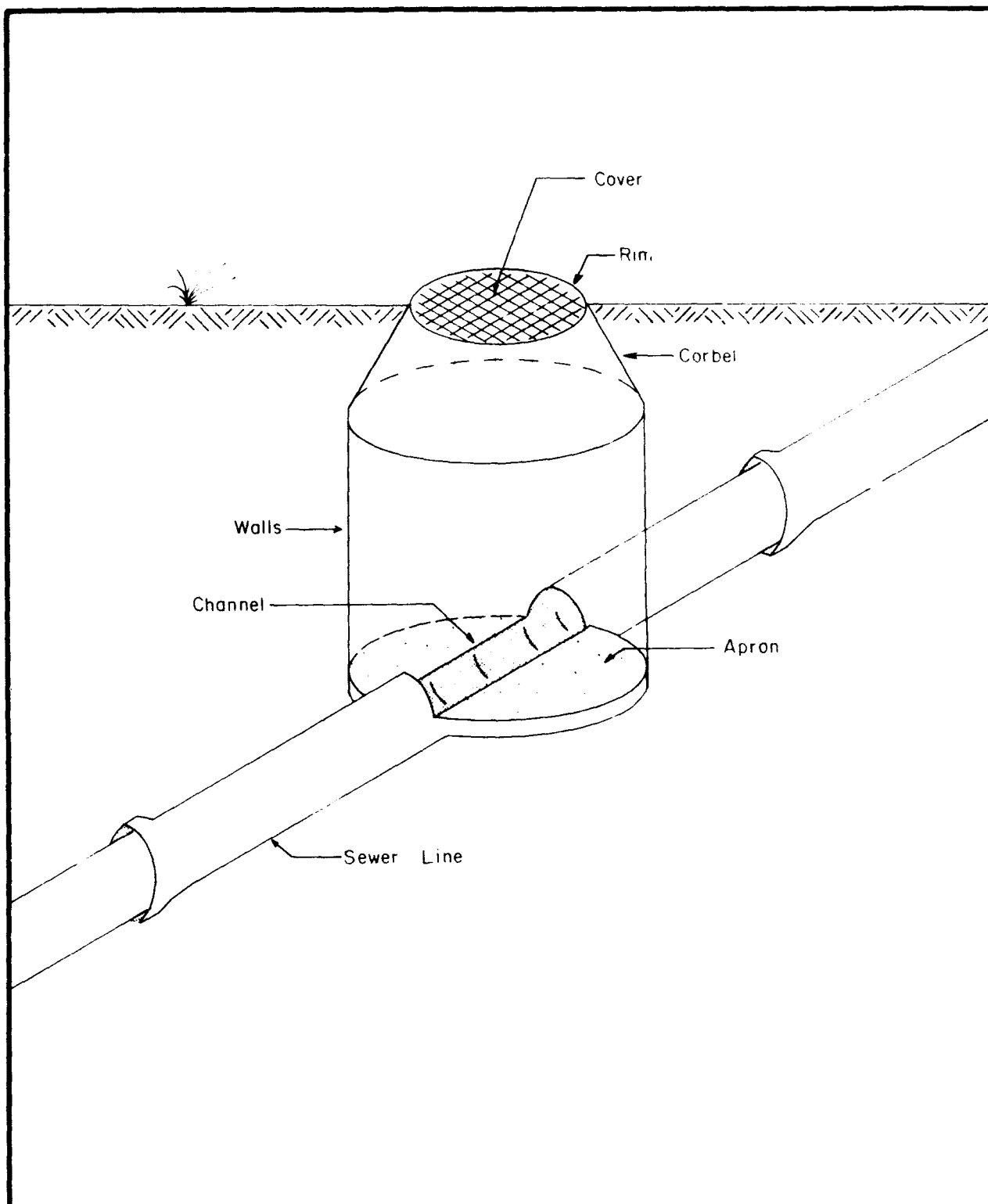
Manhole materials were assessed during field operations. A typical manhole cross-section showing the channel, walls, rim, cover, corbel, and apron is presented in Figure SS-RA-3. The manholes are constructed of brick and mortar, and the joints between the pipe lengths are sealed with oakum and cement.

1.2 GEOLOGY

The two uppermost stratigraphic units beneath the railyard and administration area sanitary sewer system are Quaternary alluvium and the Denver Formation bedrock (May, 1982/RIC 82295R01). Wells drilled near the sanitary sewer line in the railyard area and in Section 34 along the western portion of the sewer system indicate an alluvial thickness ranging from about 71 ft (Well 03008) to 110 ft (Well 03001) (Plate SS-RA-3). The logs from wells in the area show an alluvial section primarily composed of sand and gravelly sand with lesser amounts of silt and clay as in Well 04035 (Figure SS-RA-4a), which is approximately 400 ft west of Manhole (MH) R20 (not shown). Borings drilled beneath MH R17 and MH R30 penetrated 5 ft of medium to coarse grained sand.

The eastern portion of the sewer system lies primarily in Section 35. Here the alluvium ranges in thickness from 0 ft near the center of the section, where the Denver Formation crops out, to 45 ft in Wells 35045 and 35019. Borelogs show that eolian and alluvial materials in this area are composed primarily of silty sand with lesser clay, as shown in Well 35051 (Figure SS-RA-4b).

The underlying Denver Formation consists of claystone, shale, sandstone, and minor lignite. As wells and borings drilled in the vicinity of the railyard and administration area sanitary sewer system do not penetrate the Denver Formation completely, the total thickness of the formation beneath this area is unknown. A detailed description of the Denver Formation is found in a study by May (1982/RIC 82295R01).



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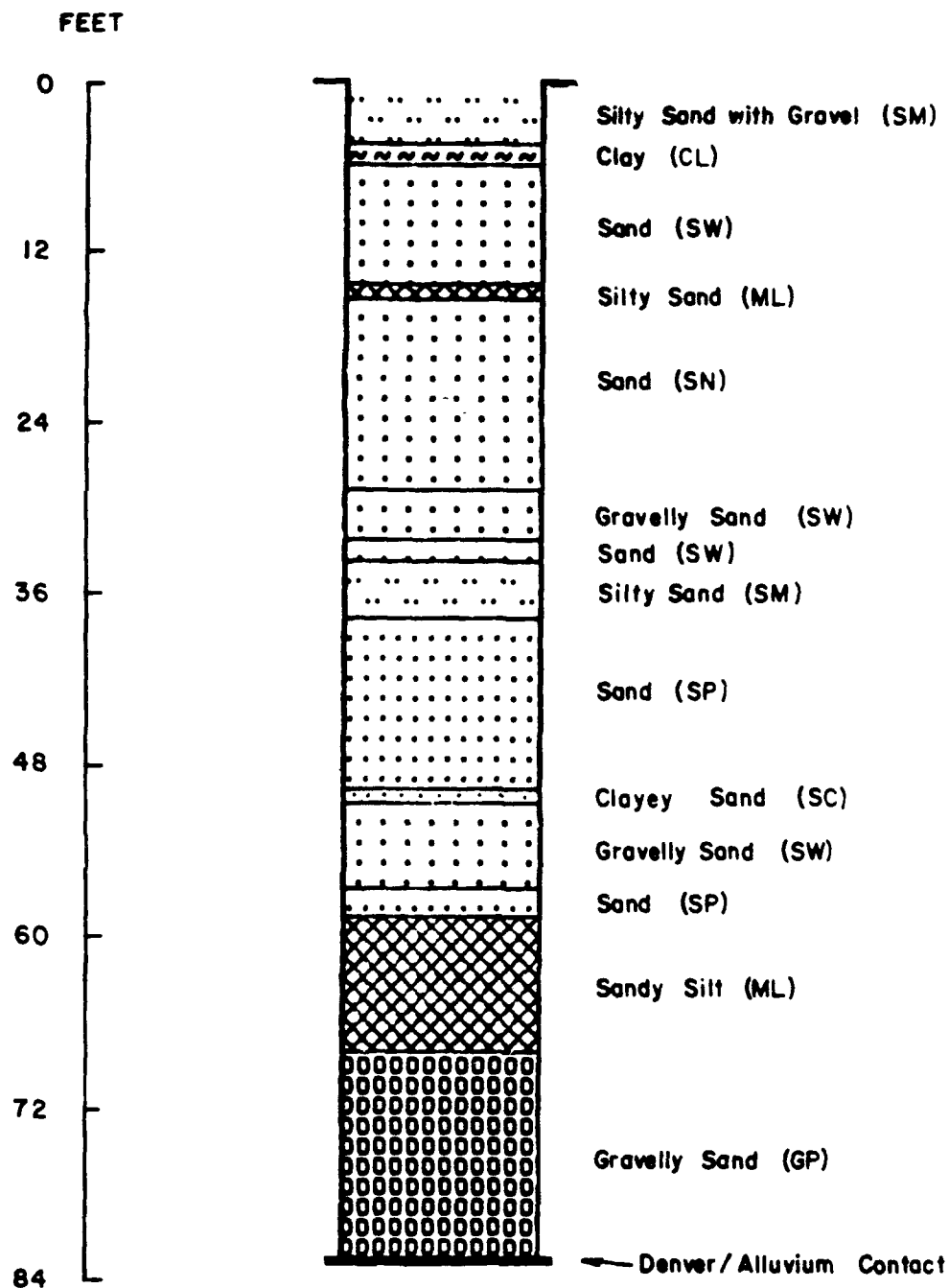
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FIGURE SS-RA-3

Typical Manhole Configuration

Rocky Mountain Arsenal, Task 10

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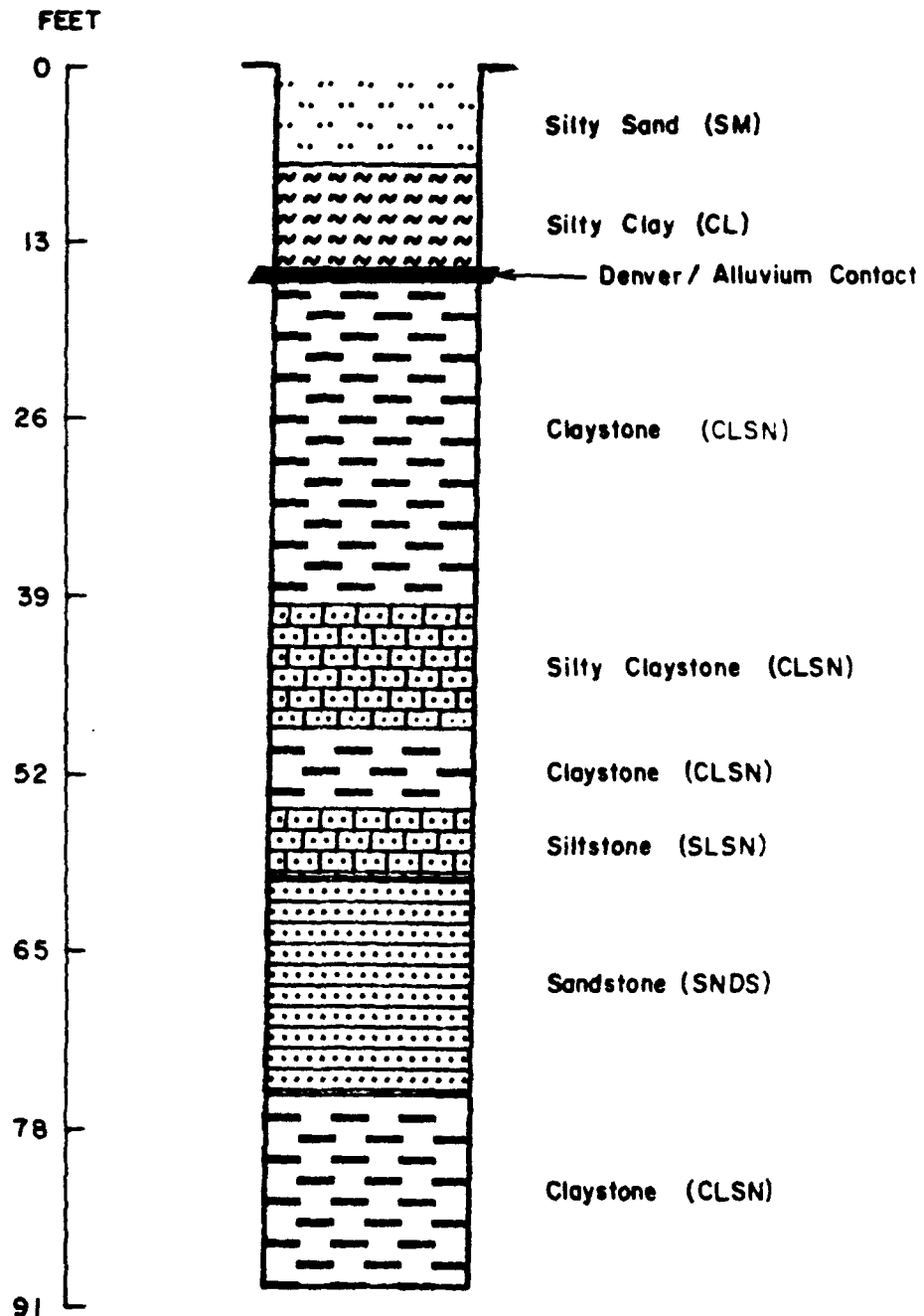
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FIGURE SS- RA-4a

Field Boring Profile for Well 04035

Rocky Mountain Arsenal, Task 10

Prepared by: Ebasco Services Incorporated



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8/3/87

FIGURE SS-RA-4b

Field Boring Profile for Well 35051

Rocky Mountain Arsenal, Task 10
Prepared by: Ebasco Services Incorporated

1.3 HYDROLOGY

Surface water flow along the sewer line in the railyard and administration area is shown on Plate SS-RA-2. In the railyard area, surface water generally flows north along the west side of "B" Street. In Section 34, surface flow is primarily to the northwest. Several culverts cross under December 7th Avenue, carrying water from the northern portion of Section 3 into drainages that cross over the sewer line. One of the drainage channels is located west of the length of sewer line from MH R5A to MH R1. As the sewer crosses into Section 35, surface water flow is controlled by Sand Creek Lateral, which runs west and north of the sewer line throughout the section. No documented surface water quality studies were conducted for this area.

The primary groundwater flow direction across RMA is toward the northwest (Plate SS-RA-3). This flow direction is maintained throughout most of the railyard sanitary sewer system except in the vicinity of the motor pool and rail classification yard where the flow is predominantly toward the north (ESE, 1986b/RIC 86317R01). In the spring of 1986, depth to groundwater in the vicinity of the sewer line ranged from 12.3 ft (5,241.3 ft above mean sea level, msl) in Well 35052, located approximately 950 ft east of MH 71, to 62.5 ft (5,134.4 ft msl) in Well 04033, located approximately 400 ft west of MH R20 (not shown). Groundwater was not reached in any borings along the sewer line.

In the area of the railyard, alluvial groundwater data are only available for Wells 03003, 03009, 03010, and 03523 and Well Cluster 04030, 04031, 04032, and 04033 (ESE, 1986b/RIC 86317R01). These wells are located within 800 ft of the sewer line and were sampled in late 1985 and early 1986. Potential contaminants identified in the wells in Section 3 include aldrin, dibromochloropropane, endrin, benzene, chloroform, and toluene. Samples from the well cluster, located 500 ft west of Manhole R18 (not shown) contained dibromochloropropane, benzene, chloroform, trans-1,2-dichloroethylene, trichloroethylene, and 1,2-dichloroethane. Downgradient Wells 04019 and 04020 were also sampled, but no target analytes were detected. Additionally, Wells 04035 and 04036 located approximately 500 ft west of the sewer line in the motor pool area (not shown) have recently been sampled under Task 38, and have

shown the presence of chloroform, trichloroethylene, 1,1,2-trichloroethane, 1,1,1-trichloroethane, benzene, and 1,1-dichloroethylene. In the administration area, upgradient alluvial Well 35052 contained isodrin and downgradient alluvial Well 35058 contained the dieldrin and chloroform. In samples from alluvial Well 34002, located between the former housing area and MH R1, no target analytes were detected. No alluvial wells downgradient of the system in Section 34 were sampled (ESE 1986b/RIC 86317R01).

Downgradient alluvial groundwater data are available for Section 35 (ESE, 1986b/RIC 86317R01). Wells 35012 and 35016 are located in the Basin A neck. Well 35012 contained chlorobenzene, dieldrin, isodrin, diisopropylmethyl phosphonate, 1,4-oxathiane, p-chlorophenylmethyl sulfide, p-chlorophenylmethyl sulfone, trichloroethylene, and benzene. Well 35016 contained diisopropylmethyl phosphonate, 1,4-oxathiane, dithiane, benzene, trichloroethylene, and chlorobenzene. Downgradient Wells 35034 and 35058 contained dieldrin and chloroform; Well 35034 also contained diisopropylmethyl phosphonate.

Because of the potential for additional contaminant sources in the vicinity of the sanitary sewer in this area, the presence of these chemicals in the wells downgradient from the sewer system does not imply that the sewer system is contributing to contamination in the groundwater.

2.0 HISTORY

Information on the history of the area defined as the railyard and administration area sanitary sewer was gathered through a search of the available literature. It has been prepared following full review of information identified during the course of discovery in United States v. Shell Oil Co., Civil Action No. 83-C-2379 (consolidated with No. 83-C-2386) (D. Colo.). No review of aerial photographs was conducted for the largely underground system.

The sanitary sewer system was installed in the railyard and administration areas during the construction of RMA in the 1940s. Because construction of the

sewer system was not complete before RMA began operations, the railyard and temporary administration areas (former housing area) were serviced with septic tanks and drainage fields prior to connection with the sewer system. A 1945 history of RMA (CWS, 1945) indicates that both of these areas were connected to the sanitary sewer system by that time.

Two lift stations are located between the railyard collection system and the tie-in with the interceptor sewer line leading to the domestic wastewater treatment facility in Section 24 (Site 24-6). Approximately 6,800 ft of steel pipe carries wastewater under pressure between these lift stations and then on to a 12 inch gravity line north of the permanent administration building, Building 111. Much of the steel pipe used for this line had been used previously, and some was pitted by corrosion (CWS, 1945). No documentation was located to indicate that the pipe was repaired prior to installation. Overflow from the lift station north of the railyard (Building 393) ran into a shallow depression northwest of the station and just east of "B" Street (CWS, 1945).

The second lift station (Building 392) overflowed to the septic tank and drainage field used previously by the temporary administration area prior to connection with the sewer system (CWS, 1945). Visual observations indicate that the overflow was disconnected from the septic tank and drainage field and now discharges to a ditch and depression northwest of the lift station.

3.0 FIELD INVESTIGATION

3.1 PREVIOUS INVESTIGATIONS

The regional soil type in the vicinity of the railyard and administration area sewer line is of the Ascalon-Vona-Truckton Association. This association consists of loamy and sandy soils formed in wind-laid deposits on uplands that are somewhat excessively drained to well drained (USDA, 1974/RIC 81266R54).

The condition of the RMA sanitary sewer system was investigated in 1979 and 1980 (Black & Veatch, 1979/RIC 81266R35, 1980). These studies included verification of maps, estimates of infiltration and inflow, smoke testing, visual inspections, and water quality sampling.

Smoke testing indicated a blockage between MH 71 and MH 74A. The blockage may have been caused by a dip in the line (acting as a water trap), a partially caved-in pipe, or foreign material in the line. Open pit excavation and visual inspection of the sewer line between MH 60 and MH 61 showed that the line was in poor condition. The pipe showed signs of exfiltration and was on the verge of collapse. The study concluded that rainwater could have infiltrated the line easily along this section.

Additional infiltration points were located during smoke tests when smoke was seen rising from eleven prairie dog holes. These infiltration points were in the vicinity of MH 47, MH 58, MH 59, MH 60, and MH 62 and indicated the presence of cracked or broken pipe or offset and separated joints. Again, it was concluded that rainwater infiltration could have occurred at any of these points.

The general condition of the entire RMA sanitary sewer system was determined to be poor, and slip-lining of the entire system was recommended (Black & Veatch, 1979/RIC 81266R35). An alternate plan was to abandon the existing system (except in the South Plants area where slip-lining was again recommended) and install separate package treatment plants for the administration area, North Plants complex, and South Plants area. The latter alternative was chosen, but was never implemented due to declining activity at RMA.

Further studies conducted by the Army also indicated that the sanitary sewers were in poor condition (USAEHA, 1985). When V-notch weirs were used to measure the flow through MH R2 and MH R16 in the railyard area, it was found that as much as half of the flow was being lost through exfiltration. As part of the Army study, the flows were totaled daily for a period of six days. The total volume of flow through MH R16 for all six days was 74,200 gallons (gal.) and the total flow through MH R2 (downstream of R16) was 38,000 gal. Unfortunately, the flows during the study period were too low to give the required 2 inch head above the notch to minimize weir effects, so the usual accuracy of the weir was not attained.

Soil and water contamination associated with the sanitary sewer system has received some attention in previous studies. The previous study by Black and Veatch (1979/RIC 81266R35) included water sampling, but only two manholes in the administration area and none in the railyard were checked. Two water samples were taken on different days between August 30 and September 14, 1979, from MH 49 and MH 55. Both of these manholes are close to the point where the interceptor line from the South Plants area joins the line from the railyard and administration areas.

Detection limits were not stated for this study, but the chemical analyses were performed by the RMA laboratory. At that time the detection limits for the laboratory in parts per billion (ppb) were as follows (Jones, 1987):

<u>Analyte</u>	<u>Concentration (ppb)</u>
Dibromochloropropane	0.2
Aldrin	1.0
Isodrin	0.5
Dieldrin	0.5
Endrin	0.5
Diisopropylmethyl phosphonate	2.0

Further investigation has revealed that the values presented in the Black and Veatch report that are equal to the detection limits should have been noted as "less than" the detection limit (Jones, 1987). When this is taken into consideration, the data show that dibromochloropropane and isodrin were the only analytes found at levels above the detection limits. Analysis showed isodrin present in one of the samples from MH 55 at 0.56 ppb and dibromochloropropane present in one of the samples from both MH 49 and MH 55 at 0.34 and 0.26 ppb, respectively.

In 1980, evidence was found of a dibromochloropropane groundwater plume originating in the railyard area and moving to the northwest. Although data from Shell Oil Company indicate the plume originates in the railyards area

east of the sewer line in Section 3, an exact source has not been determined (Swift & Chiang, 1987). Further investigations are being carried out by Ebasco under Tasks 7 and 20 (Ebasco, 1987c). The Irondale Groundwater Treatment System was installed along the northwestern boundary of RMA when the dibromochloropropane plume was discovered (USAEWES, 1984/RIC 85130R01). It should be noted, however, that the water table in this area is 60 ft below the ground surface, and therefore does not come into contact with the sewer system. It is not possible for dibromochloropropane from the groundwater plume to infiltrate the sewers and be transported downstream within the system.

During the sewer system studies performed by the Army (USAEHA, 1985), water samples were collected and analyzed at MH R2 and MH R16 in the railyard and administration areas. Chloroform was found in both manholes at concentrations of 16 and 37 micrograms per liter, ug/L, respectively. These values represent average concentrations over a six day study period.

Additional studies were initiated by the U.S. Environmental Protection Agency (EPA) when trichloroethylene was found in wells to the west of RMA. At the request of the EPA, the Army is sponsoring continuing studies to evaluate RMA's possible contribution to the trichloroethylene contamination existing off-post (Ebasco, 1987a). These studies cover the western tier of RMA as well as the rail classification yard area and the abandoned officers' housing area.

3.2 FIELD SURVEY

3.2.1 Field Program

Using the methodology presented in the Task 10 Technical Plan (Ebasco, 1987b/RIC 87336R30) manholes were inspected and sampled in the railyard and administration areas. Field observations led to the inspection of 20 manholes rather than the 15 recommended in the Technical Plan. Soil samples were collected from beneath 3 manholes, sediment samples were collected from inside 5 manholes, and soil samples were collected in the overflow ditches from the lift stations (Buildings 392 and 393). Hydrostatic testing of the pressure line from Building 393 to Manhole 65 was not done at the request of the facilities engineer. No geophysical borehole clearance for safety purposes

was conducted as there was no likelihood of unexploded ordnance, buried metal, or other buried objects.

The manholes that were inspected were generally in good condition. Table SS-RA-2 summarizes observations of the manholes obtained by visual inspection and probes conducted with a metal rod. The manholes were all constructed of brick and mortar, with concrete aprons and concrete or vitrified clay pipe (VCP) invert channels. The corbels were solid, with areas of eroded mortar near the top of some manholes. Standing water and sediment were found in several of the manholes in the channel or on the apron.

Based on the results of the manhole reconnaissance survey, sediment grab samples were collected from 5 manholes. The manholes were selected based on their location in the system. These manholes are located throughout the railyard and administration areas and were sampled to provide an indication of the source of potential contamination in the sewer system.

The three manholes selected for drilling (R30, R17, and 64) were determined to be "worst-case" manholes. All have VCP invert channels with joints in the manhole. Channels constructed in this manner have a greater potential for leaking than concrete channels. MH R30 has joints at each end of the manhole. MH 64 has a VCP channel, and wet areas and gaps were observed at the connection to the inlet and outlet pipes.

During drilling of the manholes it was found that the VCP channels in MH R30 and MH R17 were installed directly on top of the underlying soil. The first sample from each of these manholes had several inches of reddish brown silty sand directly under the VCP channels. By comparison, the bottom of MH 64 was constructed of brick covered with a layer of mortar. The VCP channel was set into this mortar layer. The material in the first sample under MH 64 was very moist.

In addition to the manhole borings and grab samples, a boring was hand-augered at each of the two lift station overflows. Overflows of the lift stations are

Table SS-RA-2. Manhole Reconnaissance Survey Observations. Page 1 of 2.

Manhole	Depth	Material	Rim	Walls	Apron	Channel	Connections	Comments
R5A	6.4 ft	brick	Broken. Gaps between bricks and rim.	no problems noted	concrete	concrete	tight	Dirt and bricks mounded around manhole on ground.
R6	6.8 ft	brick	South side broken	no problems noted	concrete	concrete	mortar not evident	Some cracked mortar near top of walls.
R7	7.5 ft	brick	concrete, broken	no problems noted	concrete	concrete	tight	No mortar visible in connections.
R12	7.1 ft	brick	crumbling	top layers in bad shape	concrete	concrete	tight	One inch of moist sediments on apron.
R13	7.5 ft	brick	no problems noted	no problems noted	concrete	very deep	no problems noted	Loose mortar around top of wall. Sediments around outer 5 inches of apron.
R17	8.5 ft	brick	no problems noted	no problems noted	concrete	VCP with a joint	no problems noted	
R19								Not located - buried in parking lot.
R20	7.9 ft	brick	no problems noted	no problems noted	concrete	concrete	no mortar	Pieces of concrete on apron.
R24A	8.6 ft	brick	8-inch thick concrete slab	no problems noted	sounds hollow	feels cracked	tight	
R27	not measured	brick	4-inch thick concrete slab	feels solid	concrete	solid	tight	Standing water in east side of channel. Sediment on apron.
R29	8.1 ft	brick	no problems noted	top has gaps in mortar	concrete	concrete	mortared	Sediment in channel, some on apron. MH in drainage, covered with dirt and cobbles.
R30	5.5 ft	brick	broken and displaced	missing mortar near top	concrete	VCP, joints at each end	no problems noted	One inch of sediment in channel.
H-1	4.8 ft	brick	some cracks	no problems noted	concrete	concrete	no grout	Areas of standing water in channel.

Table SS-BA-2. Manhole Reconnaissance Survey Observations. Page 2 of 2.

Manhole	Depth	Material	Rim	Walls	Apron	Channel	Connections	Comments
H-2	not measured	brick	no problems noted	no problems noted	solid	solid	no problems noted	Full of standing water. Sediment fills channel.
46	7.2 ft	brick	no problems noted	bricks are chipped	concrete	deep	top of inlet is cracked	Sediment in inlet from southwest. Piece missing from inlet.
50	4.5 ft	brick	concrete is broken	some cracked bricks and missing mortar	concrete	concrete	surrounding bricks chipped	Standing water, dead animal and sludge in channel.
64	3.9 ft	brick	no problems noted	no problems noted	brick and mortar eroding on east side	mortar	wet areas in connections, gap	
65	5.5 ft	brick	broken concrete	very crumbly	solid	solid	no problems noted	Channel filled with black sludge. Apron covered with pieces of brick and mortar. Inlet comes from lift station.
70	4.0 ft	brick	no problems noted	no problems noted; wet 1 ft above apron	concrete	concrete	no problems noted	Wet mud on apron. No observed cracks.
71	5.5 ft	brick	no problems noted	no problems noted	solid	solid	no problems noted	

not common, but could occur in the event of equipment failure. The overflow at the western lift station, Building 393, appeared to enter a ditch about 6 ft wide. Boring LS0001 was drilled at the source of this ditch, approximately 50 ft west of the lift station. The ditch was followed for some 200 ft before it was lost. The ditch was dry and there was no catch basin evident at the end of it. The eastern lift station, Building 392, overflowed to a ditch approximately 3 ft wide and 275 ft long. Boring LS0002 was drilled at the source of this ditch, approximately 2 ft northwest of the lift station. This ditch terminated in a basin about 20 ft wide and 80 ft long. The top 3 ft of soil was black and was saturated at the time of sampling.

The railyard and administrative areas sanitary sewer was investigated under Task 10 in the winter and spring of 1987. A total of 5 borings, drilled to a maximum depth of 13.5 ft, and 5 sediment grab samples, yielding a total of 15 samples, were completed and are summarized below. Borings R17, R30, and 64 were drilled through their corresponding manholes, and Borings LS0001 and LS0002 refer to the two lift stations, 393 and 392, respectively.

<u>Manhole No.</u>	<u>Type</u>	<u>Depth From Ground Surface (ft)</u>	<u>Depth Beneath Sewer Invert (ft)</u>	<u>No. of Samples</u>
H2	Grab	5.2	0	1
R12	Grab	7.2	0	1
R17	Boring	13.5	5.0	2
R29	Grab	7.9	0	1
R30	Boring	10.5	5.0	2
50	Grab	4.7	0	1
64	Boring	9.1	5.2	2
65	Grab	5.4	0	1
<u>Lift Station</u>				
LS0001	Boring	5.0	-	2
LS0002	Boring	5.0	-	2

It should be noted that depths were measured from the ground surface, not from the bottom of the manhole. In the manhole borings, the first sample was taken from directly under the manhole channel, and the second was taken 4 to 5 ft

below the first. The depths shown for the sediment samples represent the depth of the manhole channel. Borings at the lift stations were made from the ground surface and did not involve manholes.

All samples from the manhole borings were analyzed by gas chromatography/mass spectrometry (GC/MS) for volatile and semivolatile organics; by an inductively coupled argon plasma (ICP) screen for metals; and by separate analyses for arsenic, mercury, and thiodiglycol. Borings at the lift stations were also analyzed by GC/MS for volatile organics (except the 0-1 ft interval) and semivolatile organics; by an ICP screen for metals; and by separate analyses for arsenic, mercury, thiodiglycol, and agent degradation products (organo-acids). The sediment grab samples were analyzed by GC/MS for semivolatile organics; by an ICP screen for metals; and by separate analyses for dibromochloropropane, arsenic, mercury, and thiodiglycol. Samples from the 0 to 1 ft intervals of the lift station borings and the sediment grab samples were not analyzed for volatile organics because they were in direct contact with the atmosphere. Any volatile organic compounds would have volatilized before the samples were collected. Appendix SS-RA-A presents the specific target analytes for which laboratory analyses were conducted. A summary of the results of these analyses is presented in Table SS-RA-3, Section 3.2.4 of this report.

The remedial investigation program for the sanitary sewer in the railyard and administration areas was developed and implemented based on historical documentation and other information available at the time of its implementation. Since that time, previously unavailable information has been identified and incorporated into the history section of this report. Furthermore, this additional information has been evaluated in detail to determine how it might impact the investigation approach for this system. Based upon this evaluation, it has been determined that the additional information collected since the field program was designed does not substantially alter the view of potential contamination for this system. As a result, the field program as conducted is judged to provide a complete and accurate investigation of the possible contamination associated with the sanitary sewer in the railyard and administration areas.

3.2.2 Field Observations

To ensure safety, in situ air monitoring was conducted during the sampling operations using a photoionization detector (HNU) and an organic vapor analyzer (OVA). Readings from the HNU were above background for the two samples taken from Boring LS0002; however, readings in the breathing zone were at background levels. All other OVA and HNU readings were at or near background levels.

Neither an M8 alarm nor an M18A2 test kit was used, as there was no likelihood of the presence of chemical agents at this site. No unexploded ordnance, buried metal, or other objects were detected during sampling operations. No unusual coloring or staining of the core samples was noted.

3.2.3 Geophysical Exploration

A geophysical survey was not conducted as part of the railyard and administration areas sanitary sewer study, as no underground metallic utilities were expected to be present at the sampling sites.

3.2.4 Analyte Levels and Distribution

Methylene chloride, dibromochloropropane, cadmium, chromium, copper, lead, zinc, arsenic, mercury, and chloroacetic acid were found at concentrations within or above their indicator levels in samples from the sanitary sewer system in the railyard and administration areas. The number of samples containing each analyte, and the concentration range, median, mean, standard deviation, detection limit, and indicator level are listed in Table SS-RA-3. The results of geologic field observations, air monitoring during drilling, and the chemical analysis of each soil sample are summarized in Table SS-RA-4.

Indicator levels and ranges were established to assess the significance of metal and organic analytical values. The indicator levels are the method detection limits for organic compounds. The indicator ranges for metals reflect the concentrations expected to occur naturally in RMA alluvial soils. Selection of these ranges is discussed in the Introduction to the Contamination Assessment Reports (ESE, 1986a RIC 87336R01).

Table SS-RA-3. Summary of Analytical Results for the Railyard and Administration Area Sanitary Sewer System. Page 1 of 1.

Constituent Detected	Number of Samples*	Range	Median**	Mean**	Standard Deviation**	Concentration (ug/g)		Indicator Level
						DataChem Detection Limit	CAL Detection Limit	
<u>Volatiles (N=8)</u>								
Methylene Chloride	1	1	-	-	-	2	0.7	DL
<u>Semivolatiles (N=15)</u>								
None detected								
<u>Dibromochloropropane (N=5)</u>	2	0.0072-0.014	-	-	-	0.0050	0.014	DL
<u>ICP Metals (N=15)</u>								
Cadmium	1	1.8	-	-	-	0.74	0.66	1.0-2.0
Chromium	11	10-81	14	23	22	6.5	5.2	25-40
Copper	11	8.5-500	40	88	140	4.7	4.9	20-35
Lead	9	22-700	43	130	220	8.4	13	25-40
Zinc	15	22-180	48	71	51	8.7	9.5	60-80
Arsenic (N=15)	3	3.7-8.4	-	-	-	2.5	5.0	DL-10
Mercury (N=15)	6	0.25-1.3	1.1	0.86	0.42	0.050	0.060	DL-0.10
<u>Thiodiglycol</u>								
Thiodiglycol (N=15)	0							DL
Chloroacetic acid (N=9)	3	62-65	-	-	-	4.2	***	DL
<u>Agent Products (N=2)</u>								
None detected								

DL - The indicator level is the detection limit for DataChem and CAL Laboratories, as appropriate
 N - Number of samples analyzed
 * - Number of samples in which constituent was detected; only these sample results were used in statistical analyses
 ** - Median, mean, and standard deviation not calculated when constituent detected in fewer than 5 samples
 *** - Laboratory not certified for analytical method
 Site SS-RA
 4901A/1041A
 Rev. 7/29/88

Table SS-RA-4. Results of Field Study. Page 1 of 2.

	Sample H2*	Sample R12*	Boring R17		Sample R29*	Boring R30	
Depth (feet)	5.2	7.2	8.5-9.5	12.5-13.5	7.9	5.5-6.5	9.5-10.5
Geologic Material	NR	NR	Sand	Gravelly Sand	NR	Sand, Trace Pebbles	Sand, Trace Pebbles
Percent PinesVO			0	0		0	0
AIR MONITORING							
Volatile Organic Readings (ppm)							
HNUS	BDL	BDL	BDL	BDL	NR	NR	NR
OVAS	0-2.4	0-2.4	NR	NR	NR	1-1.6	NR
SOIL CHEMISTRY							
Volatiles (ug/g)							
Methylene chloride	NA	NA	BDL	BDL	NA	BDL	1
Semivolatiles (ug/g)							
None detected							
Dibromochloropropane (ug/g)							
BDL	BDL	BDL	NA	NA	BDL	NA	NA
ICP Metals (ug/g)							
Cadmium	BDL	BDL	BDL	BDL	1.8	BDL	BDL
Chromium	50	22	BDL	BDL	81	11	BDL
Copper	40	35	BDL	BDL	500	8.5	BDL
Lead	700	99	25	BDL	170	22	BDL
Zinc	120	87	25	22	170	43	24
Arsenic (ug/g)							
BDL	BDL	BDL	BDL	BDL	8.4	BDL	BDL
Mercury (ug/g)							
BDL	BDL	0.25	BDL	BDL	0.98	BDL	BDL
Thiodiglycol (ug/g)							
Thiodiglycol	BDL	BDL	BDL**	BDL**	BDL	BDL**	BDL**
Chloroacetic acid	63	BDL	NA	NA	65	NA	NA
Agent Products (ug/g)							
NA	NA	NA	NA	NA	NA	NA	NA

BDL - Below detection limit

BKD - Background

NA - Not analyzed

NR - Not recorded

S - As referenced to calibration standard of methane for OVA, and benzene for HNU; reading has been adjusted to account for background level

VO - As determined by visual observation and rounded to the nearest 5 percent

* - Sediment grab sample

** - Sample was sent to the ESF lab, which analyzed for thiodiglycol with a detection limit of 2.6 ug/g and did not analyze for chloroacetic acid

Site SS-RA

4900A/1041A

Rev. 7/29/88

Table SS-RA-4. Results of Field Study. Page 2 of 2.

Depth (feet) Geologic Material	Sample 50*		Boring 64		Sample 65*		Boring LS0001		Boring LS0002	
	4.7 NR	4.1-5.1 Clayey Sand Trace Cobbles	8.1-9.1 Sandy Clay	5.4 NR	0-1 Sandy Clayey Silt	4-5 Silty Sand	0-1 Silty Sand w/Organics	4-5 Clayey Silty Sand		
Percent PinesVO		30	60		65	25	40	40		
AIR MONITORING										
Volatile Organic Readings (ppm)										
HNUS	BKD	BKD	NR	BKD	NR	NR	80	80		
OVAS	NR	BKD	NR	NR	BKD	BKD	BKD	BKD		
SOIL CHEMISTRY										
Volatiles (ug/g)										
Methylene chloride	NA	BDL	BDL	NA	NA	BDL	NA	BDL		
Semivolatiles (ug/g)										
None detected										
Dibromochloropropane (ug/g)										
	0.014	NA	NA	0.0072	NA	NA	NA	NA		
ICP Metals (ug/g)										
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		
Chromium	BDL	10	13	10	14	13	15	14		
Copper	180	BDL	13	63	48	9.7	57	14		
Lead	29	BDL	BDL	87	38	BDL	43	BDL		
Zinc	180	26	43	40	87	48	89	59		
Arsenic (ug/g)										
	BDL	BDL	3.7	3.7	BDL	BDL	BDL	BDL		
Mercury (ug/g)										
	1.1	BDL	BDL	1.3	0.42	BDL	1.1	BDL		
Thiodiglycol (ug/g)										
Thiodiglycol	BDL	BDL**	BDL**	BDL	BDL	BDL	BDL	BDL		
Chloroacetic acid	BDL	NA	NA	62	BDL	BDL	BDL	BDL		
Agent Products (ug/g)										
	NA	NA	NA	NA	NA	NA	BDL	BDL		

BDL - Below detection limit

BKD - Background

NA - Not analyzed

NR - Not recorded

S - As referenced to calibration standard of methane for OVA, and benzene for HNU; reading has been adjusted to account for background level

VO - As determined by visual observation and rounded to the nearest 5 percent

* - Sediment grab sample

** - Sample was sent to the ESE lab, which analyzed for thiodiglycol with a detection limit of 2.6 ug/g and did not analyze for chloroacetic acid

Site SS-RA

4900A/1041A

Rev. 7/29/88

The distribution of the analytes detected within or above their indicator levels in the sampling program is presented in Plate SS-RA-4. A tabulation of all analytical data associated with the sampling program is presented in Appendix SS-RA-B.

The sampling program for this part of the sanitary sewer included both sediment grab samples and samples from borings. Results from each type of sampling method will be discussed separately, although all results are combined in Table SS-RA-3.

Borings: Borings were drilled through the bottoms of three manholes and at the overflows of the two lift stations. Methylene chloride was found in the 9.5 to 10.5 ft interval of Boring R30 at a concentration of 1 microgram per gram (ug/g), slightly above its detection limit of 0.7 ug/g. Lead was found at 25 ug/g, the lower limit of its indicator range, in the 8.5 to 9.5 ft interval of Boring R17. Boring 64 contained arsenic within its indicator range at 3.7 ug/g in the 8.1 to 9.1 ft interval. Borings at the lift station overflows contained several metals within or above their indicator ranges in the surface samples. The 0 to 1 ft interval of Boring LS0001 (lift station 393) contained copper at 48 ug/g, lead at 38 ug/g, zinc at 87 ug/g, and mercury at 0.42 ug/g. Lead was within its indicator range and copper, zinc, and mercury were above their indicator ranges in this sample. The 0 to 1 ft interval from Boring LS0002 contained copper, lead, zinc, and mercury above their indicator ranges at 57 ug/g, 43 ug/g, 89 ug/g, and 1.1 ug/g, respectively. No target analytes were detected within or above their indicator levels in the 4 to 5 ft intervals of the lift station borings.

Sediment Samples: The sediment grab samples taken from inside manholes did not contain volatile or semivolatile organic compounds at levels detectable by the GC/MS screen. Although dibromochloropropane was not detected in the semivolatile analysis where its detection limit is 0.3 ug/g, it was detected at 0.014 ug/g in Grab Sample 50 and at 0.0072 ug/g in Grab Sample 65 in a separate analysis. This analytical method utilized gas chromatography/electron capture techniques, and has a detection limit of 0.005 ug/g.

All of the sediment grab samples contained elevated levels of metals. Cadmium was found within its indicator range at 1.8 ug/g in Grab Sample R29. Chromium was found at 50 ug/g in Grab Sample H2 and at 81 ug/g in Grab Sample R29, above its indicator range in both cases. Copper and lead were found above their indicator ranges in all of the grab samples except Grab Sample 50, where lead was present within its indicator range and Grab Sample R12, where copper was found within its indicator range. Grab Sample H2 contained 40 ug/g of copper, Grab Sample R12 contained 35 ug/g, Grab Sample R29 contained 500 ug/g, Grab Sample 50 contained 180 ug/g, and Grab Sample 65 contained 63 ug/g. Lead was found at 700 ug/g in Grab Sample H2, at 99 ug/g in Grab Sample R12, at 170 ug/g in Grab Sample R29, at 29 ug/g in Grab Sample 50, and at 87 ug/g in Grab Sample 65. Zinc was present at 120 ug/g in Grab Sample H2, at 87 ug/g in Grab Sample R12, at 170 ug/g in Grab Sample R29, and at 180 ug/g in Grab Sample 50. These concentrations are all above the indicator ranges of these metals. Arsenic was within its indicator range at levels of 8.4 ug/g and 3.7 ug/g in Grab Samples R29 and 65, respectively. Mercury was above its indicator range at 0.25 ug/g in Grab Sample R12, at 0.98 ug/g in Grab Sample R29, at 1.1 ug/g in Grab Sample 50, and at 1.3 ug/g in Grab Sample 65. Chloroacetic acid was present at 63 ug/g in Grab Sample H2, at 65 ug/g in Grab Sample R29, and at 62 ug/g in Grab Sample 65, all above its indicator level.

In addition, several compounds were detected by GC/MS that were not included in the target compound list and that were not conclusively identified. Table SS-RA-5 lists the boring number, sample interval depth, relative retention time (shown as "unknown number" on the table), concentration, sample number, lot, best-fit identification, and comments for these nontarget compounds. It should be noted that an individual compound may have more than one retention time, and also that a particular retention time may be assigned to more than one compound. Therefore, Table SS-RA-5 provides only a general indication of additional compounds that may be present. Nontarget compounds of note include several tentatively identified hydrocarbons ranging in size from 12 to more than 26 carbons. These were found at concentrations of 0.2 to 0.9 parts per million (ppm) and included linear, cyclic, and branched configurations. These were found in all samples except grab samples from MH R12 and MH R29 and Borings R17 and R30.

Table SS-RA-5. Tentative Identification of Nontarget Compounds. Page 1 of 2.

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Sample Number	Lot	Best-fit Identification	Comments
R2**	5.2	603	0.2	004	BHX	linear hydrocarbon, C-19	
		635	0.2	004	RHX	cyclic hydrocarbon, C-25	
		646	0.2	004	BHX	branched hydrocarbon, C-25	
		650	0.2	004	BHX	branched hydrocarbon, C-26	
R12**	7.2			003	BHX		K
R17	8.5-9.5			007	BSR		K
				008	BSU		K
	12.5-13.5	615	0.7	008	BSR	nonmedic acid, dibutyl ester	K
				009	BSU		D
R29**	7.9	609	0.7	002	BHX	hexadecanoic acid	D
		619	0.4	002	BHX	octadecanoic acid	D
R30	5.5-6.5			009	BSR		K
				010	BSU		K
	9.5-10.5			002	BSV		K
50**	4.7	584	0.6	006	RHX	cyclic hydrocarbon, C-20	A
		607	0.3	006	RHX	hexadecanoic acid	D
		610	2	006	BHX	molecular sulfur, S8	D
		611	1	006	BHX	molecular sulfur, S8	D
		611	1	006	BHX	molecular sulfur, S8	D
		613	2	006	BHX	molecular sulfur, S8	D
		614	2	006	BHX	cyclic hydrocarbon, C-23	D
		619	0.6	006	BHX	octadecanoic acid	D
		619	2	006	BHX		
		631	1	006	BHX	ethanol, 2-butoxy, phosphate (3:1)	
64	4.1-5.1			002	BUC	tetradecanoic acid	K
		598	0.4	002	RUH		D
		608	0.9	002	RUH	hexadecanoic acid	A
		609	2	002	RUH		D
		618	0.9	002	RUH	octadecanoic acid	A
		619	0.6	002	RUH		D
		636	0.5	002	RUH	branched hydrocarbon, C-25	
	8.1-9.1			003	RUC	hexadecanoic acid	K
		609	0.5	003	RUH	branched hydrocarbon, C-25	D
		636	0.3	003	RUH		
		650	1	003	RUH		A

A - No positive identification
D - Derived from natural products
K - None detected
* - Values reported are blank corrected
** - Sediment grab sample

Site SS-RA
4869A/1041A
Rev. 5/11/88

Table SS-RA-5. Tentative Identification of Nontarget Compounds. Page 2 of 2.

Borehole Number	Interval Depth (ft)	Unknown Number	Concentration (ppm)*	Sample Number	Lot	Best-fit Identification	Comments
65**	5-6	609	1	005	BXH	hexadecanoic acid	D
		619	0.5	005	BXH	branched hydrocarbon, C-23	
		620	0.9	005	BXH	octadecanoic acid	D
		635	0.4	005	BXH	linear hydrocarbon, C-25	
		637	0.6	005	BXH	unknown phthalate	C, F
		638	0.8	005	BXH	docosanoic acid	D
		643	0.4	005	BXH	linear hydrocarbon, C-26	
		647	0.5	005	BXH	hydrocarbon, C-26	
LS0001	0-1	579	0.5	008	CEP	2-butenedioic acid, bis(2-methylpropyl) ester	D
		609	1	008	CEP	unknown carboxylic acid	D
		619	0.6	008	CEP	unknown carboxylic acid	D
		636	0.9	008	CEP	unknown olefin, GT C-26	
	4-5			008	CEM		K
				009	CEP		K
LS0002	0-1	544	0.5	005	CFK	alkene, C-17	
		580	0.5	005	CFK	2-butenedioic acid, bis(2-methylpropyl) ester	D
		582	0.3	005	CFK	sulfur	D
		596	0.2	005	CFK	4-(2,2,3,3-tetramethyl butyl) phenol (or isomer)	B
		596	0.3	005	CFK	4-nonyl phenol	B
		599	0.2	005	CFK	4(1,1,3,3-tetramethyl butyl) phenol (or isomer)	B
		599	0.2	005	CFK	tetradecanoic acid plus an unidentified phthalate	D, C, F
		610	0.9	005	CFK	hexadecanoic acid	D
		614	2	005	CFK	molecular sulfur	D
		620	0.5	005	CFK	octadecanoic acid	D
				008	CFB	alkene, C-12	K
		544	0.4	006	CFK	2-butenedioic acid, bis(2-methylpropyl) ester	D
		580	0.5	006	CFK	hexadecanoic acid plus an unidentified phthalate	D, C, F
		610	0.3	006	CFK	molecular sulfur	D
		614	2	006	CFK		
				006	CFK		

B - Surfactant
 C - Plasticizer
 D - Derived from natural products
 F - Low concentration
 GT - Greater than
 K - None detected
 * - Values reported are blank corrected
 ** - Sediment grab sample
 Site SS-RA
 4869A/1041A

Numerous naturally occurring compounds were found throughout the samples, appearing in grab samples and in samples from borings with equal frequency. These compounds are those tentatively identified as molecular sulfur, hexadecanoic acid, octadecanoic acid, nonanedioic acid, butenedioic acid, docosanoic acid, and associated esters.

Unidentified phthalates (ubiquitous plasticizers) were noted in Boring LS0002 and in Grab Sample MH 65 at a maximum concentration of 0.6 ppm. Phenols were tentatively identified three times in the 0 to 1 ft interval of Boring LS0002 at concentrations of 0.2, 0.3, and 0.2 ppm.

3.2.5 Contamination Assessment

Initial manhole inspection of the railyard and administration areas sanitary sewers showed the manholes to be in fair to good condition. However, previous studies have concluded that the lines were in poor condition and that considerable exfiltration may have been taking place.

Analyses of samples taken from the manhole borings indicated the presence of methylene chloride in just one of the samples. Although this compound was not found in the laboratory blanks for these lots, methylene chloride is used extensively in laboratories. Because this was an isolated occurrence and because methylene chloride is a common laboratory contaminant (it has often been found in blanks even when not found in associated samples), it is probable that its presence at this level is laboratory introduced. Lead and arsenic were each found once within their indicator ranges in the manhole borings. The detected concentrations of these metals are consistent with their natural levels in the soils being analyzed. Lead was detected at the lower limit of its indicator range in sandy soil, and arsenic was detected within its indicator range in sandy clay.

The sampling program also included sediment grab samples from inside five manholes. Samples from MH 50 and MH 65 contained 0.014 and 0.0072 ug/g of dibromochloropropane, respectively. The presence of this pesticide in the

administration area was not anticipated. This compound was detected in only two of the five sediment grab samples and was not found in the manhole boring samples taken from beneath the sewers. As the borings were conducted at "worst-case" manholes (Ebasco, 1987b/RIC 87336R30), the pesticide appears to be contained within the sewer system. Dibromochloropropane was stored in the railyard (Adcock, 1980) and shipped from the railyard area (Sheppard, 1981). It may be possible that it could have entered the sanitary sewer through a sink drain, toilet, or manhole cover, but there is no historic documentation to support this contention. This compound is slightly soluble in water and may have some affinity for the organic matter in the sediments. As noted previously (USAEHA, 1985), wastewater flow through this system is very low. These characteristics are among the factors that determine how fast dibromochloropropane migrates down the sewer line.

Chloroacetic acid was found in three of the samples, at levels of 62, 63, and 65 ug/g. Chloroacetic acid is a possible breakdown product of thiodiglycol, which is a hydrolysis product of mustard. However, thiodiglycol was not detected in any of the samples, indicating that the chloroacetic acid may be from another source. Chloroacetic acid is frequently used as a reagent in organic chemical synthesis, especially in dye synthesis (Snell & Snell, 1962). One of these dyes, indigo, may be used in cleansers and disinfectants for toilets. The presence of these compounds in the sanitary sewer system is highly probable. Chloroacetic acid was detected only in sediment grab samples indicating the compound is contained within the sewer system.

These sediment samples also contained elevated levels of metals, most notably chromium, copper, lead, zinc, and mercury. Chromium was found at concentrations above its indicator range in Samples H2 and R29. Copper was above its indicator range in samples from H2, R29, 50, and 65. Lead was found above its indicator range in samples from H2, R12, R29, and 65. Zinc was also found above its indicator range in samples from H2, R12, R29, and 50. Mercury was above its indicator range in samples from R12, R29, 50, and 65.

Metals form positively charged ions in water that are attracted to ion exchange sites on sediment or soil particles. This exchange or sorption

process removes some metals from the solution. If metal compounds or ions were present in the sewer system, the sediment throughout the system would retain elevated levels of those metals. The presence of metals in the sediment inside the sewers, but not in the soil samples collected under the "worst-case" manholes, indicates that these metals are well contained. The only exception to this would be exfiltration points such as breaks in the line or off-set joints. At such a point it is possible, although unlikely, that sediment could escape from the sewer system. Material from the sewers also may be lost periodically at the lift station overflows.

Samples were taken at the overflow discharge points from lift stations 392 and 393. Boring LS0001 (lift station 393) contained copper, zinc, and mercury above its indicator range in the 0 to 1 ft interval. Copper, lead, zinc, and mercury were detected above their indicator ranges in the 0 to 1 ft interval of Boring LS0002 (lift station 392). All target analytes were below their indicator levels in the 4 to 5 ft intervals of the lift station overflow borings.

The nontarget compound analyses indicated the presence of several tentatively identified hydrocarbons. These appeared more often in the grab samples taken from inside the manholes than in samples from borings. These compounds were not chlorinated or brominated, which implies that they are not related to pesticide manufacture. The highest concentration encountered was 0.9 ppm.

Numerous naturally occurring compounds were also detected, but are not of concern in the contamination assessment. The three instances of phthalates, which are commonly used as plasticizers, can be attributed to the polybutyrate tubes and other devices used to collect and analyze the samples. Phenols, tentatively identified in the 0 to 1 ft interval of Boring LS0002, are commonly used as surfactants. These were present at low concentrations.

The semivolatile method, although not certified for volatile compounds, has been shown capable of detecting tetrachloroethylene, toluene, chlorobenzene, ethylbenzene, and xylenes in the nontarget fraction. The absence of these

compounds in the nontarget results for this part of the sanitary sewer system is an indication that there is no contamination present from these compounds.

The results of the field investigation indicate that contamination from metals, dibromochloropropane, and chloroacetic acid in the railyard and administration areas is contained within the sewer line or is in the upper 4 ft of the lift station overflow drainage ditches. Of the target compounds identified, dibromochloropropane and chloroacetic acid are the two whose presence was least anticipated. Historical research has not explained the presence of dibromochloropropane in the administration area sanitary sewer. Chloroacetic acid, because of its high solubility, is most probably a recent addition to the system, and its likely source is cleansers and disinfectants used in bathrooms.

3.3 FOLLOW-ON INVESTIGATIONS

Although a worst-case estimate of potential contamination has been delineated, additional work may be needed to more precisely define the extent of potential contamination. If the Feasibility Study determines this additional information is needed, the recommended work will be completed as part of the conceptual or detailed design phase of remedial action to be conducted for the railyard and administration areas sanitary sewer.

The additional work, if it occurs, will consist of:

- o A dye and excavation study between Manholes 60 and 61. This is the only portion of the pipe in the railyard and administration areas that has been investigated previously and is known to be in poor condition (Black & Veatch, 1980).
- o Borings placed beneath and adjacent to the segment of pipe under investigation. Samples from these borings would show if compounds that were found inside the sewer have exfiltrated and migrated away from the pipe.

- o Analysis of the samples for chloroacetic acid (as part of the Agent Products test) and dibromochloropropane. This information will determine if compounds that were found inside the sewer have exfiltrated to the surrounding soils.

The proposed excavation and dye study should be between Manholes 60 and 61, 90 ft upstream of Manhole 60, because the pipe was found to be in poor condition along this section (Black & Veatch, 1980). This will also be between the manholes where dibromochloropropane was found during the field program (Manholes 50 and 65). Following a previously used method (Ebasco, 1987b/RIC 87336R30), the sewer line would be plugged at these two manholes and the connecting line segment filled with a tracer dye solution. After twenty-four hours, the plugs would be removed and the dye allowed to flow downstream in the sewer system. A trench would be dug, exposing about ten joints of the pipe, and the ground inspected for visible areas of staining and/or sediment exfiltration. One joint would then be identified as the worst-case and a sample would be collected from the first foot of soil directly under this joint. Similar samples would be taken from under adjacent joints and half-way between the center joint and the adjacent joints, yielding a total of five samples. In addition, a boring would be drilled 1 ft out from the center joint and samples taken at 5 ft intervals until the water table is reached. It is anticipated that this boring will yield 8 samples based on the depths to groundwater and to the sewer. A final boring would be drilled 5 ft out from the pipe and samples taken at 5 ft intervals until a depth of 15 ft (below the bottom of the pipe) or the water table is reached. Groundwater is approximately 40 ft below the surface in this area, so the boring would be drilled to 15 ft below the pipe and would yield 4 samples. Figure SS-RA-5 illustrates the proposed follow-on work assuming Joint 5 is identified as the worst-case joint. This follow-on work would result in 7 borings yielding 17 samples. The number of borings and samples to be taken at specific depths are tabulated below.

<u>No. of Borings</u>	<u>Depth Below Sewer (ft)</u>	<u>No of Samples</u>
1	1	5
1	water table	8
1	15	4

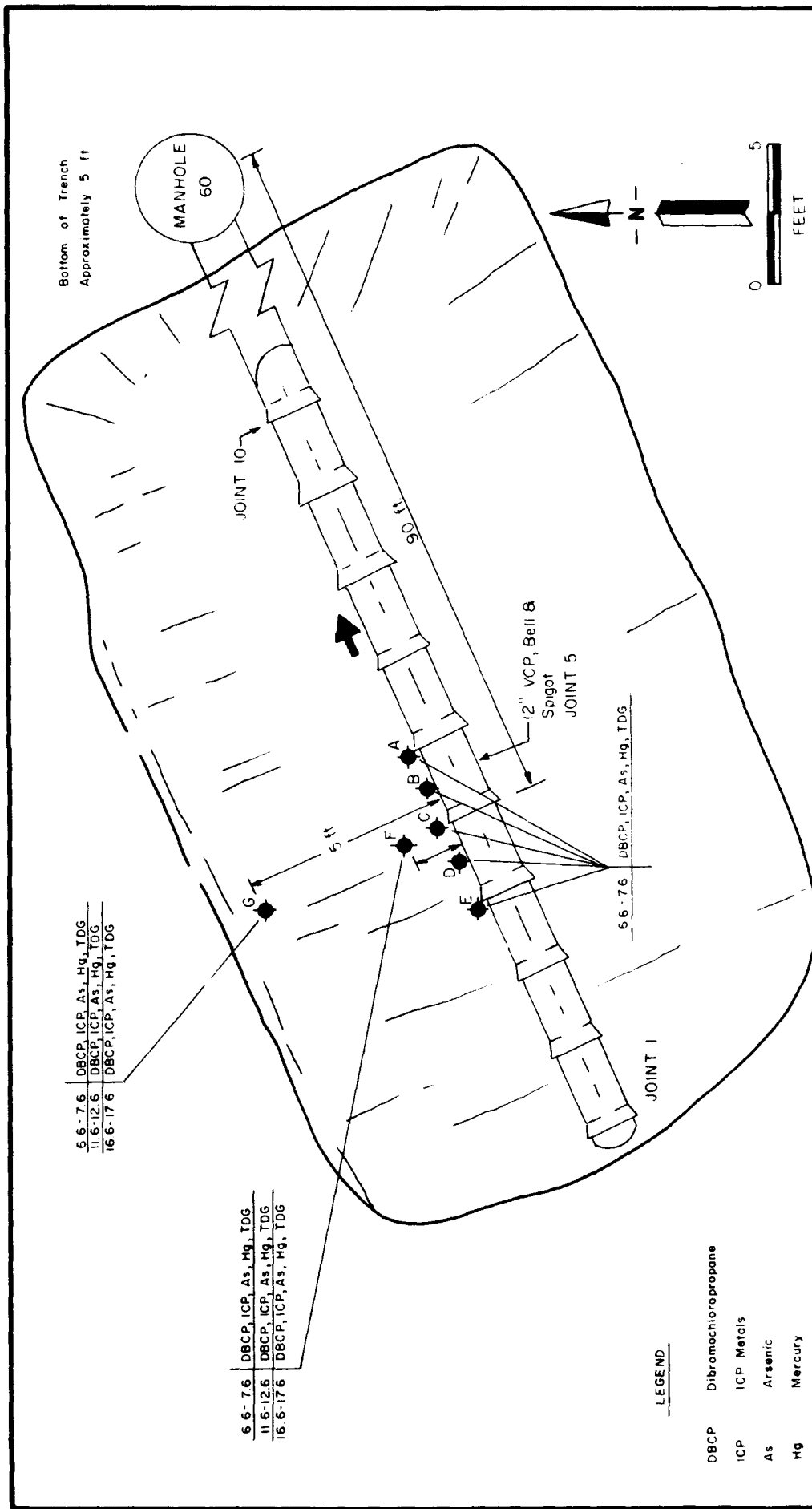


FIGURE SS-RA-5

Proposed Follow-On Boring Locations

Rocky Mountain Arsenal, Task 10.
Prepared by Ebsco Services Incorporated

Prepared for :

Program Manager's Office for
Rocky Mountain Arsenal Clean-up
Aberdeen Proving Ground, Maryland

Drafted : 6/10/88

The number of samples to be tested by each analytical method is listed below.

<u>Analytical Method</u>	<u>No of Samples</u>
Dibromochloropropane (DBCP)	17
ICP Metals	17
Arsenic	17
Mercury	17
Agent Products/High Performance Liquid Chromotography	
Chloroacetic Acid	17
Thiodiglycol	17

Comments were received from Shell Oil Company and were considered in the preparation of this final report. EPA comments are an integral part of the report review process, and have been incorporated into this report. Comments and responses are provided in Appendix SS-RA-C.

3.4 QUANTITY OF POTENTIALLY CONTAMINATED MATERIAL

The elevated levels of metals found in this study area were contained in the sediment inside the sewers and at the lift station overflow areas. The volume of potentially contaminated sediment inside the sewers is based on the interior volume of the piping, as described in Section 1.1 of this report, and the interior volume of ninety-six manholes. The manholes are assumed to average 7 ft in depth and 5 ft in diameter, based on the results of the manhole survey. Because the sanitary sewers in the railyard and administration areas are being used far below their design capacity, they are almost empty except for accumulated sediment. Based on visual inspection, the sediment is estimated to occupy no more than 10 percent of the pipe and manhole interior.

In addition, soils at the lift station overflow areas were shown to have elevated levels of mercury in the 0 to 1 ft interval but not in the 4 to 5 ft interval. A conservative volume estimate of potentially contaminated soil at these areas is derived by calculating a volume for a 0 to 4 ft depth over the

surface area of the overflow basins and ditches. The westernmost lift station has an overflow ditch that is roughly 6 by 200 ft, and the eastern lift station has a 3 ft wide and 275 ft long ditch leading to a 20 by 80 ft basin.

The volume of potentially contaminated material is estimated as follows:

Interior volume of piping = 14,000 cubic feet, (ft³)
Estimated sediment volume in piping = 1,400 ft³ (52 cubic yards, yd³)
Interior volume of manholes = 13,000 ft³
Estimated sediment volume in manholes = 1,300 ft³ (48 yd³)
Surface area of lift station overflow ditches = 3,625 ft²
Vertical extent of potential contamination at lift stations = 4 ft
Estimated volume of potentially contaminated soil at lift stations =
14,500 ft³ (540 yd³)
Estimated total volume of potentially contaminated soil = 640 yd³

Results from the field investigation were used to generate a most conservative (worst-case) estimate of the volume of potentially contaminated material associated with the railyard and administration area's sanitary sewer system. This delineation of potential contamination should not be construed to indicate the actual presence of contamination within the volumes outlined. In addition, this approach is not intended to imply that any or all of the material within the potentially contaminated volume must be remediated, nor does it make any assumption about the type of remediation that may be required. Rather, this approach is intended to provide preliminary estimates of the maximum volume of contaminated materials for planning purposes only.

4.0 REFERENCES CITED

Adcock, W.E. 1980. Interoffice memorandum to R.D. Lundahl, July 18, 1980: Irondale contamination. Shell Oil Company. Microfilm RSH845, Frame 1437-1450.

RIC 81266R35

Black & Veatch. 1979, October. Sanitary sewerage system repairs, Rocky Mountain Arsenal, Commerce City, Colorado. Omaha District COE. G&M 21.

Black & Veatch. 1980, September. Sanitary sewerage system repairs phase II, Rocky Mountain Arsenal, Commerce City, Colorado. Omaha District COE.

COE (Corps of Engineers). 1984, June 1. The master plan of Rocky Mountain Arsenal, Colorado. Basic information maps, Drawing No. 18-02-01. U.S. Army Engineer District, Omaha, Nebraska.

CWS (Chemical Warfare Service). 1945, August 15. History of Rocky Mountain Arsenal - 1945 part I. Microfilm RSA008, Frames 597-613.

DOA (Department of the Army). 1972, May 26. Sanitary sewer lateral from existing Manhole 19 to Building 619, alternate no. 1. Plot plan, profile and manhole details. Rocky Mountain Arsenal, Colorado. Drawing no. E6-6-4.

Ebasco (Ebasco Services Incorporated). 1987a, October. Final western tier trichloroethylene investigation, technical plan version 3.1, task no. 38. Contract No. DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.

RIC 87336R30

Ebasco. 1987b, November. Final technical plan, task no. 10, sewers and process water system investigations. Contract DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.

Ebasco. 1987c, December. Draft final contamination assessment report, Site 3-4, nemagon spill area, version 2.3. Contract No. DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.

RIC 87336R02

ESE (Environmental Science & Engineering, Inc.). 1986a. Introduction to the contamination assessment reports. RMA. Prepared for Program Manager's Office for Rocky Mountain Arsenal Contamination Cleanup.

RIC 86317R01

ESE. 1986b. Task 4, initial screening program report, v. I, II, and III for Program Manager's Office, Rocky Mountain Arsenal.

Jones, E. 1987, July 22. Personal communication with Envirosphere employee. RMA10-EDEN-T-075.

RIC 82295R01

May, J.H. 1982. Regional groundwater study of Rocky Mountain Arsenal, Colorado: Report #1, hydrogeological definition. USAEWES. Microfilm RMA040, Frames 1851-1931.

Shepherd, W.D. 1981. Interoffice memorandum to W.E. Adcock, November 19, 1981: DBCP source investigation - Irondale-RMA-project, Denver, Colorado. Shell Oil Company. Microfilm RSH859, Frames 0304-0309.

Snell, F.D. and C.T. Snell. 1962. Dictionary of Commercial Chemicals. D VanNostrand Co., Inc. New York, NY. p. 300.

Swift, E.W. and C.Y. Chiang. 1987, July. Irondale DBCP control system, Rocky Mountain Arsenal. Review of 1986 operations. Shell Oil Company.

USAEHA (U.S. Army Environmental Hygiene Agency). 1985, May 30. Water quality engineering study no. 32-66-0154-85, Domestic waste water characterization, Rocky Mountain Arsenal Commerce City, Colorado, 18 March - 10 April, 1985. U.S. Army Materiel Command.

RIC 85130R01

USAEWES. 1984. Evaluation of Shell Chemical Company's groundwater DBCP control system at Rocky Mountain Arsenal for the period January 1984 thru September 1984.

RIC 81266R54

USDA (U.S. Department of Agriculture, Soil Conservation Service). 1974. Soil Survey of Adams County, Colorado.

WR&SK (Whitman, Requardt & Smith - H.A. Kuljian & Co. Engineers). 1942a, July 1. Sanitary outfall sewer for temp. administration area. No. 7164-2002, drawing. As built data added 5/15/43.

WR&SK. 1942b, July 7. Sanitary collecting sewers for temp. administration area. No. 7164-2001, drawing. As built data added 1/4/43, 7/22/43.

WR&SK. 1942c, September 19. Depot (storage) area plan - 8" sanitary sewer. No. 7164-2010, drawing. As built data added 10/27/42, 11/19/42, 11/26/42, 12/31/42.

Appendix SS-RA-A

Chemical Names and Abbreviations

APPENDIX SS-RA-A
Chemical Names and Abbreviations

Analytic Methods

Abbreviations

Atomic Absorption Spectroscopy	AA
Gas Chromatography/Conductivity Detector	GCCON
Gas Chromatography/Electron Capture Detector	GCECD
Gas Chromatography/Flame Ionization Detector	GCFID
Gas Chromatography/Flame Photometric Detector	GCFPD
Gas Chromatography/Mass Spectrometry	GCMS
Gas Chromatography/Nitrogen Phosphorous Detector	GCNPD
Gas Chromatography/Photoionization Detector	GCPID
High Performance Liquid Chromatography	HPLC
Inductive Coupled Argon Plasma Screen	ICP
Ion Chromatography	IONCHROM

PHASE I ANALYTES AND CERTIFIED METHODS SOIL SAMPLES

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>AGENT PRODUCTS/HPLC</u>		TDG
Chloroacetic acid	Chloroacetic acid	CLC2A
Thiodiglycol	Thiodiglycol (TDG)	TDGCL
<u>AGENT PRODUCTS/IONCHROM</u>		GBDP
Fluoroacetic acid	Fluoroacetic	FC2A
Isopropylmethylphosphonic acid	Isopropylmethylphosphonate	IMPA
Methylphosphonic acid	Methylphosphonate	MPA
<u>ANIONS/IONCHROM</u>		<u>ANIONS</u>
Chloride	Chloride	CL
Fluoride	Fluoride	FL
Sulfate	Sulfate	SO4
<u>ARSENIC/AA</u>	Arsenic	AS
<u>DIBROMOCHLOROPROPANE/GCECD</u>	Dibromochloropropane	DBCP
<u>HYDRAZINES/SPECT</u>		HYD
Hydrazine	Hydrazine	HYDRZ
Methylhydrazine	Methylhydrazine	MHYDRZ
Unsymmetrical dimethyl hydrazine	Unsymmetrical dimethyl hydrazine	UDMH
<u>MERCURY/AA</u>	Mercury	HG

APPENDIX SS-RA-A (Continued)
Phase I

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>METALS/ICP</u>		<u>ICP</u>
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	CU
Lead	Lead	PB
Zinc	Zinc	ZN
<u>ORGANONITROGEN COMPOUNDS/GCNPB</u>		<u>QNC</u>
n-Nitrosodimethylamine	n-Nitrosodimethylamine	NNDMEA
n-Nitrosodi-n-propylamine	n-Nitrosodi-n-propylamine	NNDNFA
<u>ORGANOPHOSPHOROUS COMPOUNDS/GCFPD</u>		<u>OPC</u>
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphate	DMMP
<u>SEMIVOLATILE ORGANIC COMPOUNDS/ GCMS</u>		<u>SVO</u>
1,4-Oxathiane	1,4-Oxathiane	OXAT
2,2-bis(Para-chlorophenyl)- 1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-bis(Para-chlorophenyl)- 1,1,1-trichloroethane	Dichlorodiphenyltrichloro- ethane	PPDDT
Aldrin	Aldrin	ALDRN
Atrazine	Atrazine	ATZ
Chlordane	Chlordane	CLDAN
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	CPMSO2
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dieldrin	Dieldrin	DLDRN
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMMP
Dithiane	Dithiane	DITH
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene	CL6CP
Isodrin	Isodrin	ISODR
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1 (2,4-dichlorophenyl) vinyl-diethyl phosphates	SUPONA
Vapona	Vapona	DDVP

APPENDIX SS-RA-A (Continued)
Phase I

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>VOLATILE ORGANIC COMPOUNDS/ GCMS</u>		<u>VO</u>
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1,1-Trichloroethane	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Benzene	Benzene	C6H6
Bicycloheptadiene	Bicycloheptadiene	BCHPD
Carbon tetrachloride	Carbon tetrachloride	CCL4
Chlorobenzene	Chlorobenzene	CLC6H5
Chloroform	Chloroform	CHCL3
Dibromochloropropane	Dibromochloropropane	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dimethyldisulfide	Dimethyldisulfide	DMDS
Ethylbenzene	Ethylbenzene	ETC6H5
m-Xylene	m-Xylene	13DMB
Methylene chloride	Methylene chloride	CH2CL2
Methylisobutyl ketone	Methylisobutyl ketone	MIRK
o- and p-Xylene	Ortho- & Para-xylene	XYLEN
Tetrachloroethylene	Tetrachloroethene	TCLEE
Toluene	Toluene	MEC6H5
Trans-1,2-dichloroethylene	Trans-1,2-dichloroethene	T12DCE
Trichloroethylene	Trichloroethene	TRCLE

APPENDIX SS-RA-A
Phase II

PHASE II ANALYTES AND CERTIFIED METHODS
SOIL SAMPLES

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>AGENT PRODUCTS/GCMS</u>		LEWDP
Diisopropylaminoethanethiol	Diisopropylaminoethanethiol	DIAET
Dimethyl arsenous acid	Dimethyl arsenous acid	ME2AEA
Methyl aronic acid	Methyl aronic acid	MEAOA
Tributylamine	Tributylamine	TBA
<u>AGENT PRODUCTS/HPLC</u> (Same as Phase I)		TDG
<u>AGENT PRODUCTS/IONCHROM</u> (Same as Phase I)		GBDP
<u>ANIONS/IONCHROM</u> (Same as Phase I)		ANIONS
<u>ARSENIC/AA</u>	Arsenic	AS
<u>DIBROMOCHLOROPROPANE/GC</u>	Dibromochloropropane	DBCP
<u>FLUORIDE/ISE</u>	Fluoride	F
<u>HYDRAZINES/SPECT</u> (Same as Phase I)		HYD
<u>MERCURY/AA</u>	Mercury	HG
<u>METALS/ICP</u> (Same as Phase I)		ICP
<u>ORGANO-ARSENIC</u>	Organo-arsenic	ORGAS
<u>ORGANOCHLORINE PESTICIDES/GCECD</u>		OCP
2,2-bis(Para-chlorophenyl)- 1,1-dichloroethane	Dichlorodiphenylethane	PPDDE
2,2-bis(Para-chlorophenyl)- 1,1,1-trichloroethane	Dichlorodiphenyltrichloro- ethane	PPDDT
Aldrin	Aldrin	ALDRN
Chlordane	Chlordane	CLDAN
Dibromochloropropane	Dibromochloropropane	DBCP
Dieldrin	Dieldrin	DLDRN
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene	CL6CP
Isodrin	Isodrin	ISODR

APPENDIX SS-RA-A (Continued)
Phase II

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>ORGANO-MERCURY</u>	Organo-mercury	ORGHG
<u>ORGANONITROGEN COMPOUNDS/GCNP</u> (Same as Phase I)		ONC
<u>ORGANOPHOSPHOROUS COMPOUNDS/GCFPD</u> (Same as Phase I)		OPC
<u>ORGANOPHOSPHORUS PESTICIDES/ GCNP</u>		OPP
Atrazine	Atrazine	ATZ
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1 (2,4-dichlorophenyl) vinyl diethyl phosphates	SUPONA
Vapona	Vapona	DDVP
<u>ORGANOSULPHUR COMPOUNDS/GCFPD</u>		OSC
1,4-Oxathiane	1,4-Oxathiane	OXAT
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	CPMSO2
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Dimethyldisulfide	Dimethyldisulfide	DMDS
Dithiane	Dithiane	DITH
<u>SEMIVOLATILE ORGANIC COMPOUNDS/ GCMS</u>		SVO
<u>VOLATILE AROMATIC ORGANIC COMPOUNDS/GCPI</u>		VAO
Benzene	Benzene	C6H6
Ethylbenzene	Ethylbenzene	ETC6H5
m-Xylene	m-Xylene	13DMB
o- and p-Xylene	Ortho- & Para-xylene	XYLEN
Toluene	Toluene	MEC6H5
<u>VOLATILE HALOGENATED ORGANIC COMPOUNDS/GCCON</u>		VHO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1-Dichloroethene	1,1-Dichloroethene	11DCE
1,1,1-Trichloroethane	1,1,1-Trichloroethane	111TCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE

APPENDIX SS-RA-A (Continued)
Phase II

<u>Analysis/Methods/Analytes</u>	<u>Synonymous Names Used in Appendix B</u>	<u>Abbreviations</u>
<u>VOLATILE HALOGENATED ORGANIC COMPOUNDS/GCCON (Continued)</u>		
Carbon tetrachloride	Carbon tetrachloride	CCL4
Chlorobenzene	Chlorobenzene	CLC6H5
Chloroform	Chloroform	CHCL3
Methylene chloride	Methylene chloride	CH2CL2
Tetrachloroethylene	Tetrachloroethene	TCLEE
Trans-1,2-dichloroethylene	Trans-1,2-dichloroethene	T12DCE
Trichloroethylene	Trichloroethene	TRCLE
<u>VOLATILE HYDROCARBON COMPOUNDS/ GCFID</u>		
Bicycloheptadiene	Bicycloheptadiene	HYDCBN
Dicyclopentadiene	Dicyclopentadiene	BCHPD
Methylisobutyl ketone	Methylisobutyl ketone	DCPD
		MIBK
<u>VOLATILE ORGANIC COMPOUNDS/GCMS</u> (Same as Phase I)		VO

Appendix SS-RA-B
Chemical Data

APPENDIX SS-RA-B

Chemical Data

The analytical results of the laboratory analysis of soil samples collected as part of the program comprise the first part of Appendix SS-RA-B. Data are listed sequentially by boring number and successive depths below the surface. Within each depth, all analytes for which the samples were tested are listed alphabetically. Results are given as less than (LT) the detection limit for the test laboratory, or as detected concentrations above this limit. Based on the accuracy of laboratory test methods, values for volatile and semivolatile compounds are considered accurate to one significant figure, values for dibromochloropropane when tested separately and for metals are considered accurate to two significant figures.

The second part of Appendix SS-RA-B contains data from the blanks associated with the analytical work. Blanks for the soil samples were based on a homogenized subsample of composited samples from a known uncontaminated soil that is stratigraphically similar to the RMA soils. Blanks for the water samples were based on distilled water. Control samples, or blanks, are introduced into the train of environmental samples to function as monitors on the performance of the analytical method. These samples function as quality control (QC) samples, and are an integral part of the quality assurance (QA) program for the project. The method blanks listed in this Appendix were utilized to verify that the laboratory was not a source of sample contamination. If contamination were detected in a method blank, corrective actions were taken to assure that reported concentrations of target analytes reflected sample analytes, and not analytes introduced by the laboratory process.

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
10340000H2	5.2	Soil	Aldrin	LT 3 -01	ug/g	BXH004
			Arsenic	LT 2.5 +00	ug/g	BXD014
			Atrazine	LT 3 -01	ug/g	BXH004
			Cadmium	LT 7.3 -01	ug/g	BXI007
			Hexachlorocyclopentadiene	LT 6 -01	ug/g	BXH004
			Chloroacetic Acid	6.2 +01	ug/g	BXE007
			Chlordane	LT 2 +00	ug/g	BXH004
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BXH004
			p-Chlorophenylmethyl Sulfoxide	LT 3 -01	ug/g	BXH004
			p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BXH004
			Chromium	5.0 +01	ug/g	BXI007
			Copper	4.0 +01	ug/g	BXI007
			Dibromochloropropane	LT 5.0 -03	ug/g	BXF007
			Dibromochloropropane	LT 3 -01	ug/g	BXH004
			Dicyclopentadiene	LT 1 +00	ug/g	BXH004
			Vapona	LT 3 +00	ug/g	BXH004
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BXH004
			Clthiane	LT 4 -01	ug/g	BXH004
			Dieldrin	LT 3 -01	ug/g	BXH004
			Endrin	LT 5 -01	ug/g	BXH004
			Mercury	LT 5.0 -02	ug/g	BXE006
			Isodrin	LT 3 -01	ug/g	BXH004
			Malathion	LT 7 -01	ug/g	BXH004
			1,4-Oxethiane	LT 3 -01	ug/g	BXH004
			Lead	6.9 +02	ug/g	BXI007
			Dichlorodiphenylethane	LT 6 -01	ug/g	BXH004
			Dichlorodiphenyltrichloroethane	LT 5 -01	ug/g	BXH004
1004000R12	7.2	Soil	Perathion	LT 9 -01	ug/g	BXH004
			2-Chloro-1(2,4-Dichlorophenyl) Vinyl diethyl Phosphates	LT 6 -01	ug/g	BXH004
			Thiodiglycol	LT 4.2 +00	ug/g	BXE007
			Zinc	1.2 +02	ug/g	BXI007
			Aldrin	LT 3 -01	ug/g	BXH003

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated
Summary of Analytical Results

Task 10 Sanitary Sewers -- Rail Yard & Administration

Rocky Mountain Arsenal Program

08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1004000R17	8.5-9.5	Soil	1,1,2-Trichloroethane	LT 3 -01	ug/g	BSR007
			1,1-Dichloroethane	LT 9 -01	ug/g	BSR007
			1,2-Dichloroethane	LT 3 -01	ug/g	BSR007
			1,2-Dichloroethane	LT 3 -01	ug/g	BSR007
			m-Xylene	LT 7 -01	ug/g	BSR007
			Aldrin	LT 3 -01	ug/g	BSU008
			Arsenic	LT 5. +00	ug/g	BSH020
			Atrazine	LT 3 -01	ug/g	BSU008
			Bicycloheptadiene	LT 3 -01	ug/g	BSR007
			Benzene	LT 3 -01	ug/g	BSR007
			Carbon Tetrachloride	LT 3 -01	ug/g	BSR007
			Cadmium	LT 7.3 -01	ug/g	BSR017
			Methylene Chloride	LT 7 -01	ug/g	BSR007
			Chloroform	LT 3 -01	ug/g	BSR007
			Hexachlorocyclopentadiene	LT 6 -01	ug/g	BSU008
			Chlorobenzene	LT 3 -01	ug/g	BSR007
			Chlordane	LT 2 +00	ug/g	BSU008
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BSU008
			p-Chlorophenylmethyl Sulfonide	LT 3 -01	ug/g	BSU008
			p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BSU008
			Chromium	LT 6.5 +00	ug/g	BSR017
			Copper	LT 4.7 +00	ug/g	BSR017
			Dibromochloropropane	LT 4 -01	ug/g	BSR007
			Dibromochloropropane	LT 3 -01	ug/g	BSU008
			Dicyclopentadiene	LT 1 +00	ug/g	BSU008
			Dicyclopentadiene	LT 3 -01	ug/g	BSR007
			Vapone	LT 3 +00	ug/g	BSU008
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BSU008
			Dithiane	LT 4 -01	ug/g	BSU008
			Dieldrin	LT 3 -01	ug/g	BSU008
			Dimethyldisulfide	LT 8 -01	ug/g	BSR007
			Endrin	LT 5 -01	ug/g	BSU008
			Ethylbenzene	LT 3 -01	ug/g	BSR007
			Mercury	LT 5.0 -02	ug/g	BSY005

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Ebasco Services Incorporated
 Summary of Analytical Results
 Task 10 Sanitary Sewers -- Rail Yard & Administration
 Rocky Mountain Arsenal Program
 08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1004000R17	8.5-9.5	Soil	Isodrin	LT 3	-01	BSU008
			Toluene	LT 3	-01	BSR007
			Methylisobutyl Ketone	LT 3	-01	BSR007
			Melathion	LT 7	-01	BSU008
			1,4-Oxathiane	LT 3	-01	BSU008
			Lead	2.4	+01	BS9017
			Dichlorodiphenylethane	LT 6	-01	BSU008
			Dichlorodiphenyltrichloroethane	LT 5	-01	BSU008
			Parathion	LT 9	-01	BSU008
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6	-01	BSU008
			Tetrachloroethene	LT 3	-01	BSR007
			Triodiglycol	LT 2.5	+00	BSA009
			Trichloroethene	LT 3	-01	BSR007
			Ortho- & Para-Xylene	LT 3	-01	BSR007
			Zinc	2.5	+01	BS9017
1004000R17	12.5-13.5	Soil	1,1,1-Trichloroethane	LT 3	-01	BSR008
			1,1,2-Trichloroethane	LT 3	-01	BSR008
			1,1-Dichloroethane	LT 9	-01	BSR008
			1,2-Dichloroethane	LT 3	-01	BSR008
			1,2-Dichloroethane	LT 3	-01	BSR008
			m-Xylene	LT 7	-01	BSR008
			Aldrin	LT 3	-01	BSU009
			Arsenic	LT 5	+00	BSH021
			Atrazine	LT 3	-01	BSU009
			Bicycloheptadiene	LT 3	-01	BSR008
			Benzene	LT 3	-01	BSR008
			Carbon Tetrachloride	LT 3	-01	BSR008
			Cadmium	LT 7.3	-01	BS9018
			Methylene Chloride	LT 7	-01	BSR008
			Chloroform	LT 3	-01	BSR008
			Hexachlorocyclopentadiene	LT 6	-01	BSU009

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Ebasco Services Incorporated
 Summary of Analytical Results
 Task 10
 Rocky Mountain Arsenal Program
 Sanitary Sewers -- Rail Yard & Administration
 08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1004000R17	12.5-13.5	Soil	Chlorobenzene	LT 3 -01	ug/g	BSR008
			Chlordane	LT 2 +00	ug/g	BSU009
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BSU009
			p-Chlorophenylmethyl Sulfoxide	LT 3 -01	ug/g	BSU009
			p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BSU009
			Chromium	LT 6.5 +00	ug/g	BS5018
			Copper	LT 4.7 +00	ug/g	BS5018
			Dibromochloropropane	LT 4 -01	ug/g	BSR008
			Dibromochloropropane	LT 3 -01	ug/g	BSU009
			Dicyclopentadiene	LT 3 -01	ug/g	BSR008
			Dicyclopentadiene	LT 1 +00	ug/g	BSU009
			Vapona	LT 3 +00	ug/g	BSU009
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BSU009
			Dithiane	LT 4 -01	ug/g	BSU009
			Dieldrin	LT 3 -01	ug/g	BSU009
			Dimethyldisulfide	LT 8 -01	ug/g	BSR008
			Endrin	LT 5 -01	ug/g	BSU009
			Ethylbenzene	LT 3 -01	ug/g	BSR008
			Mercury	LT 5.0 -02	ug/g	BS1006
			Isodrin	LT 3 -01	ug/g	BSU009
			Toluene	LT 3 -01	ug/g	BSR008
			Methylisobutyl Ketone	LT 3 -01	ug/g	BSR008
			Malathion	LT 7 -01	ug/g	BSU009
			1,4-Oxathiane	LT 3 -01	ug/g	BSU009
			Lead	LT 8.3 +00	ug/g	BS5018
			Dichlorodiphenylethane	LT 6 -01	ug/g	BSU009
			Dichlorodiphenyltrichloroethane	LT 5 -01	ug/g	BSU009
			Parathion	LT 9 -01	ug/g	BSU009
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6 -01	ug/g	BSU009
			Tetrachloroethene	LT 3 -01	ug/g	BSR008
			Thiodiglycol	LT 2.5 +00	ug/g	BSAD10
			Trichloroethene	LT 3 -01	ug/g	BSR008

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08/01/88

Rocky Mountain Arsenal Program

Ebasco Services Incorporated

Task 10 Sanitary Sewers -- Rail Yard & Administration

Summary of Analytical Results

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1004000R17	12.5-13.5	Soil	Ortho- & Para-Xylene Zinc	LT 3 -01 2.2 +01	ug/g ug/g	BSR008 BSR018
1003000R29	7.9	Soil	Aldrin Arsenic Atrazine Cadmium Hexachlorocyclopentadiene	LT 3 -01 8.4 +00 LT 3 -01 1.8 +00 LT 6 -01	ug/g ug/g ug/g ug/g ug/g	BSR002 BXD012 BSR002 BXI005 BSR002
			Chloroacetic Acid Chlordane p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfoxide p-Chlorophenylmethyl Sulfone	6.4 +01 LT 2 +00 LT 9 -01 LT 3 -01 LT 3 -01	ug/g ug/g ug/g ug/g ug/g	BSR005 BSR002 BSR002 BSR002 BSR002
			Chromium Copper Dibromochloropropane Dibromochloropropane Dicyclopentadiene	6.0 +01 5.0 +02 LT 3 -01 LT 5.0 -03 LT 1 +00	ug/g ug/g ug/g ug/g ug/g	BSR005 BSI005 BSR002 BSR005 BSR002
			Vapors Diisopropylmethyl Phosphonate Dithiane Dieldrin Endrin	LT 3 +00 LT 1 +00 LT 4 -01 LT 3 -01 LT 5 -01	ug/g ug/g ug/g ug/g ug/g	BSR002 BSR002 BSR002 BSR002 BSR002
			Mercury Isodrin Malathion 1,4-Oxathiane Lead	9.7 -01 LT 3 -01 LT 7 -01 LT 3 -01 1.6 +02	ug/g ug/g ug/g ug/g ug/g	BSR020 BSR002 BSR002 BSR002 BSI005
			Dichlorodiphenylethane Dichlorodiphenyltrichloro- ethane Parathion 2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates Thiodiglycol	LT 6 -01 LT 5 -01 LT 9 -01 LT 6 -01 LT 4.2 +00	ug/g ug/g ug/g ug/g ug/g	BSR002 BSR002 BSR002 BSR002 BSR005

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Ebasco Services Incorporated Rocky Mountain Arsenal Program 08/01/88
 Summary of Analytical Results Task 10 Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1003000R29	7.9	Soil	Zinc	1.6 +02	ug/g	BSR005
1003000R30	5.5-6.5	Soil	1,1,1-Trichloroethane	LT 3 -01	ug/g	BSR009
			1,1,2-Trichloroethane	LT 3 -01	ug/g	BSR009
			1,1-Dichloroethane	LT 9 -01	ug/g	BSR009
			1,2-Dichloroethane	LT 3 -01	ug/g	BSR009
			1,2-Dichloroethane	LT 3 -01	ug/g	BSR009
			m-Xylene	LT 7 -01	ug/g	BSR009
			Aldrin	LT 3 -01	ug/g	BSU010
			Arsenic	LT 5. +00	ug/g	BSH022
			Atrazine	LT 3 -01	ug/g	BSU010
			Bicycloheptadiene	LT 3 -01	ug/g	BSR009
			Benzene	LT 3 -01	ug/g	BSR009
			Carbon Tetrachloride	LT 3 -01	ug/g	BSR009
			Cadmium	LT 7.3 -01	ug/g	BS5019
			Methylene Chloride	LT 7 -01	ug/g	BSR009
			Chloroform	LT 3 -01	ug/g	BSR009
			Hexachlorocyclopentadiene	LT 6 -01	ug/g	BSU010
			Chlorobenzene	LT 3 -01	ug/g	BSR009
			Chlordane	LT 2 +00	ug/g	BSU010
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BSU010
			p-Chlorophenylmethyl Sulfide	LT 3 -01	ug/g	BSU010
			p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BSU010
			Chromium	1.1 +01	ug/g	BS5019
			Copper	8.4 +00	ug/g	BS5019
			Dibromochloropropane	LT 3 -01	ug/g	BSU010
			Dibromochloropropane	LT 4 -01	ug/g	BSR009
			Dicyclopentadiene	LT 1 +00	ug/g	BSU010
			Dicyclopentadiene	LT 3 -01	ug/g	BSR009
			Vapone	LT 3 +00	ug/g	BSU010
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BSU010
			Dithlene	LT 4 -01	ug/g	BSU010
			Dieldrin	LT 3 -01	ug/g	BSU010
			Dimethyldisulfide	LT 3 -01	ug/g	BSR009

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Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1003000R30	5.5-6.5	Soil	Endrin	LT 5	-01	BSU010
			Ethylbenzene	LT 3	-01	BSR009
			Mercury	LT 5.0	-02	BSU007
			Isodrin	LT 3	-01	BSU010
			Toluene	LT 3	-01	BSR009
			Methylisobutyl Ketone	LT 3	-01	BSR009
			Malethion	LT 7	-01	BSU010
			1,4-Oxathiane	LT 3	-01	BSU010
			Lead	2.2	+01	BSU019
			Dichlorodiphenylethane	LT 6	-01	BSU010
			Dichlorodiphenyltrichloroethane	LT 5	-01	BSU010
			Parathion	LT 9	-01	BSU010
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6	-01	BSU010
			Tetrachloroethene	LT 3	-01	BSR009
1003000R30	9.5-10.5	Soil	Thiodiglycol	LT 2.5	+00	BSA011
			Trichloroethene	LT 3	-01	BSR009
			Ortho- & Para-Xylene	LT 3	-01	BSR009
			Zinc	4.2	+01	BSU019
			1,1,1-Trichloroethene	LT 3	-01	BSR010
			1,1,2-Trichloroethene	LT 3	-01	BSR010
			1,1-Dichloroethene	LT 9	-01	BSR010
			1,2-Dichloroethene	LT 3	-01	BSR010
			1,2-Dichloroethane	LT 3	-01	BSR010
			Aldrin	LT 6	-01	BSV002
			Arsenic	LT 5.	+00	BSH023
			Atrazine	LT 3	+00	BSV002
			Bicycloheptadiene	LT 3	-01	BSR010
			Benzene	LT 3	-01	BSR010
			Carbon Tetrachloride	LT 3	-01	BSR010
			Cadmium	LT 7.3	-01	BSU020
			Methylene Chloride	1	+00	BSR010
			Chloroform	LT 3	-01	BSR010

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08/01/88

Rocky Mountain Arsenal Program

Ebasco Services Incorporated

Task 10 Sanitary Sewers -- Rail Yard & Administration

Summary of Analytical Results

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1003000R30	9.5-10.5	Soil	Hexachlorocyclopentadiene	LT 3 -01	ug/g	BSV002
			Chlordane	LT 2 +00	ug/g	BSV002
			p-Chlorophenylmethyl Sulfide	LT 5 -01	ug/g	BSV002
			p-Chlorophenylmethyl Sulfoxide	LT 6 -01	ug/g	BSV002
			p-Chlorophenylmethyl Sulfone	LT 7 -01	ug/g	BSV002
			Chromium	LT 6.5 +00	ug/g	BS9020
			Copper	LT 4.7 +00	ug/g	BS9020
			Dibromochloropropane	LT 3 -01	ug/g	BSV002
			Dicyclopentadiene	LT 1 +00	ug/g	BSV002
			Vapona	LT 6 -01	ug/g	BSV002
			Diisopropylmethyl Phosphonate	LT 8 -01	ug/g	BSV002
			Dithiane	LT 3 -01	ug/g	BSV002
			Dieldrin	LT 8 -01	ug/g	BSV002
			Dimethyldisulfide	LT 8 -01	ug/g	BSR010
			Endrin	LT 6 -01	ug/g	BSV002
			Mercury	LT 5.0 -02	ug/g	BSY008
			Isodrin	LT 5 -01	ug/g	BSV002
			Methylisobutyl Ketone	LT 3 -01	ug/g	BSR010
			Malathion	LT 4 -01	ug/g	BSV002
			1,4-Oxathiane	LT 9 -01	ug/g	BSV002
			Lead	LT 8.3 +00	ug/g	BS9020
			Dichlorodiphenylethane	LT 9 -01	ug/g	BSV002
			Dichlorodiphenyltrichloroethane	LT 3 -01	ug/g	BSV002
			Parathion	LT 6 -01	ug/g	BSV002
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 3 -01	ug/g	BSV002
			Tetrachloroethene	LT 3 -01	ug/g	BSR010
1035000050	4.7	Soil	Thiodiglycol	LT 2.5 +00	ug/g	BSA017
			Trichloroethene	LT 3 -01	ug/g	BSR010
			Zinc	2.3 +01	ug/g	BS9020
			Aldrin	LT 3 -01	ug/g	BSX006
			Arsenic	LT 2.5 +00	ug/g	BSX016
			Atrazine	LT 3 -01	ug/g	BSX006

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Ebasco Services Incorporated Rocky Mountain Arsenal Program 08/01/88
 Summary of Analytical Results Task 10 Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1035000050	4.7	Soil	Cadmium	LT 7.3 -01	ug/g	BX1009
			Hexachlorocyclopentadiene	LT 6 -01	ug/g	BX1006
			Chloroacetic Acid	LT 3.5 +01	ug/g	BX1009
			Chlordane	LT 2 +00	ug/g	BX1006
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BX1006
			p-Chlorophenylmethyl Sulfoxide	LT 3 -01	ug/g	BX1006
			p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BX1006
			Chromium	LT 6.5 +00	ug/g	BX1009
			Copper	LT 1.8 +02	ug/g	BX1009
			Dibromochloropropane	LT 3 -01	ug/g	BX1006
			Dibromochloropropane	1.3 -02	ug/g	BX1009
			Dicyclopentadiene	LT 1 +00	ug/g	BX1006
			Vapona	LT 3 +00	ug/g	BX1006
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BX1006
			Dithiane	LT 4 -01	ug/g	BX1006
			Dieldrin	LT 3 -01	ug/g	BX1006
			Endrin	LT 5 -01	ug/g	BX1006
			Mercury	1.0 +00	ug/g	BX1008
			Isodrin	LT 3 -01	ug/g	BX1006
			Malathion	LT 7 -01	ug/g	BX1006
			1,4-Oxathiane	LT 3 -01	ug/g	BX1006
			Lead	2.9 +01	ug/g	BX1009
			Dichlorodiphenylethane	LT 6 -01	ug/g	BX1006
			Dichlorodiphenyltrichloroethane	LT 5 -01	ug/g	BX1006
			Parathion	LT 9 -01	ug/g	BX1006
1035000064	4.1-5.1	Soil	2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6 -01	ug/g	BX1006
			Thiodiethylcol	LT 4.2 +00	ug/g	BX1009
			Zinc	1.8 +02	ug/g	BX1009
			1,1,1-Trichloroethane	LT 4 -01	ug/g	BUG002
			1,1,2-Trichloroethane	LT 4 -01	ug/g	BUG002
			1,1-Dichloroethane	LT 2 +00	ug/g	BUG002
			1,2-Dichloroethane	LT 2 +00	ug/g	BUG002

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Summary of Analytical Results

Task 10

Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1035000064	4.1-5.1	Soil	1,2-Dichloroethane	LT 6	-01	BUG002
			m-Xylene	LT 8	-01	BUG002
			Aldrin	LT 3	-01	BUG002
			Arsenic	LT 2.5	+00	BTY011
			Atrazine	LT 3	-01	BUG002
			Bicycloheptadiene	LT 4	-01	BUG002
			Benzene	LT 3	-01	BUG002
			Carbon Tetrachloride	LT 3	-01	BUG002
			Cadmium	LT 7.3	-01	BTX007
			Methylene Chloride	LT 2	+00	BUG002
			Chloroform	LT 3	-01	BUG002
			Hexachlorocyclopentadiene	LT 6	-01	BUG002
			Chlorobenzene	LT 1	+00	BUG002
			Chlordane	LT 2	+00	BUG002
			p-Chlorophenylmethyl Sulfide	LT 9	-01	BUG002
			p-Chlorophenylmethyl Sulfoxide	LT 3	-01	BUG002
			p-Chlorophenylmethyl Sulfone	LT 3	-01	BUG002
			Chromium	1.0	+01	BTX007
			Copper	LT 4.7	+00	BTX007
			Dibromochloropropane	LT 3	-01	BUG002
			Dibromochloropropane	LT 2	+00	BUG002
			Dicyclopentadiene	LT 7	-01	BUG002
			Dicyclopentadiene	LT 1	+00	BUG002
			Vepona	LT 3	+00	BUG002
			Diisopropylmethyl Phosphonate	LT 1	+00	BUG002
			Dithiane	LT 4	-01	BUG002
			Dieldrin	LT 3	-01	BUG002
			Dimethyldisulfide	LT 2	+01	BUG002
			Endrin	LT 5	-01	BUG002
			Ethylbenzene	LT 4	-01	BUG002
			Mercury	LT 5.0	-02	BTZ011
			Isodrin	LT 3	-01	BUG002
			Toluene	LT 3	-01	BUG002
			Methylisobutyl Ketone	LT 7	-01	BUG002

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Ebasco Services Incorporated

Rocky Mountain Arsenal Program

08/01/88

Summary of Analytical Results

Task 10 Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1035000064	4.1-5.1	Soil	Melathion	LT 7	-01	BUH002
			1,4-Oxathiane	LT 3	-01	BUH002
			Lead	LT 8.3	+00	BTX007
			Dichlorodiphenylethane	LT 6	-01	BUH002
			Dichlorodiphenyltrichloroethane	LT 5	-01	BUH002
			Parathion	LT 9	-01	BUH002
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6	-01	BUH002
			Tetrachloroethene	LT 3	-01	BUG002
			Thiodiglycol	LT 2.5	+00	BBF002
			Trichloroethene	LT 5	-01	BUG002
1035000064	8.1-9.1	Soil	Ortho- & Para-Xylene	LT 5	+00	BUG002
			Zinc	2.6	+01	BTX007
			1,1,1-Trichloroethane	LT 4	-01	BUG003
			1,1,2-Trichloroethane	LT 4	-01	BUG003
			1,1-Dichloroethane	LT 2	+00	BUG003
			1,2-Dichloroethane	LT 2	+00	BUG003
			1,2-Dichloroethane	LT 6	-01	BUG003
			m-Xylene	LT 8	-01	BUG003
			Aldrin	LT 3	-01	BUH003
			Arsenic	3.6	+00	BTY012
			Atrazine	LT 3	-01	BUH003
			Bicycloheptadiene	LT 4	-01	BUG003
			Benzene	LT 3	-01	BUG003
			Carbon Tetrachloride	LT 3	-01	BUG003
			Cadmium	LT 7.3	-01	BTX008
			Methylene Chloride	LT 2	+00	BUG003
			Chloroform	LT 3	-01	BUG003
			Hexachlorocyclopentadiene	LT 6	-01	BUH003
			Chlorobenzene	LT 1	+00	BUG003
			Chloroethane	LT 2	+00	BUH003
			p-Chlorophenylmethyl Sulfide	LT 9	-01	BUH003
			p-Chlorophenylmethyl Sulfoxide	LT 3	-01	BUH003

Note: Results for some parameters may appear in more than one analytical fraction.

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1035000064	8.1-9.1	Soil	p-Chlorophenylmethyl Sulfone	LT 3	-01	BUH003
			Chromium	1.3	+01	BTX008
			Copper	1.2	+01	BTX008
			Dibromochloropropene	LT 2	+00	BUG003
			Dibromochloropropane	LT 3	-01	BUG003
			Dicyclopentadiene	LT 7	-01	BUG003
			Dicyclopentadiene	LT 1	+00	BUG003
			Vapors	LT 3	+00	BUG003
			Diisopropylmethyl Phosphonate	LT 1	+00	BUG003
			Dithiane	LT 4	-01	BUG003
			Dieldrin	LT 3	-01	BUG003
			Dimethyldisulfide	LT 2	+01	BUG003
			Endrin	LT 5	-01	BUG003
			Ethylbenzene	LT 4	-01	BUG003
			Isodrin	LT 3	-01	BUG003
			Toluene	LT 3	-01	BUG003
			Methylisobutyl Ketone	LT 7	-01	BUG003
			Methathion	LT 7	-01	BUG003
			1,4-Oxathiane	LT 3	-01	BUG003
			Lead	LT 8.3	+00	BTX008
			Dichlorodiphenylethane	LT 6	-01	BUG003
			Dichlorodiphenyltrichloroethane	LT 5	-01	BUG003
			Parathion	LT 9	-01	BUG003
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6	-01	BUG003
			Tetrachloroethene	LT 3	-01	BUG003
			Thiodiglycol	LT 2.5	+00	BUG003
			Trichloroethene	LT 5	-01	BUG003
			Ortho- & Para-Xylene	LT 5	+00	BUG003
			Zinc	4.3	+01	BTX008
			Aldrin	LT 3	-01	BUG003
			Arsenic	3.6	+00	BUG003
			Atrazine	LT 3	-01	BUG003
1035000065	5.4	Soil				

Note: Results for some parameters may appear in more than one analytical fraction.

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1035000065	5.4	Soil	Cadmium	LT 7.3	-01	BX1008
			Hexachlorocyclopentadiene	LT 6	-01	BX1005
			Chloroacetic Acid	LT 6.2	+01	BXE008
			Chlordane	LT 2	+00	BX1005
			p-Chlorophenylmethyl Sulfide	LT 9	-01	BX1005
			p-Chlorophenylmethyl Sulfoxide	LT 3	-01	BX1005
			p-Chlorophenylmethyl Sulfone	LT 3	-01	BX1005
			Chromium	LT 1.0	+01	BX1008
			Copper	LT 6.3	+01	BX1008
			Dibromochloropropane	LT 3	-01	BX1005
			Dibromochloropropane	LT 7.2	-03	BXF008
			Dicyclopentadiene	LT 1	+00	BX1005
			Vapona	LT 3	+00	BX1005
			Diisopropylmethyl Phosphonate	LT 1	+00	BX1005
			Dithlene	LT 4	-01	BX1005
			Dieldrin	LT 3	-01	BX1005
			Endrin	LT 5	-01	BX1005
			Mercury	LT 1.3	+00	BXG007
			Isodrin	LT 3	-01	BX1005
			Malathion	LT 7	-01	BX1005
1034LS0001	0-1	Soil	1,4-Oxathiane	LT 3	-01	BX1005
			Lead	LT 8.7	+01	BX1008
			Dichlorodiphenylethane	LT 6	-01	BX1005
			Dichlorodiphenyltrichloro-ethane	LT 5	-01	BX1005
			Parathion	LT 9	-01	BX1005
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6	-01	BX1005
			Thiodiglycol	LT 4.2	+00	BXE008
			Zinc	LT 3.9	+01	BX1008
			Aldrin	LT 2	-01	CEP008
			Arsenic	LT 2.5	+00	CEU020
			Atrazine	LT 2	-01	CEP008
			Cadmium	LT 7.40	-1	CEY007

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated
 Summary of Analytical Results
 Task ID
 Sanitary Sewers -- Rail Yard & Administration
 Rocky Mountain Arsenal Program
 08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1034L50001	0-1	Soil	Hexachlorocyclopentadiene	LT 5. -01	ug/g	CEP008
			Chloroacetic Acid	LT 3.5 +01	ug/g	CEX009
			Chlordane	LT 1. +00	ug/g	CEP008
			p-Chlorophenylmethyl Sulfide	LT 9. -01	ug/g	CEP008
			p-Chlorophenylmethyl Sulfoxide	LT 2. -01	ug/g	CEP008
			p-Chlorophenylmethyl Sulfone	LT 2. -01	ug/g	CEP008
			Chromium	1.41 1	ug/g	CEY007
			Copper	4.76 1	ug/g	CEY007
			Dibromochloropropane	LT 2. -01	ug/g	CEP008
			Dicyclopentadiene	LT 1. +00	ug/g	CEP008
			Vapona	LT 3. +00	ug/g	CEP008
			Diisopropylmethyl Phosphonate	LT 1. +00	ug/g	CEP008
			Dithiane	LT 3. -01	ug/g	CEP008
			Dieldrin	LT 2. -01	ug/g	CEP008
			ndrin	LT 4. -01	ug/g	CEP008
			Mercury	4.1 -01	ug/g	CEY013
			Isodrin	LT 2. -01	ug/g	CEP008
			Malethion	LT 7. -01	ug/g	CEP008
			1,4-Oxathiane	LT 2. -01	ug/g	CEP008
			Lead	3.76 1	ug/g	CEY007
			Dichlorodiphenylethane	LT 3. -01	ug/g	CEP008
			Dichlorodiphenyltrichloroethane	LT 4. -01	ug/g	CEP008
			Parathion	LT 8. -01	ug/g	CEP008
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidylethyl Phosphates	LT 6. -01	ug/g	CEP008
			Thiodiglycol	LT 4.2 +00	ug/g	CEX009
1034L50001	4-5	Soil	Zinc	8.66 1	ug/g	CEY007
			1,1,1-Trichloroethane	LT 3 -01	ug/g	CEM008
			1,1,2-Trichloroethane	LT 3 -01	ug/g	CEM008
			1,1-Dichloroethane	LT 9 -01	ug/g	CEM008
			1,2-Dichloroethane	LT 3 -01	ug/g	CEM008
			1,2-Dichloroethane	LT 3 -01	ug/g	CEM008

Note: Results for some parameters may appear in more than one analytical fraction.

Fbaco Services Incorporated
 Summary of Analytical Results
 Task 10
 Rocky Mountain Arsenal Program
 Sanitary Sewers -- Rail Yard & Administration
 08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1034LS0001	4-5	Soil	m-Xylene	LT 7 -01	ug/g	CEM008
			Aldrin	LT 2 -01	ug/g	CEP009
			Arsenic	LT 2.5 +00	ug/g	CEU021
			Atrazine	LT 2 -01	ug/g	CEP009
			Bicycloheptadiene	LT 3 -01	ug/g	CEM008
			Benzene	LT 3 -01	g/g	CEM008
			Carbon Tetrachloride	LT 3 -01	ug/g	CEM008
			Cadmium	LT 7.40 -1	ug/g	CEY008
			Methylene Chloride	LT 7 -01	ug/g	CEM008
			Chloroform	LT 3 -01	ug/g	CEM008
			Hexachlorocyclopentadiene	LT 5 -01	ug/g	CEP009
			Chloroacetic Acid	LT 3.5 +01	ug/g	CEX010
			Chlorobenzene	LT 3 -01	ug/g	CEM008
			Chlordane	LT 1 +00	ug/g	CEP009
			p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	CEP009
			p-Chlorophenylmethyl Sulfoxide	LT 2 -01	ug/g	CEP009
			p-Chlorophenylmethyl Sulfone	LT 2 -01	ug/g	CEP009
			Chromium	1.30 1	ug/g	CEY008
			Copper	9.69 0	ug/g	CEY008
			Dibromochloropropane	LT 4 -01	ug/g	CEM008
			Dibromochloropropane	LT 2 -01	ug/g	CEP009
			Dicyclopentadiene	LT 3 -01	ug/g	CEM008
			Dicyclopentadiene	LT 1 +00	ug/g	CEP009
			Vapors	LT 3 +00	ug/g	CEP009
			Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	CEP009
			Dithiane	LT 3 -01	ug/g	CEP009
			Dieldrin	LT 2 -01	ug/g	CEP009
			Dimethyldisulfide	LT 8 -01	ug/g	CEM008
			Endrin	LT 4 -01	ug/g	CEP009
			Ethylbenzene	LT 3 -01	ug/g	CEM008
			Mercury	LT 5.0 -02	ug/g	CE5014
			Isodrin	LT 2 -01	ug/g	CEP009
			Toluene	LT 3 -01	ug/g	CEM008
			Methylisobutyl ketone	LT 3 -01	ug/g	CEM008

Note: Results for some parameters may appear in more than one analytical fraction.

08/01/88

Rocky Mountain Arsenal Program

Ebasco Services Incorporated

Task 10 Sanitary Sewers -- Reil Yard & Administration

Summary of Analytical Results

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1034LS0001	4-5	Soil	Malathion	LT 7. -01	ug/g	CEP009
			1,4-Oxathiane	LT 2. -01	ug/g	CEP009
			Lead	LT 8.40 0	ug/g	CEY008
			Dichlorodiphenylethane	LT 5. -01	ug/g	CEP009
			Dichlorodiphenyltrichloroethane	LT 4. -01	ug/g	CEP009
			Parathion	LT 8. -01	ug/g	CEP009
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6. -01	ug/g	CEP009
			Tetrachloroethene	LT 3 -01	ug/g	CEM008
			Thiodiglycol	LT 4.2 +00	ug/g	CEX010
			Trichloroethene	LT 3 -01	ug/g	CEM008
1034LS0002	0-1	Soil	Ortho- & Para-Xylene	LT 3 -01	ug/g	CEM008
			Zinc	4.83 1	ug/g	CEY008
			Aldrin	LT 3 -01	ug/g	CFK005
			Arsenic	LT 5. +00	ug/g	CFD016
			Atrazine	LT 3 -01	ug/g	CFK005
			Cadmium	LT 7.40 -1	ug/g	CEY020
			Hexachlorocyclopentadiene	LT 3 -01	ug/g	CFK005
			Chloroacetic Acid	LT 3.5 +01	ug/g	CFM019
			Chlordane	LT 6 -01	ug/g	CFK005
			p-Chlorophenylmethyl Sulfide	LT 4 +00	ug/g	CFK005
			p-Chlorophenylmethyl Sulfoxide	LT 7 +00	ug/g	CFK005
			p-Chlorophenylmethyl Sulfone	LT 6 -01	ug/g	CFK005
			Chromium	1.49 1	ug/g	CEY020
			Copper	5.69 1	ug/g	CEY020
			Dibromochloropropane	LT 3 -01	ug/g	CFK005
			Dicyclopentadiene	LT 4 -01	ug/g	CFK005
			Vapona	LT 3 -01	ug/g	CFK005
			Diisopropylmethyl Phosphonate	LT 3 -01	ug/g	CFK005
			Dithiane	LT 7 +00	ug/g	CFK005
			Dieldrin	LT 3 -01	ug/g	CFK005
			Endrin	LT 3 -01	ug/g	CFK005
			Mercury	1.1 +00	ug/g	CFR019

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program
Task 10 Sanitary Sewers -- Rail Yard & Administration

08/01/88

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1034LS0002	0-1	Soil	Isopropylmethyl Phosphonic Acid	LT 4. +00	ug/g	CFF005
			Isodrin	LT 3 -01	ug/g	CFK005
			Malethion	LT 3 -01	ug/g	CFK005
			1,4-Oxathiane	LT 6 +00	ug/g	CFK005
			Lead	4.28 1	ug/g	CEY020
			Dichlorodiphenylethane	LT 3 -01	ug/g	CFK005
			Dichlorodiphenyltrichloro-ethane	LT 6 -01	ug/g	CFK005
			Parathion	LT 4 -01	ug/g	CFK005
			2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 3 -01	ug/g	CFK005
			Thiodiglycol	LT 4.2 +00	ug/g	CFM019
1034LS0002	4-5	Soil	Zinc	8.92 1	ug/g	CEY020
			1,1,1-Trichloroethane	LT 4. -01	ug/g	CFB008
			1,1,2-Trichloroethane	LT 3. -01	ug/g	CFB008
			1,1-Dichloroethane	LT 1. +00	ug/g	CFB008
			1,2-Dichloroethane	LT 1. +00	ug/g	CFB008
			1,2-Dichloroethane	LT 5. -01	ug/g	CFB008
			m-Xylene	LT 7. -01	ug/g	CFB008
			Aldrin	LT 3. -01	ug/g	CFK006
			Arsenic	LT 5. +00	ug/g	CFD017
			Atrazine	LT 3. -01	ug/g	CFK006
			Bicycloheptadiene	LT 3. -01	ug/g	CFB008
			Benzene	LT 2. -01	ug/g	CFB008
			Carbon Tetrachloride	LT 2. -01	ug/g	CFB008
			Cadmium	LT 7.3 -01	ug/g	CFM020
			Methylene Chloride	LT 1. +00	ug/g	CFB008
			Chloroform	LT 2. -01	ug/g	CFB008
			Hexachlorocyclopentadiene	LT 3. -01	ug/g	CFK006
			Chloroacetic Acid	LT 3.5 +01	ug/g	CFM020
			Chlorobenzene	LT 1. +00	ug/g	CFB008
			Chlordane	LT 6. -01	ug/g	CFK006
			p-Chlorophenylmethyl Sulfide	LT 4. +00	ug/g	CFK006

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated Rocky Mountain Arsenal Program 08/01/88
 Summary of Analytical Results Task 10 Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
1034LS0002	4-5	Soil	p-Chlorophenylmethyl Sulfoxide	LT 7 +00	ug/g	CFK006
			p-Chlorophenylmethyl Sulfone	LT 6 -01	ug/g	CFK006
			Chromium	1.4 +01	ug/g	CFP020
			Copper	1.3 +01	ug/g	CFP020
			Dibromochloropropane	LT 3 -01	ug/g	CFK006
			Dibromochloropropane	LT 2. +00	ug/g	CFB008
			Dicyclopentadiene	LT 4 -01	ug/g	CFK006
			Dicyclopentadiene	LT 6. -01	ug/g	CFB008
			Vapors	LT 3. -01	ug/g	CFK006
			Diisopropylmethyl Phosphonate	LT 3 -01	ug/g	CFK006
			Dithiane	LT 7 +00	ug/g	CFK006
			Dieldrin	LT 3 -01	ug/g	CFK006
			Dimethyldisulfide	LT 2. +01	ug/g	CFB008
			Endrin	LT 3. -01	ug/g	CFK006
			Ethylbenzene	LT 3. -01	ug/g	CFB008
			Mercury	LT 5.0 -02	ug/g	CFR020
			Isopropylmethyl Phosphonic Acid	LT 4. +00	ug/g	CFF006
			Isodrin	LT 3 -01	ug/g	CFK006
			Toluene	LT 2. -01	ug/g	CFB008
			Methylisobutyl Ketone	LT 7. -01	ug/g	CFB008
			Malathion	LT 3 -01	ug/g	CFK006
			1,4-Oxathiane	LT 6 +00	ug/g	CFK006
			Lead	LT 8.3 +00	ug/g	CFP020
			Dichlorodiphenylethane	LT 3 -01	ug/g	CFK006
			Dichlorodiphenyltrichloroethane	LT 6 -01	ug/g	CFK006
			Parathion	LT 4 -01	ug/g	CFK006
			2-Chloro-1(2,4-Dichlorophenyl) Vinyl-diethyl Phosphates	LT 3 -01	ug/g	CFK006
			Tetrachloroethene	LT 2. -01	ug/g	CFB008
			Thiodiglycol	LT 4.2 +00	ug/g	CFP020
			Trichloroethene	LT 5. -01	ug/g	CFB008
			Ortho- & Para-Xylene	LT 4. +00	ug/g	CFB008

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated Rocky Mountain Arsenal Program 08/01/88
 Summary of Analytical Results Task 10 Sanitary Sewers -- Rail Yard & Administration

Boring Number	Depth (ft)	Sample Type	Analytical Parameters	Results	Units	Sample Number
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1034LS0002	4-5	Soil	Zinc	5.8 ±01	ug/g	CFP020
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Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program

08/02/88

Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

Type	Analytical Parameters	Results	Units	Sample Number
Blank	Arsenic	3. +00	ug/g	BBA001
Blank	Thiodiglycol	LT 2.5 +00	ug/g	BBA016
Blank	Thiodiglycol	LT 2.5 +00	ug/g	BSF001
Blank	Arsenic	LT 5. +00	ug/g	BSH001
Blank	Bicycloheptadiene	LT 3 -01	ug/g	BSN001
Blank	Carbon Tetrachloride	LT 3 -01	ug/g	BSR001
Blank	Chloroform	LT 3 -01	ug/g	BSR001
Blank	Methylene Chloride	LT 7 -01	ug/g	BSR001
Blank	Chlorobenzene	LT 3 -01	ug/g	BSR001
Blank	Benzene	LT 3 -01	ug/g	BSR001
Blank	Dibromochloropropane	LT 4 -01	ug/g	BSR001
Blank	Dicyclopentadiene	LT 3 -01	ug/g	BSR001
Blank	Dimethyldisulfide	LT 8 -01	ug/g	BSR001
Blank	Ethylbenzene	LT 3 -01	ug/g	BSR001
Blank	Toluene	LT 3 -01	ug/g	BSR001
Blank	Methylisobutyl Ketone	LT 3 -01	ug/g	BSR001
Blank	Tetrachloroethene	LT 3 -01	ug/g	BSR001
Blank	Trichloroethene	LT 3 -01	ug/g	BSR001
Blank	Ortho- & Para-Xylene	LT 3 -01	ug/g	BSR001
Blank	1,1-Dichloroethane	LT 9 -01	ug/g	BSR001
Blank	1,1,1-Trichloroethane	LT 3 -01	ug/g	BSR001
Blank	1,1,2-Trichloroethane	LT 3 -01	ug/g	BSR001
Blank	1,2-Dichloroethane	LT 3 -01	ug/g	BSR001
Blank	m-Xylene	LT 7 -01	ug/g	BSR001
Blank	Chromium	1.4 +01	ug/g	BS9001
Blank	Copper	8.6 +00	ug/g	BS9001
Blank	Lead	1.7 +01	ug/g	BS9001
Blank	Zinc	4.0 +01	ug/g	BS9001
Blank	Cadmium	LT 7.3 -01	ug/g	BS9001
Blank	Mercury	1.4 -01	ug/g	BSU001
Blank	Aldrin	LT 3 -01	ug/g	BSU001
Blank	Atrazine	LT 3 -01	ug/g	BSU001
Blank	Chlordane	LT 2 +00	ug/g	BSU001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program
Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

08/02/88

Type	Analytical Parameters	Results	Units	Sample Number
Blank	Hexachlorocyclopentadiene	LT 6 -01	ug/g	BSU001
Blank	p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BSU001
Blank	p-Chlorophenylmethyl Sulfoxide	LT 3 -01	ug/g	BSU001
Blank	p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BSU001
Blank	Dibromochloropropane	LT 3 -01	ug/g	BSU001
Blank	Dicyclopentadiene	LT 1 +00	ug/g	BSU001
Blank	Vapona	LT 3 +00	ug/g	BSU001
Blank	Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BSU001
Blank	Dithiane	LT 4 -01	ug/g	BSU001
Blank	Dieldrin	LT 3 -01	ug/g	BSU001
Blank	Endrin	LT 5 -01	ug/g	BSU001
Blank	Isodrin	LT 3 -01	ug/g	BSU001
Blank	Malathion	LT 7 -01	ug/g	BSU001
Blank	1,4-Oxathiane	LT 3 +01	ug/g	BSU001
Blank	Dichlorodiphenylethane	LT 6 -01	ug/g	BSU001
Blank	Dichlorodiphenyltrichloro-ethane	LT 5 -01	ug/g	BSU001
Blank	Parathion	LT 9 -01	ug/g	BSU001
Blank	2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6 -01	ug/g	BSU001
Blank	Aldrin	LT 6 -01	ug/g	BSV001
Blank	Atrazine	LT 3 +00	ug/g	BSV001
Blank	Chlordane	LT 2 +00	ug/g	BSV001
Blank	Hexachlorocyclopentadiene	LT 3 -01	ug/g	BSV001
Blank	p-Chlorophenylmethyl Sulfide	LT 5 -01	ug/g	BSV001
Blank	p-Chlorophenylmethyl Sulfoxide	LT 6 -01	ug/g	BSV001
Blank	p-Chlorophenylmethyl Sulfone	LT 7 -01	ug/g	BSV001
Blank	Dibromochloropropane	LT 3 -01	ug/g	BSV001
Blank	Dicyclopentadiene	LT 1 +00	ug/g	BSV001
Blank	Vapona	LT 6 -01	ug/g	BSV001
Blank	Diisopropylmethyl Phosphonate	LT 8 -01	ug/g	BSV001
Blank	Dithiane	LT 3 -01	ug/g	BSV001
Blank	Dieldrin	LT 8 -01	ug/g	BSV001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program

06/02/88

Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

Type	Analytical Parameters	Results	Units	Sample Number
Blank	Dimethylmethyl Phosphate	LT 2 +00	ug/g	BSV001
Blank	Endrin	LT 6 -01	ug/g	BSV001
Blank	Isodrin	LT 5 -01	ug/g	BSV001
Blank	Malathion	LT 4 -01	ug/g	BSV001
Blank	1,4-Oxathiane	LT 9 -01	ug/g	BSV001
Blank	Dichlorodiphenylethane	LT 9 -01	ug/g	BSV001
Blank	Dichlorodiphenyltrichloro-ethane	LT 3 -01	ug/g	BSV001
Blank	Parathion	LT 6 -01	ug/g	BSV001
Blank	2-Chloro-1(2,4-Dichlorophenyl) Vinyllethyl Phosphates	LT 3 -01	ug/g	BSV001
Blank	Chromium	1.4 +01	ug/g	BTX001
Blank	Copper	9.0 +00	ug/g	BTX001
Blank	Lead	1.1 +01	ug/g	BTX001
Blank	Zinc	3.9 +01	ug/g	BTX001
Blank	Cadmium	LT 7.3 -01	ug/g	BTX001
Blank	Arsenic	LT 2.5 +00	ug/g	BTX001
Blank	Mercury	1.0 -01	ug/g	BTZ001
Blank	Bicycloheptadiene	LT 4 -01	ug/g	BUG001
Blank	Carbon Tetrachloride	LT 3 -01	ug/g	BUG001
Blank	Methylene Chloride	LT 2 +00	ug/g	BUG001
Blank	Chlorobenzene	LT 1 +00	ug/g	BUG001
Blank	Benzene	LT 3 -01	ug/g	BUG001
Blank	Dibromochloropropane	LT 2 +00	ug/g	BUG001
Blank	Dicyclopentadiene	LT 7 -01	ug/g	BUG001
Blank	Dimethyldisulfide	LT 2 +01	ug/g	BUG001
Blank	Ethylbenzene	LT 4 -01	ug/g	BUG001
Blank	Toluene	LT 3 -01	ug/g	BUG001
Blank	Methylisobutyl Ketone	LT 7 -01	ug/g	BUG001
Blank	Tetrachloroethene	LT 3 -01	ug/g	BUG001
Blank	Ortho- & Para-Xylene	LT 5 +00	ug/g	BUG001
Blank	1,1-Dichloroethane	LT 2 +00	ug/g	BUG001
Blank	1,1,1-Trichloroethane	LT 4 -01	ug/g	BUG001
Blank	1,1,2-Trichloroethane	LT 4 -01	ug/g	BUG001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program

08/02/88

Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

Type	Analytical Parameters	Results	Units	Sample Number
Blank	1,2-Dichloroethene	LT 2 +00	ug/g	BUG001
Blank	1,2-Dichloroethene	LT 6 -01	ug/g	BUG001
Blank	m-Xylene	LT 8 -01	ug/g	BUG001
Blank	Chloroform	8. -01	ug/g	BUG001
Blank	Trichloroethene	2. +00	ug/g	BUG001
Blank	Trichloroethene	2. +00	ug/g	BUG001
Blank	Chloroform	8. -01	ug/g	BUG001
Blank	Aldrin	LT 3 -01	ug/g	BUG001
Blank	Atrazine	LT 3 -01	ug/g	BUG001
Blank	Chlordane	LT 2 +00	ug/g	BUG001
Blank	Hexachlorocyclopentadiene	LT 6 -01	ug/g	BUG001
Blank	p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	BUG001
Blank	p-Chlorophenylmethyl Sulfoxide	LT 3 -01	ug/g	BUG001
Blank	p-Chlorophenylmethyl Sulfone	LT 3 -01	ug/g	BUG001
Blank	Dibromochloropropane	LT 3 -01	ug/g	BUG001
Blank	Dicyclopentadiene	LT 1 +00	ug/g	BUG001
Blank	Vapone	LT 3 +00	ug/g	BUG001
Blank	Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	BUG001
Blank	Dithiane	LT 4 -01	ug/g	BUG001
Blank	Dieldrin	LT 3 -01	ug/g	BUG001
Blank	Endrin	LT 5 -01	ug/g	BUG001
Blank	Isodrin	LT 3 -01	ug/g	BUG001
Blank	Malathion	LT 7 -01	ug/g	BUG001
Blank	1,4-Oxathiane	LT 3 -01	ug/g	BUG001
Blank	Dichlorodiphenylethane	LT 6 -01	ug/g	BUG001
Blank	Dichlorodiphenyltrichloro-ethane	LT 5 -01	ug/g	BUG001
Blank	Parathion	LT 9 -01	ug/g	BUG001
Blank	2-Chloro-1(2,4-Dichlorophenyl) Vinylidethyl Phosphates	LT 6 -01	ug/g	BUG001
Blank	Bicycloheptadiene	LT 3 -01	ug/g	CEM001
Blank	Carbon Tetrachloride	LT 3 -01	ug/g	CEM001
Blank	Chloroform	LT 3 -01	ug/g	CEM001
Blank	Methylene Chloride	LT 7. -01	ug/g	CEM001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program

08/02/88

Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

Type	Analytical Parameters	Results	Units	Sample Number
Blank	Chlorobenzene	LT 3 -01	ug/g	CEM001
Blank	Benzene	LT 3 -01	ug/g	CEM001
Blank	Dibromochloropropane	LT 4 -01	ug/g	CEM001
Blank	Dicyclopentadiene	LT 3 -01	ug/g	CEM001
Blank	Dimethyldisulfide	LT 8 -01	ug/g	CEM001
Blank	Ethylbenzene	LT 3 -01	ug/g	CEM001
Blank	Toluene	LT 3 -01	ug/g	CEM001
Blank	Methylisobutyl Ketone	LT 3 -01	ug/g	CEM001
Blank	Tetrachloroethene	LT 3 -01	ug/g	CEM001
Blank	Trichloroethene	LT 3 -01	ug/g	CEM001
Blank	Ortho- & Para-Xylene	LT 3 -01	ug/g	CEM001
Blank	1,1-Dichloroethane	LT 9 -01	ug/g	CEM001
Blank	1,1,1-Trichloroethane	LT 3 -01	ug/g	CEM001
Blank	1,1,2-Trichloroethane	LT 3 -01	ug/g	CEM001
Blank	1,2-Dichloroethane	LT 3 -01	ug/g	CEM001
Blank	1,2-Dichloroethane	LT 3 -01	ug/g	CEM001
Blank	m-Xylene	LT 7 -01	ug/g	CEM001
Blank	Vapona	LT 3 +00	ug/g	CEP001
Blank	Aldrin	LT 2 -01	ug/g	CEP001
Blank	Atrazine	LT 2 -01	ug/g	CEP001
Blank	Chlordane	LT 1 +00	ug/g	CEP001
Blank	Hexachlorocyclopentadiene	LT 5 -01	ug/g	CEP001
Blank	p-Chlorophenylmethyl Sulfide	LT 9 -01	ug/g	CEP001
Blank	p-Chlorophenylmethyl Sulfoxide	LT 2 -01	ug/g	CEP001
Blank	p-Chlorophenylmethyl Sulfone	LT 2 -01	ug/g	CEP001
Blank	Dibromochloropropane	LT 2 -01	ug/g	CEP001
Blank	Dicyclopentadiene	LT 1 +00	ug/g	CEP001
Blank	Diisopropylmethyl Phosphonate	LT 1 +00	ug/g	CEP001
Blank	Dithiane	LT 3 -01	ug/g	CEP001
Blank	Dieldrin	LT 2 -01	ug/g	CEP001
Blank	Endrin	LT 4 -01	ug/g	CEP001
Blank	Isodrin	LT 2 -01	ug/g	CEP001
Blank	Malathion	LT 7 -01	ug/g	CEP001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated
Summary of Analytical Results

Rocky Mountain Arsenal Program
Blanks Associated with Task 10
Sanitary Sewers -- Neil Yard & Administration

08/02/88

Type	Analytical Parameters	Results	Units	Sample Number
Blank	1,4-Oxathiane	LT 2. -01	ug/g	CEP001
Blank	Dichlorodiphenylethane	LT 5. -01	ug/g	CEP001
Blank	Dichlorodiphenyltrichloroethane	LT 4. -01	ug/g	CEP001
Blank	Parathion	LT 8. -01	ug/g	CEP001
Blank	2-Chloro-1(2,4-Dichlorophenyl) Vinyl diethyl Phosphates	LT 6. -01	ug/g	CEP001
Blank	Mercury	5.1 -02	ug/g	CEX001
Blank	Arsenic	3.1 +00	ug/g	CEU001
Blank	Thiodiglycol	LT 4.2 +00	ug/g	CEX001
Blank	Chloroacetic Acid	LT 3.5 +01	ug/g	CEX001
Blank	Cadmium	LT 7.40 -1	ug/g	CEY001
Blank	Chromium	1.82 1	ug/g	CEY001
Blank	Copper	1.11 1	ug/g	CEY001
Blank	Lead	9.86 0	ug/g	CEY001
Blank	Zinc	5.08 1	ug/g	CEY001
Blank	Dimethyldisulfide	LT 2. +01	ug/g	CFB001
Blank	Bicycloheptadiene	LT 3. -01	ug/g	CFB001
Blank	Carbon Tetrachloride	LT 2. -01	ug/g	CFB001
Blank	Chloroform	LT 2. -01	ug/g	CFB001
Blank	Methylene Chloride	LT 1. +00	ug/g	CFB001
Blank	Chlorobenzene	LT 1. +00	ug/g	CFB001
Blank	Benzene	LT 2. -01	ug/g	CFB001
Blank	Dibromochloropropane	LT 2. +00	ug/g	CFB001
Blank	Dicyclopentadiene	LT 6. -01	ug/g	CFB001
Blank	Ethylbenzene	LT 3. -01	ug/g	CFB001
Blank	Toluene	LT 2. -01	ug/g	CFB001
Blank	Methylisobutyl Ketone	LT 7. -01	ug/g	CFB001
Blank	Tetrachloroethene	LT 2. -01	ug/g	CFB001
Blank	Trichloroethene	LT 5. -01	ug/g	CFB001
Blank	Ortho- & Para-Xylene	LT 4. +00	ug/g	CFB001
Blank	1,1-Dichloroethane	LT 1. +00	ug/g	CFB001
Blank	1,1,1-Trichloroethane	LT 4. -01	ug/g	CFB001
Blank	1,1,2-Trichloroethane	LT 3. -01	ug/g	CFB001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

08/02/88

Rocky Mountain Arsenal Program
Blanks Associated with Task 10
Sanitary Sewers -- Rail Yard & Administration

Summary of Analytical Results

Type	Analytical Parameters	Results	Units	Sample Number
Blank	1,2-Dichloroethene	LT 1. +00	ug/g	CFB001
Blank	1,2-Dichloroethane	LT 5. -01	ug/g	CFB001
Blank	m-Xylene	LT 7. -01	ug/g	CFB001
Blank	Arsenic	LT 5. +00	ug/g	CFD001
Blank	Isopropylmethyl Phosphonic Acid	LT 4. +00	ug/g	CFD001
Blank	Aldrin	LT 3. -01	ug/g	CFK001
Blank	Atrazine	LT 3. -01	ug/g	CFK001
Blank	Chlordane	LT 6. -01	ug/g	CFK001
Blank	Hexachlorocyclopentadiene	LT 3. -01	ug/g	CFK001
Blank	p-Chlorophenylmethyl Sulfide	LT 4. +00	ug/g	CFK001
Blank	p-Chlorophenylmethyl Sulfoxide	LT 7. +00	ug/g	CFK001
Blank	p-Chlorophenylmethyl Sulfone	LT 6. -01	ug/g	CFK001
Blank	Dibromochloropropane	LT 3. -01	ug/g	CFK001
Blank	Dicyclopentadiene	LT 4. -01	ug/g	CFK001
Blank	Vapona	LT 3. -01	ug/g	CFK001
Blank	Diisopropylmethyl Phosphonate	LT 3. -01	ug/g	CFK001
Blank	Dithiane	LT 7. +00	ug/g	CFK001
Blank	Dieldrin	LT 3. -01	ug/g	CFK001
Blank	Endrin	LT 3. -01	ug/g	CFK001
Blank	Isodrin	LT 3. -01	ug/g	CFK001
Blank	Malathion	LT 3. -01	ug/g	CFK001
Blank	1,4-Oxathiane	LT 6. +00	ug/g	CFK001
Blank	Dichlorodiphenylethane	LT 3. -01	ug/g	CFK001
Blank	Dichlorodiphenyltrichloroethane	LT 6. -01	ug/g	CFK001
Blank	Parathion	LT 4. -01	ug/g	CFK001
Blank	2-Chloro-1(2,4-Dichlorophenyl) Vinyl diethyl Phosphates	LT 3. -01	ug/g	CFK001
Blank	2-Chlorophenol - D4	7. +00	ug/g	CI K002
Blank	1,3-Dichlorobenzene - D4	6. +00	ug/g	CFK002
Blank	Di-N-Octyl Phthalate - D4	9. +00	ug/g	CFK002
Blank	Diethyl Phthalate - D4	8. +00	ug/g	CFK002
Blank	Thiodiglycol	LT 4.2 +00	ug/g	CFM001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

08/02/88

Rocky Mountain Arsenal Program

Ebasco Services, Incorporated

Summary of Analytical Results
Sanitary Sewers -- Rail Yarc & Administration

Type	Analytical Parameters	Results	Units	Sample Number
Blank	Chloroacetic Acid	LT 3.5 -01	ug/g	CFM001
Blank	Chromium	1.6 +01	ug/g	CFP001
Blank	Copper	1.0 +01	ug/g	CFP001
Blank	Zinc	4.2 +01	ug/g	CFP001
Blank	Cadmium	LT 7.3 -01	ug/g	CFP001
Blank	Lead	LT 8.3 +00	ug/g	CFP001
Blank	Mercury	5.8 -02	ug/g	CFR001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Appendix SS-RA-C
Comments and Responses

Shell Oil Company



c/o Holme Roberts & Owen
Suite 1800
1700 Broadway
Denver, CO 80290

March 9, 1988

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-PM: Mr. Donald L. Campbell, Deputy Program Manager
Aberdeen Proving Ground, Maryland 21010-5401

Dear Mr. Campbell:

Enclosed herewith are Shell Oil's comments on the following Draft Final Contamination Assessment Reports:

- 1) Draft Final Phase I CAR, Section 33: Nonsource Area, Task 15, January, 1988
- 2) Draft Final Phase I CAR, Sanitary Sewer - Railyard and Administration Areas, Task 10, January, 1988
- 3) Draft Final Phase CAR, Site 36-9, Incendiary or Munition Test Area, Task 14, January, 1988

Sincerely,

C. K. Hahn
Manager
Denver Site Project

RDL:ajg

Enclosure

cc: (w/enclosure)

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMYDM-DD: Mr. Kevin T. Bloch, Acting Chief
Aberdeen Proving Ground, Maryland 21010-5401

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-TO: Mr. Brian L. Anderson
Commerce City, Colorado 80022-2180

BRHM8800902 - 0001.0.0



cc: Mr. David Anderson
U.S. Department of Justice
Environmental Enforcement Section
Land & Natural Resources Division
P.O. Box 7415
Washington, D.C. 20044-7415

Department of the Army
Office of the Judge Advocate General
ATTN: Lt. Col. Scott Isaacson
Washington, DC 20310-2200

Ms. Patricia Bohm
Office of Attorney General
CERCLA Litigation Section
One Civic Center
1560 Broadway, Suite 250
Denver, CO 80202

Mr. Jeff Edson
Hazardous Materials and Waste Management Division
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

Mr. Robert L. Duprey
Director, Hazardous Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Connally Mears
Air and Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Thomas P. Looby
Assistant Director
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

RESPONSES TO COMMENTS OF SHELL OIL COMPANY
ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

Comment 1: Page 11, first full sentence.

Very high chloride levels were measured in alluvial Well 34002 (ESE, 1986b/RIC 86317R01).

Response: Groundwater data gathered by ESE in 1986 show chloride concentrations ranging from 103 ppm to 122 ppm in Well 34002, located approximately 2,000 ft downgradient from the former housing area. Comparable levels of chlorides (95.1 ppm to 145 ppm) were found in Wells 02008, 03005, and 34008, located both upgradient and downgradient of the sanitary sewer system. Based on these data, it does not appear that the sanitary sewers are contributing to chloride levels in groundwater in the railyard and administrative areas.

Comment 2: Page 11, first full paragraph.

Chlorobenzene and dichloroethylene were also measured in Well 35012.

Response: Chlorobenzene and trichloroethylene (not dichloroethylene) were also measured in Well 35012. The text will be changed to indicate the presence of these compounds in Well 35012.

Comment 3: Page 15, third full paragraph.

The Black and Veatch investigations identified suspected infiltration points in the vicinity of manholes 47, 58, 59, 60 and 62. Why were none of these included in the inspection?

Response: The Black and Veatch investigations (1979) indicated that segments of the sewer line in the vicinity of these manholes were potential sources of inflow into the sewer system. These conclusions were based on observations of smoke emanating from prairie dog holes during the smoke testing operations segment of their investigation. These prairie dog holes were apparently located along the alignment of the sewer line. However, points of infiltration, especially points on the crown of the sewer, are not necessarily points of exfiltration. Contamination of soil associated with the sewer line would be from points of exfiltration and not points of infiltration.

Additionally, the Black and Veatch investigations did not indicate these manholes to be in poor condition. Manholes 50 and 65, located in the vicinity of the questioned manholes, were identified as being in poor condition. These manholes were included in the Task 10 investigations.

Comment 4: Page 30, first sentence.

"Dibromochloropropane was handled in the railyard area..."

It is unclear what is meant by handled. With respect to dibromochloropropane, Shell does not believe that any activity occurred at this site other than the storage of railcars.

Response: The text will be changed to clarify that based on all information reviewed to date, dibromochloropropane was stored in rail cars in the railyard (Adcock, 1980) and shipped from the railyard area (Sheppard, 1981).



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII

999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2405

Ref: 8HWM-SR

MAY 03 1988

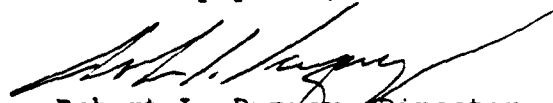
Colonel W. N. Quintrell
Program Manager
AMXRM-EE Department of the Army
U.S. Army Toxic and Hazardous Materials Agency
Building 4460
Aberdeen Proving Ground, Maryland 21010-5401

Re: Rocky Mountain Arsenal
(RMA), Task 10, Draft Final
Contamination Assessment
Report, Sanitary Sewer,
Railyard and Administration
Area, January, 1988.

Dear Colonel Quintrell:

We have reviewed the above referenced report and have the
enclosed comments from our contractor. Our contact on this
matter is Mr. Connally Mears at (303) 293-1528.

Sincerely yours,


Robert L. Duprey, Director
Hazardous Waste Management
Division

Enclosure

cc: Thomas P. Looby, CDH
David Shelton, CDH
Lt. Col. Scott P. Isaacson
Chris Hahn, Shell Oil Company
R. D. Lundahl, Shell Oil Company
Thomas Bick, Department of Justice
David Anderson, Department of Justice
Preston Chiaro, EBASCO

RESPONSES TO COMMENTS OF U.S. ENVIRONMENTAL PROTECTION AGENCY
ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER-RAILYARD AND ADMINISTRATION AREAS

Comment 1: Page 29, Last Paragraph and Page 32, Follow-on Investigations.
Although sampling was conducted at "worst case" manholes, the possibility that "considerable infiltration" may have taken place due to the "poor condition" of the line (page 29, third paragraph) necessitates that more sampling be conducted underneath broken and leaking sections of the line. This contention is based on the discovery of chloroacetic acid and/or dibromochloropropane in grab samples from the line sediments (manholes R29, H3, and G5). Therefore, it is recommended that during the feasibility study samples be collected under damaged portions of the line. Also, because their presence was "not anticipated" further historical research should be conducted to locate the sources of pesticides in the line.

Response: The primary issue raised by this comment is whether contaminants potentially within the sewer have exfiltrated to the surrounding soils. Chloroacetic acid was found in grab samples from Manholes H2, R29, and 65. Chloroacetic acid is highly soluble in water and was therefore most likely a recent addition to the sewer system. If this compound was present previously it would have been washed away by the flow in the sewer. It is not likely that additional investigations will identify this compound outside of the sewer unless the pipe is leaking at the time of sampling.

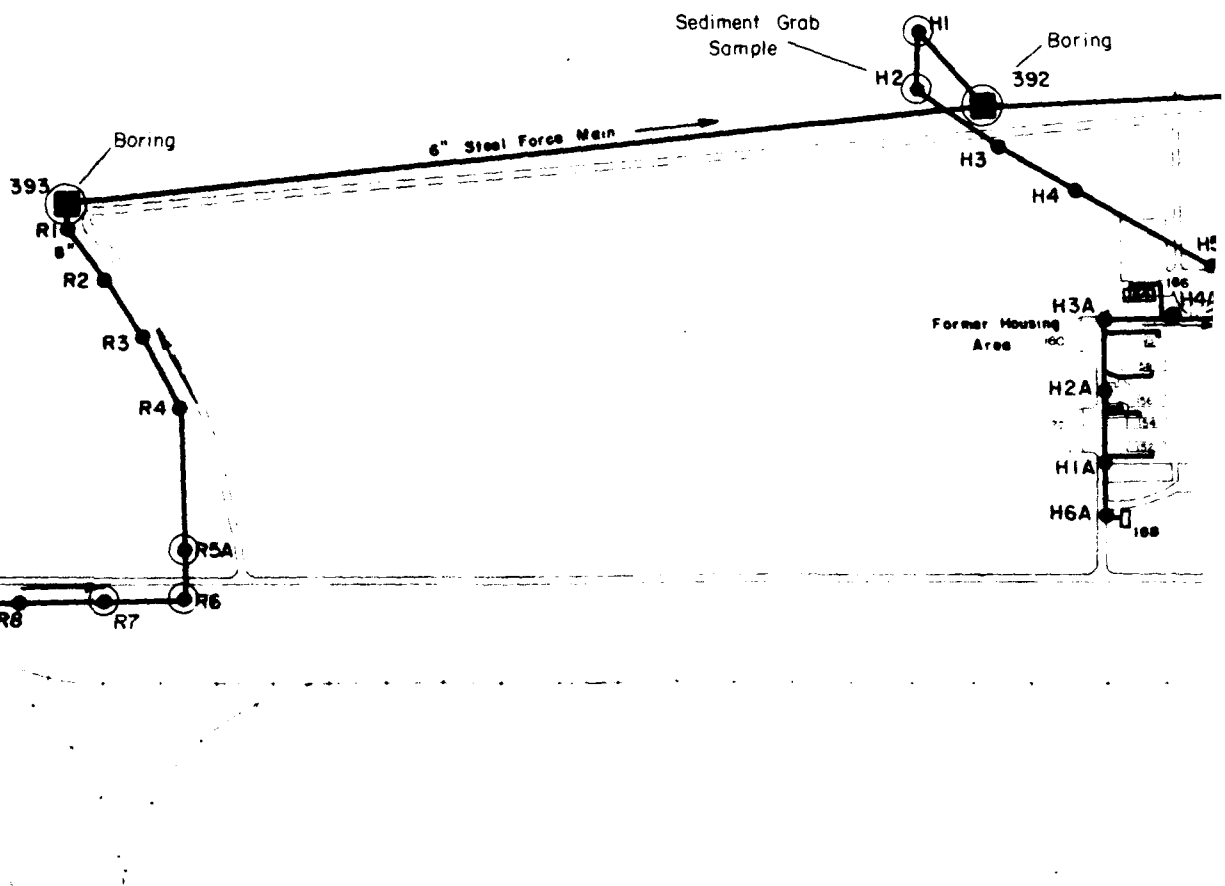
Dibromochloropropane was found in grab samples from Manholes 50 and 65 in the administration area. This compound is less water soluble and therefore much more likely to still exist in areas where it was found.

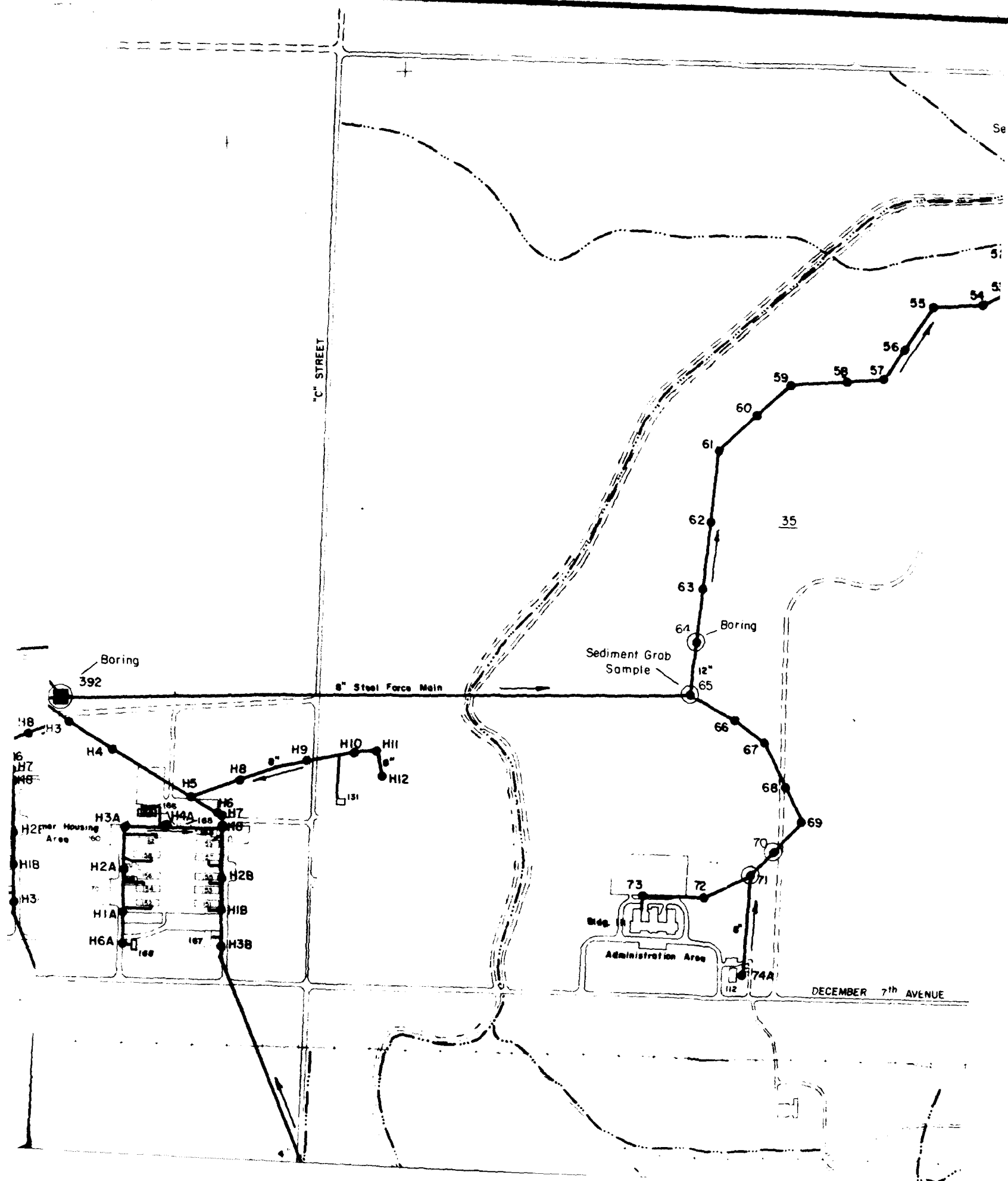
A follow-on investigation has been recommended if the Feasibility Study determines that additional information on the migration of dibromochloropropane from the sewer is needed. It has also been recommended that the samples be analysed for chloroacetic acid to determine if it is present in the soils surrounding the pipe. Sections 3.2.5 and 3.3 have been changed accordingly.

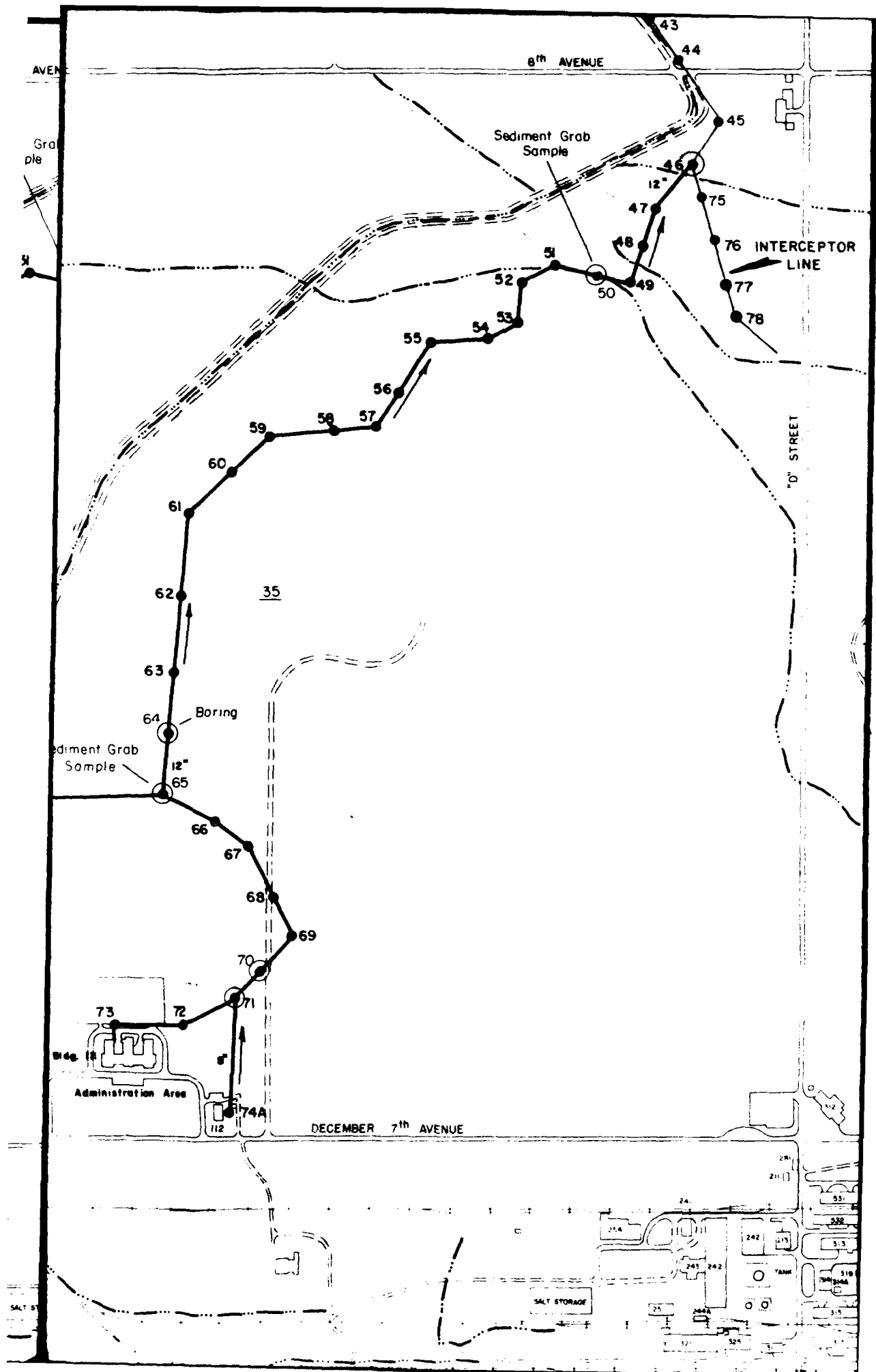
RESPONSES TO COMMENTS OF COLORADO DEPARTMENT OF HEALTH
ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

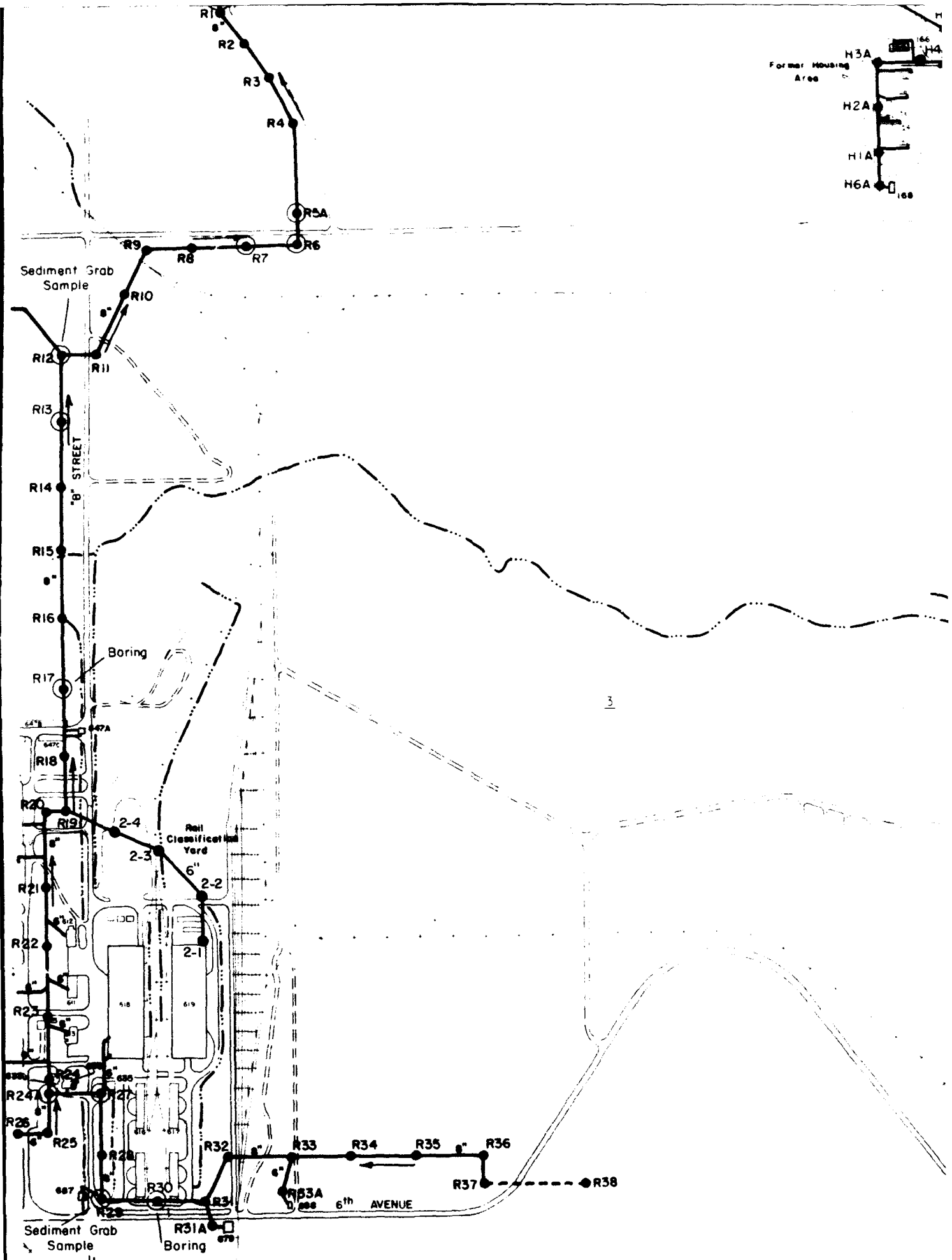
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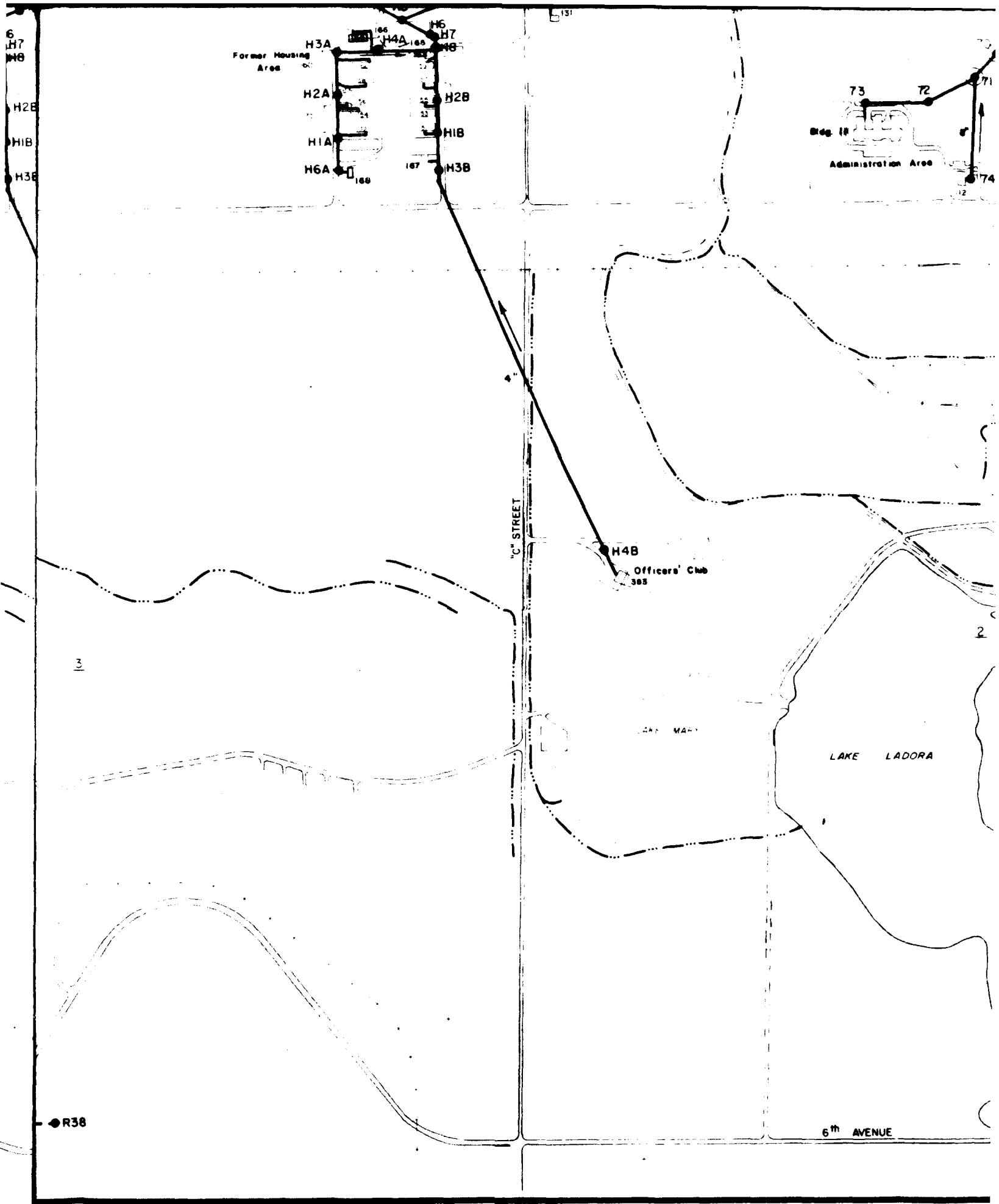
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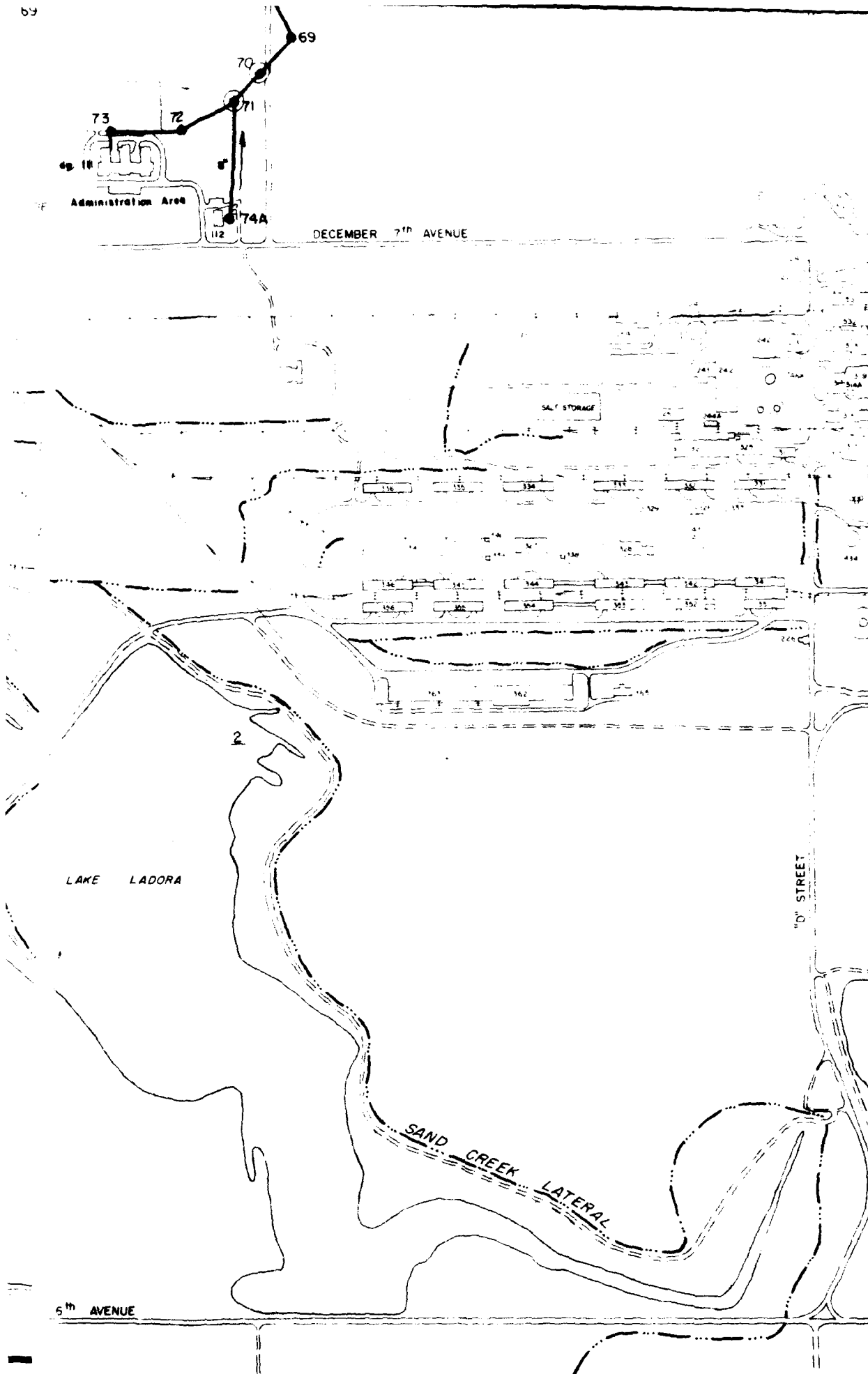












After CIB, 984, DGA, 972,
WR & SK, 1942a, WR & SK,
1942b, WR & SK, 1942c.

ROCKY MOUNTAIN ARSENAL
LOCATION

	22	23	24	19	20
28	27	26	25	20	29
33	34	35	36	31	32
4	3	2	1	6	5
9	11	12	7	8	



0 300 600
FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground,
Maryland
By Ebasco Services Incorporated

PLATE SS-RA-1

Vicinity Map Showing
Manhole and Sampling
Locations

Rocky Mountain Arsenal, Task 10

Drafted: 6/17/87

AD-A272 093

CONTAMINATION ASSESSMENT REPORT SANITARY SEWER
RAILROAD AND ADMINISTRATION AREAS VERSION 32(U) EBASCO
SERVICES INC NEW YORK AUG 88 RPA-88256R83

2/2

UNCLASSIFIED

DAK11-84-D-0017

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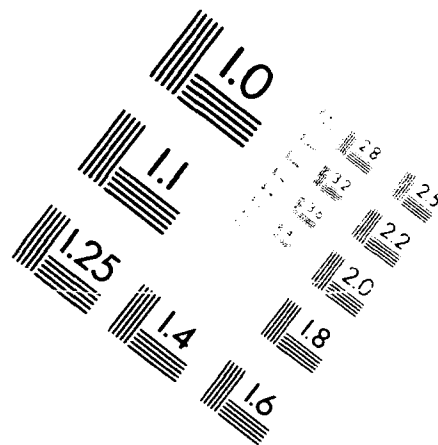
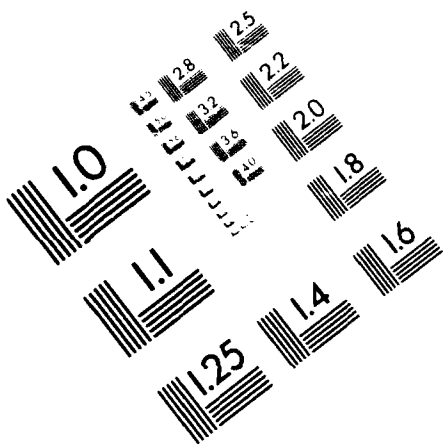


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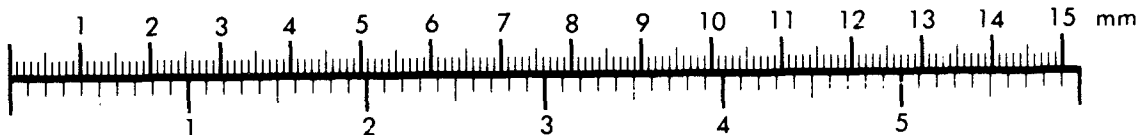
Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910

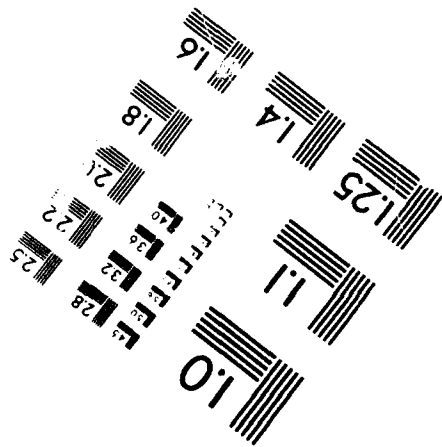
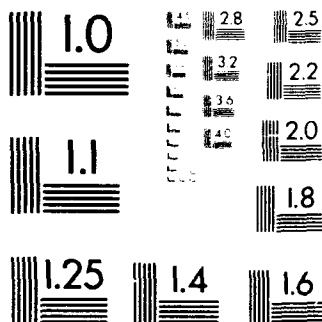
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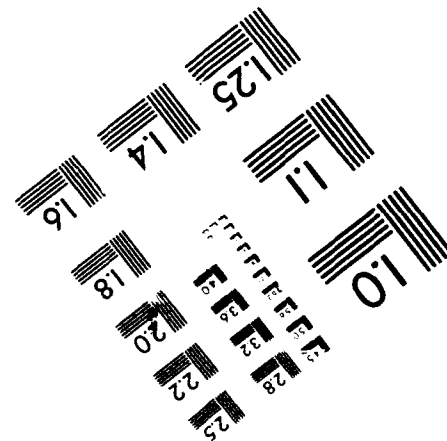
Centimeter

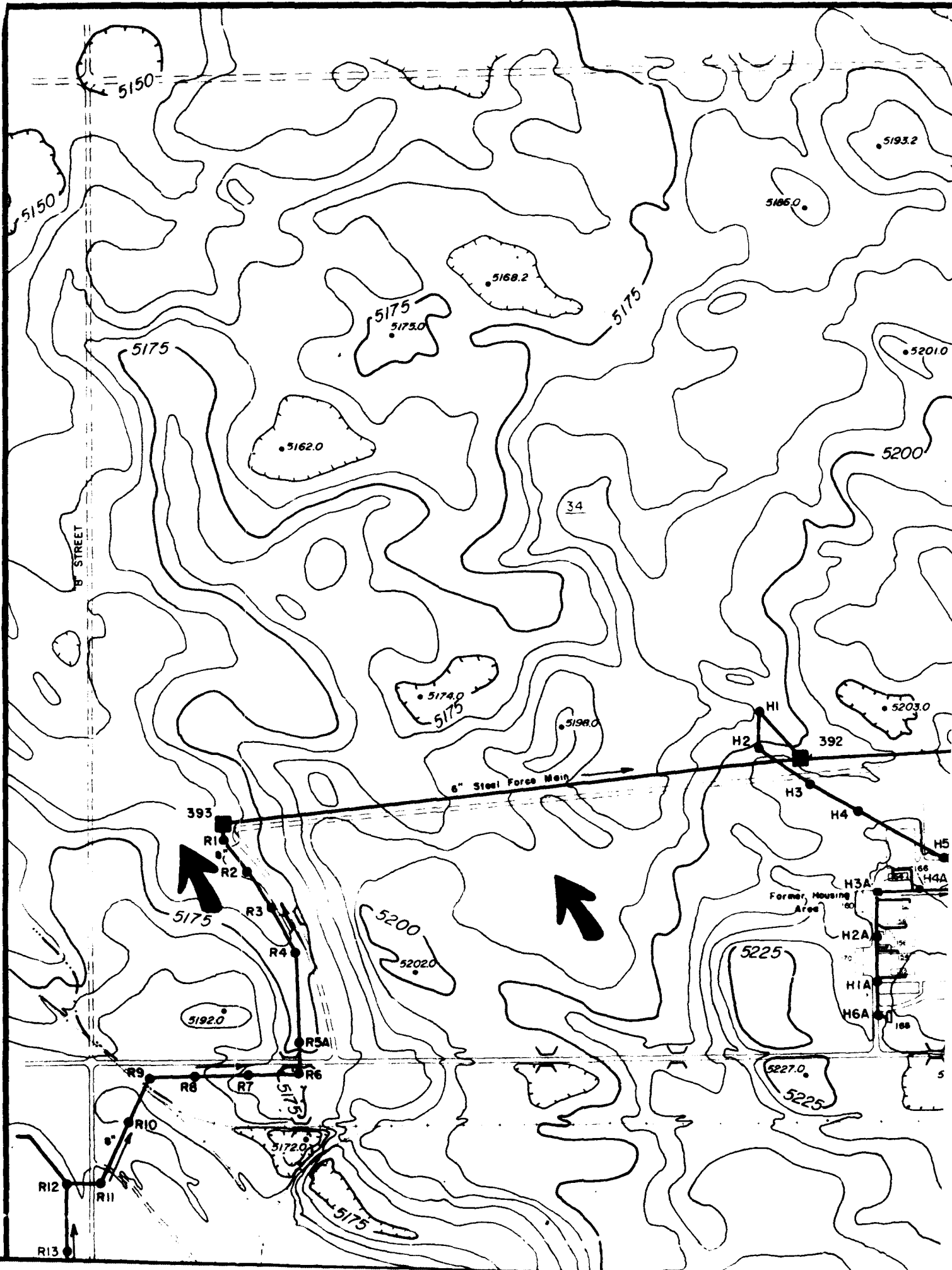


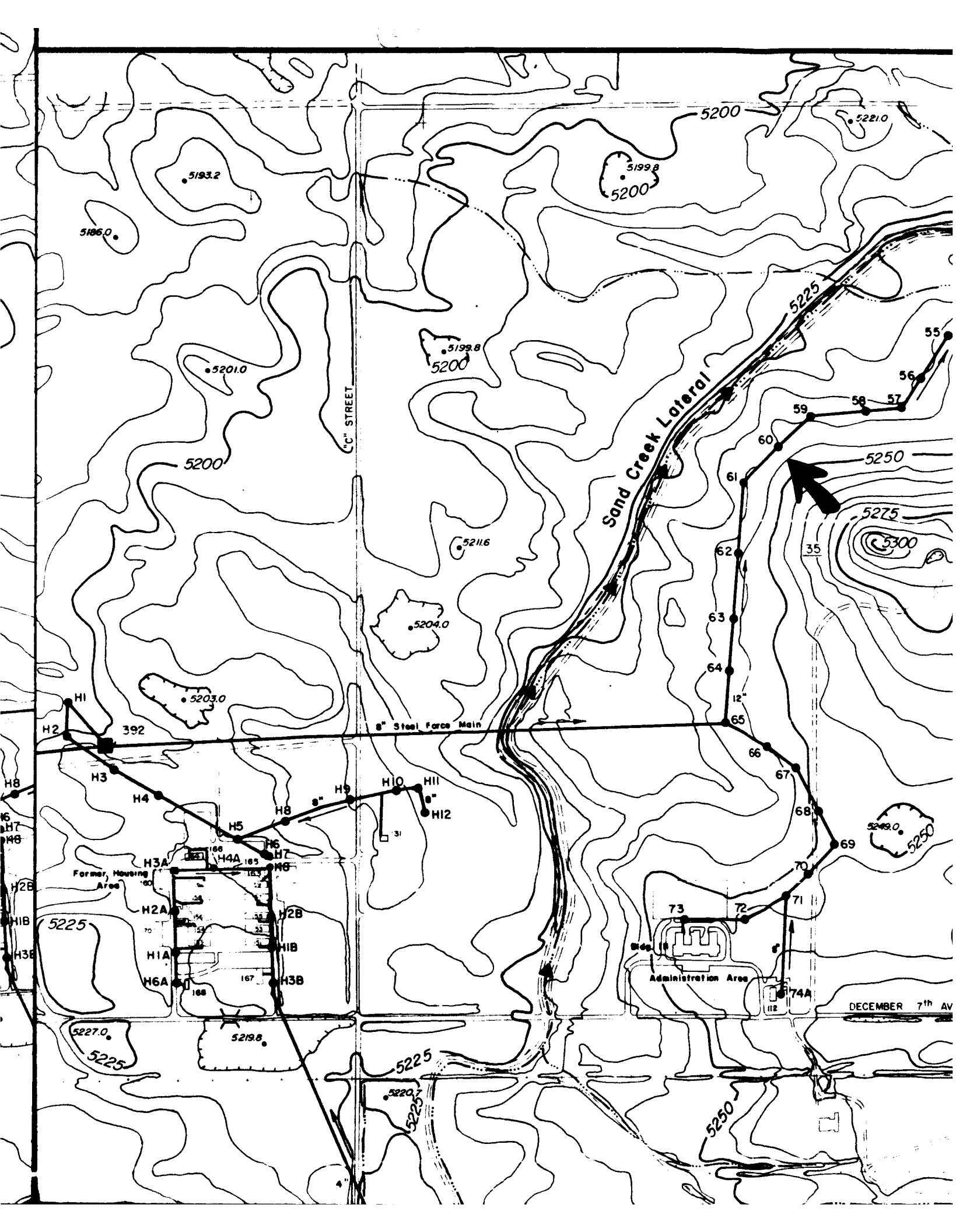
Inches

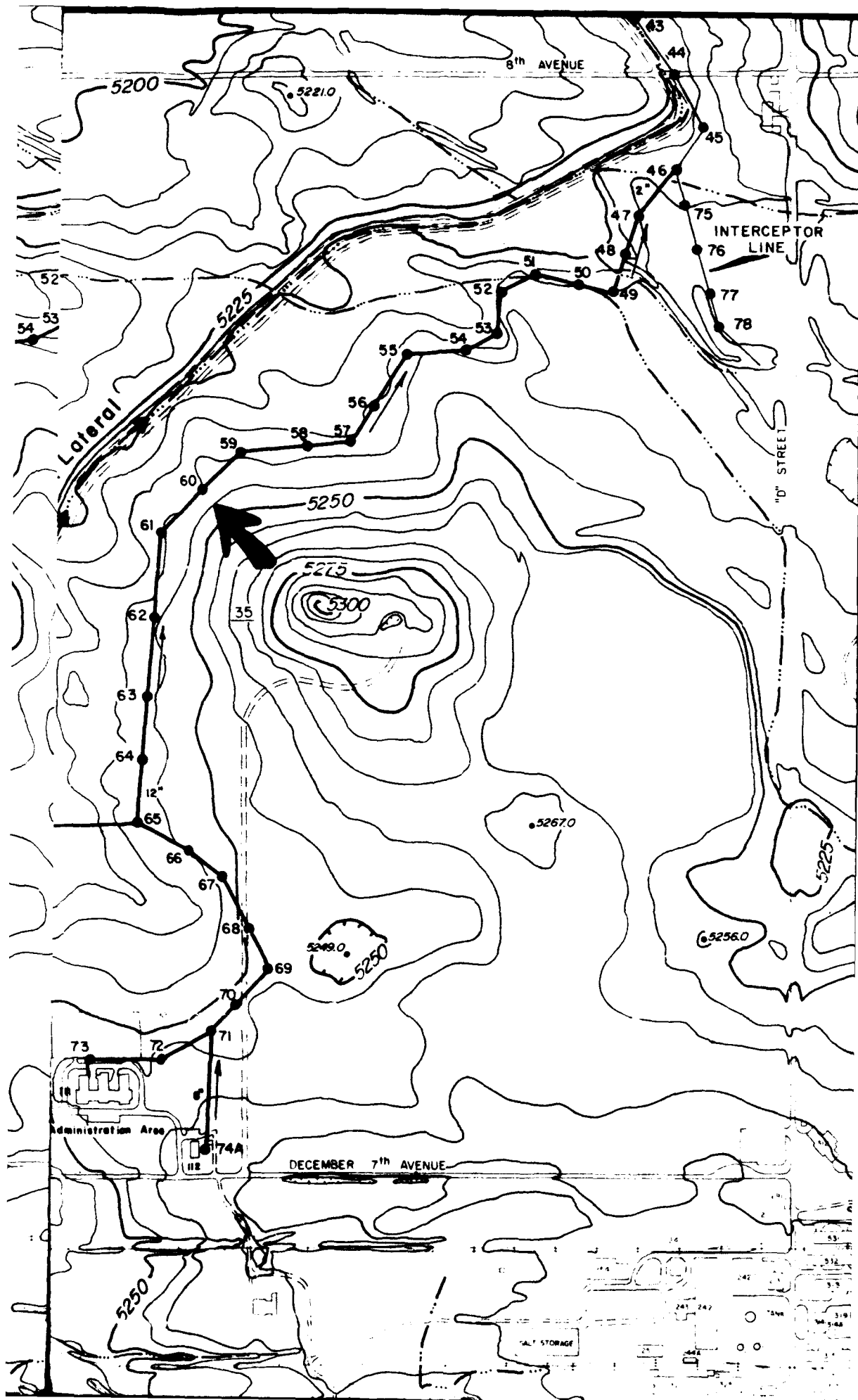


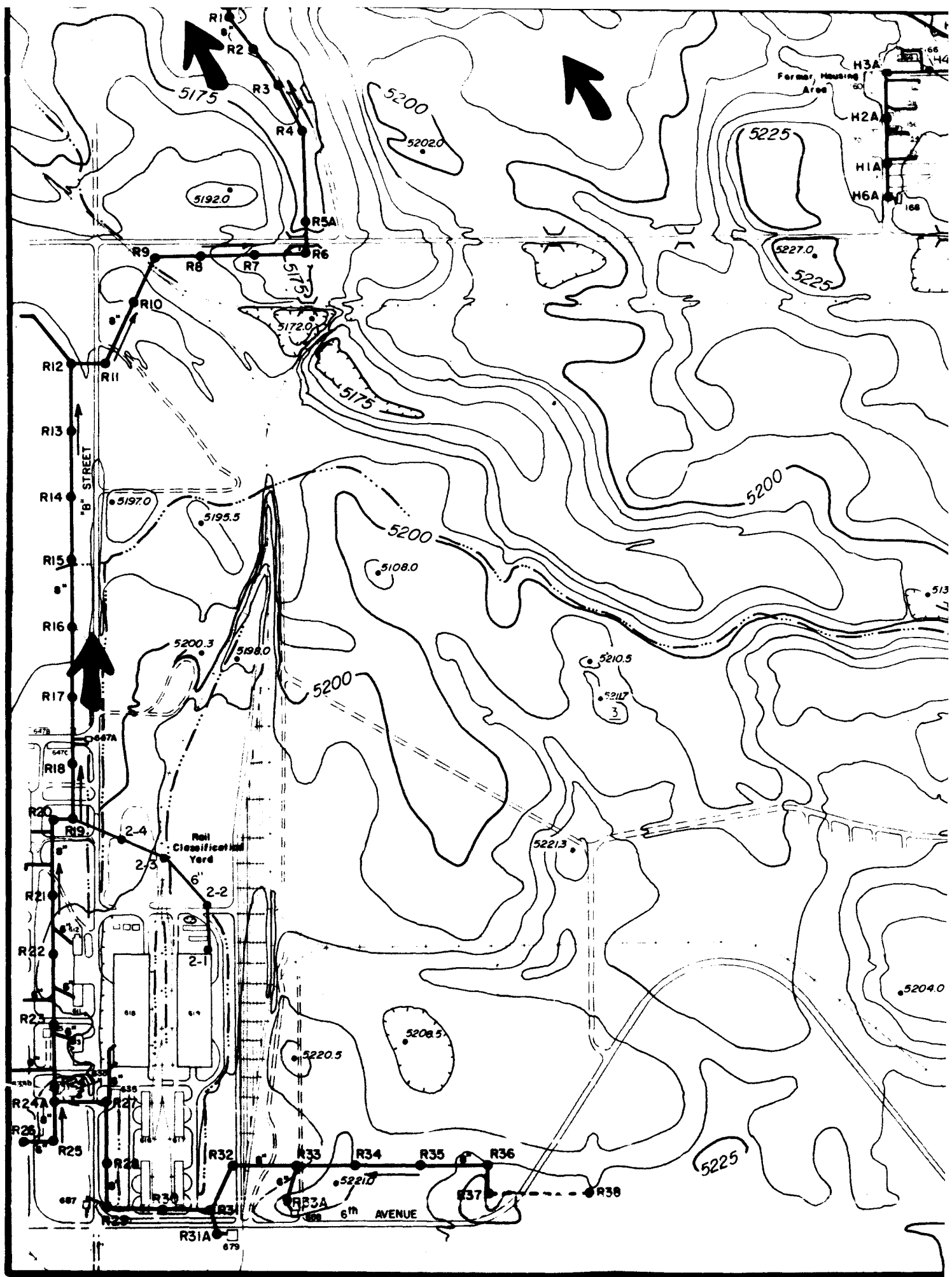
**MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.**

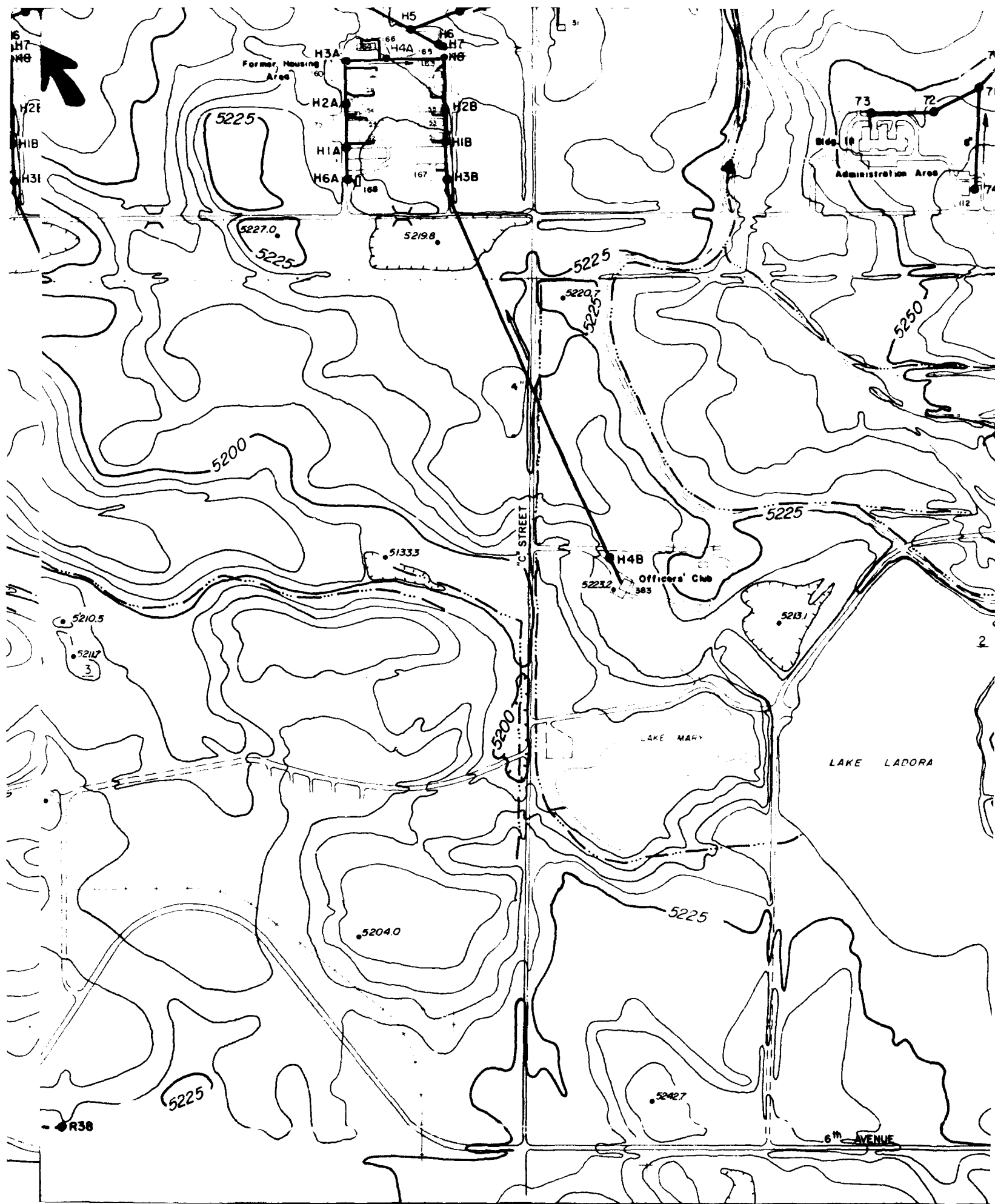








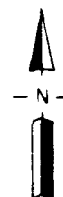






Contour Interval is 5 Feet

After : COE, 1984



0 300 600
FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground,
Maryland

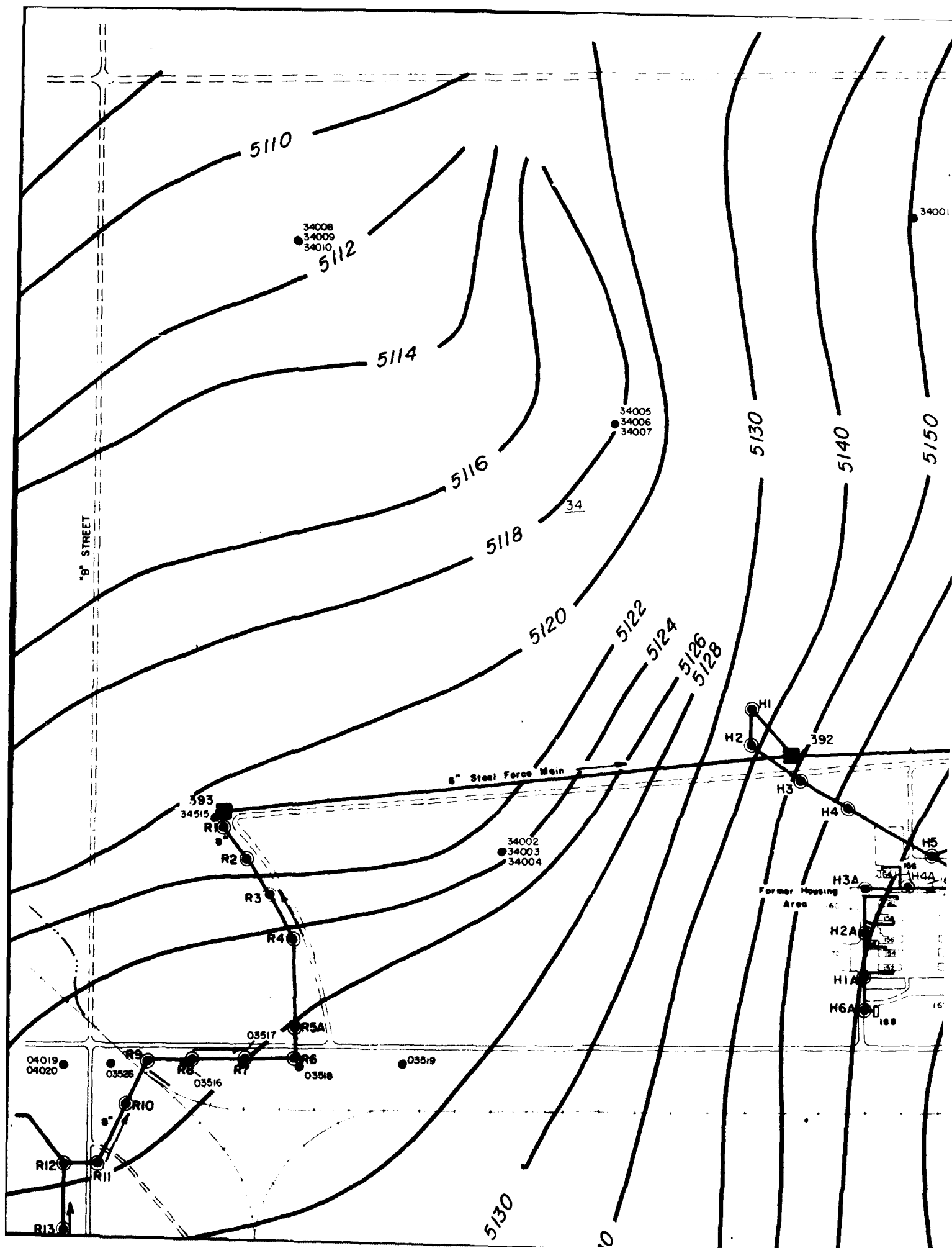
By: Ebasco Services Incorporated

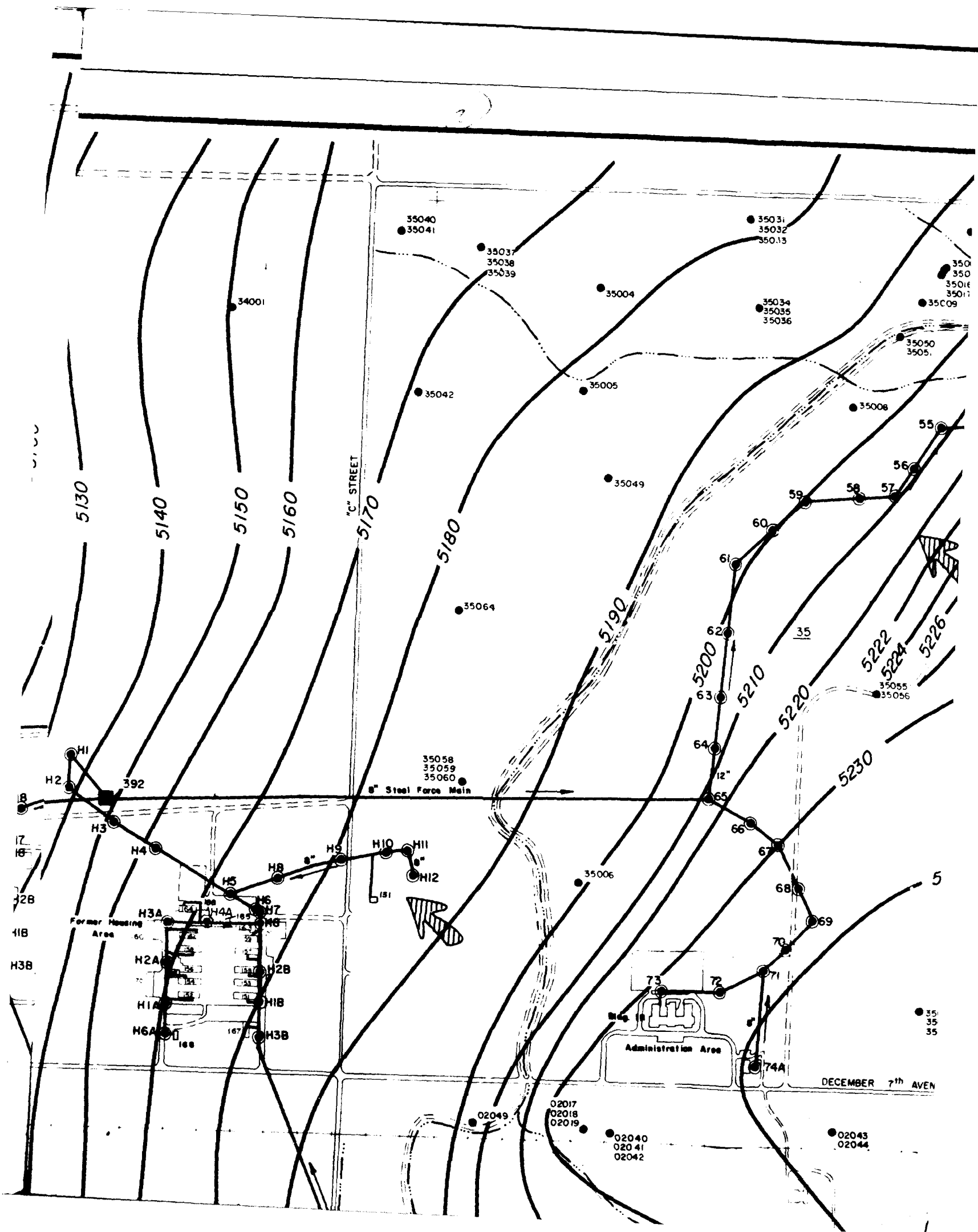
PLATE SS-RA-2

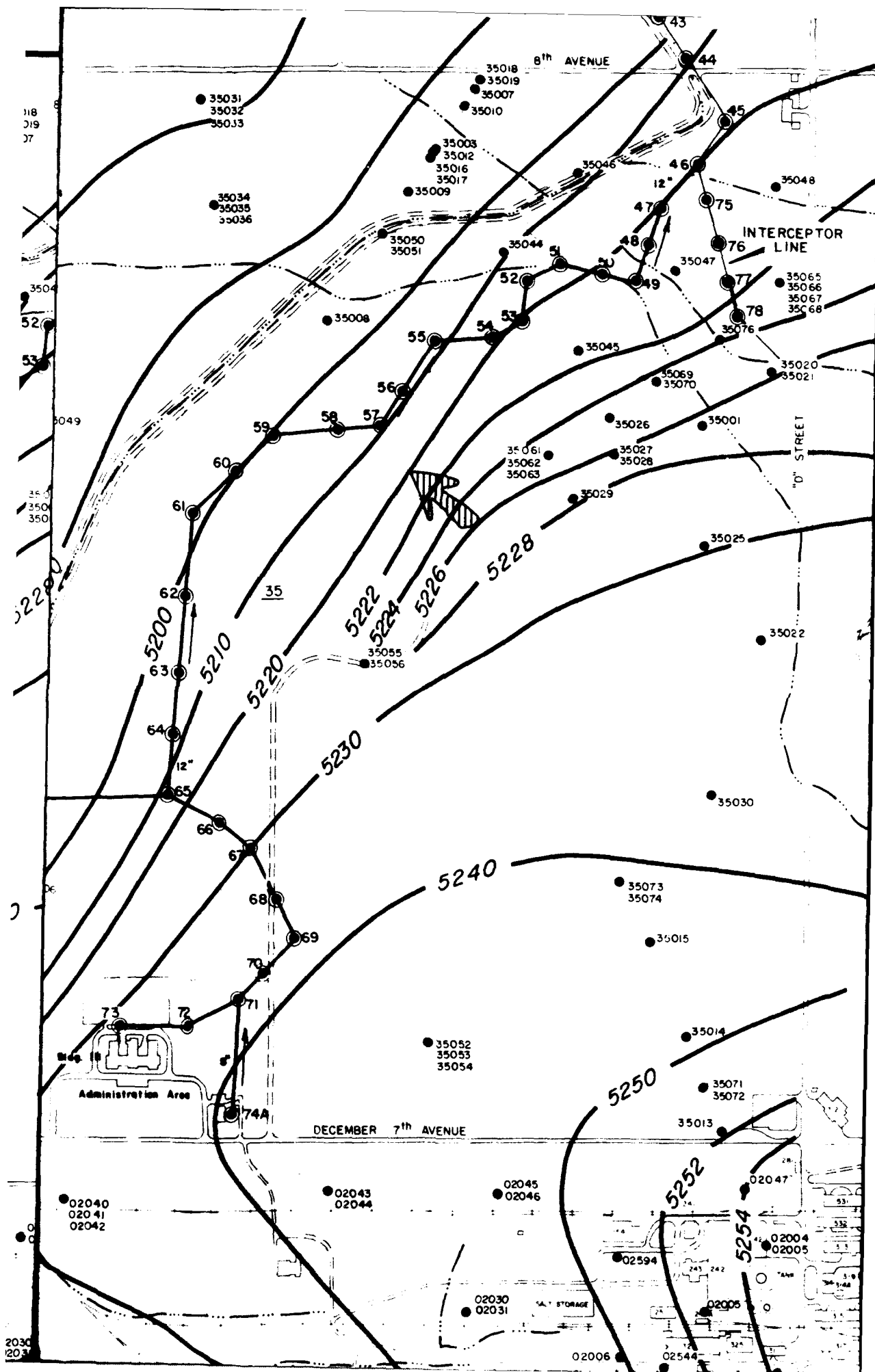
Topography and Surface
Drainage

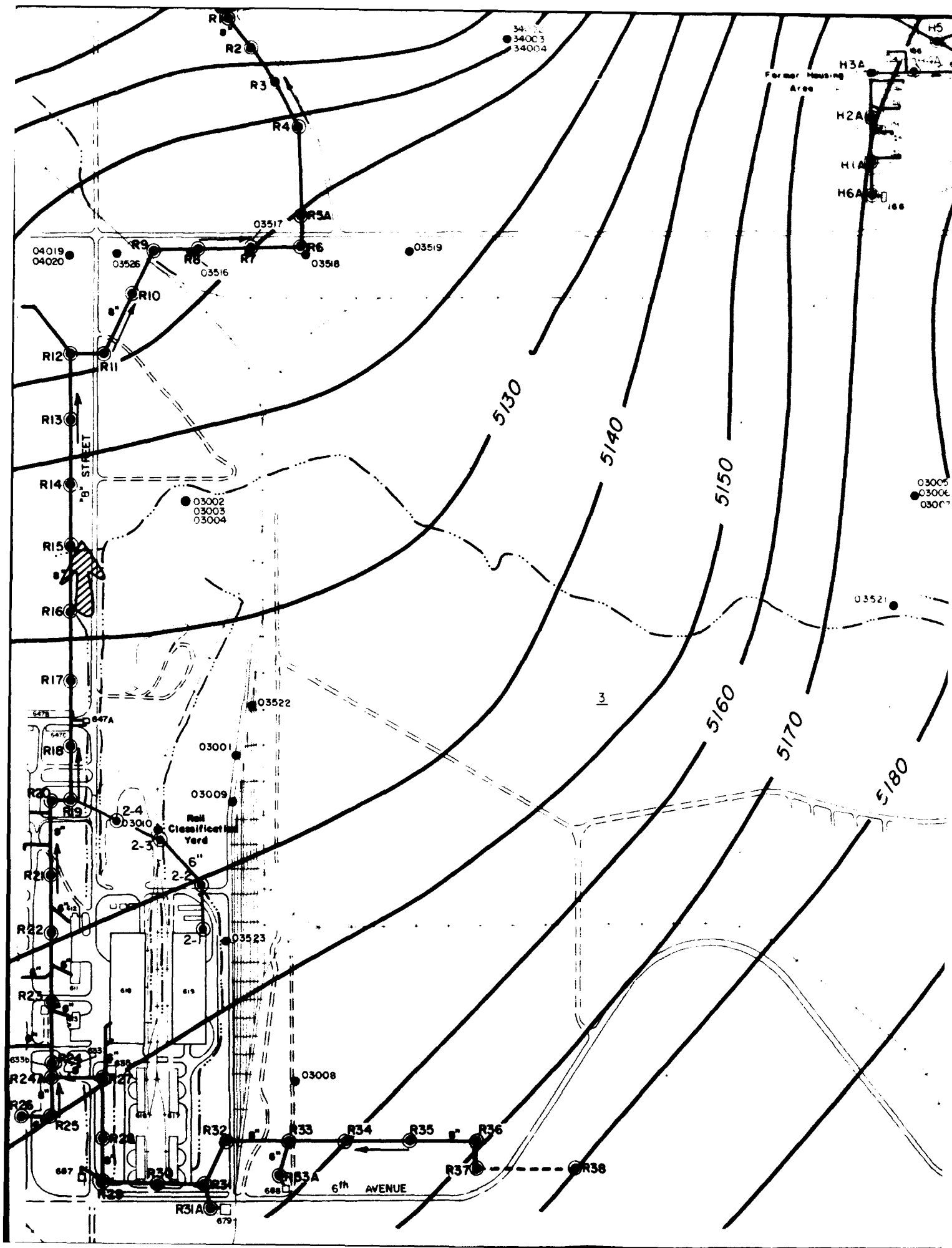
Rocky Mountain Arsenal, Task 10

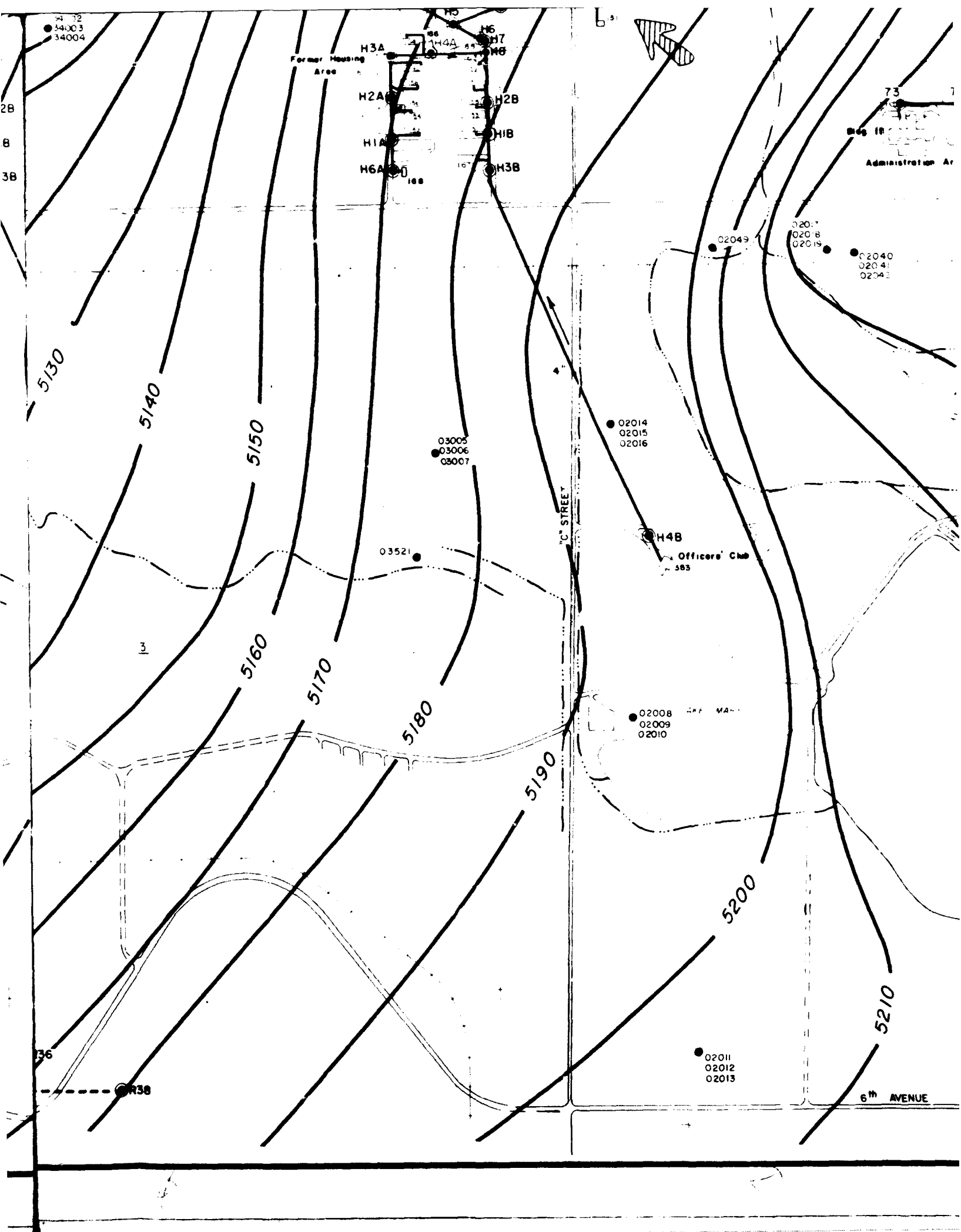
Drafted: 6/17/87











"R" STREET

34

LS0001

0-1	Cu 48
	Hg 0.42
	Pb 38
	Zn 87
4-5	BIL

393

R1

R2

R3

R4

R5A

R6

R8

R7

R9

R10

R12

R11

R13

7.2	Cu 35
	Hg 0.25
	Pb 99
	Zn 97

LS0002

0-1	Cu 57
	Hg 1.1
	Pb 43
	Zn 89
4-5	BIL

5.2	CLC ₂ A	63
	Cr	50
	Cu	40
	Pb	700
	Zn	120

H1

H2

392

H3

H4

H5

H3A

H2A

H1A

H6A

Former Housing Area

166

V14A

16

166

6" Steel Force Main

"C" STREET

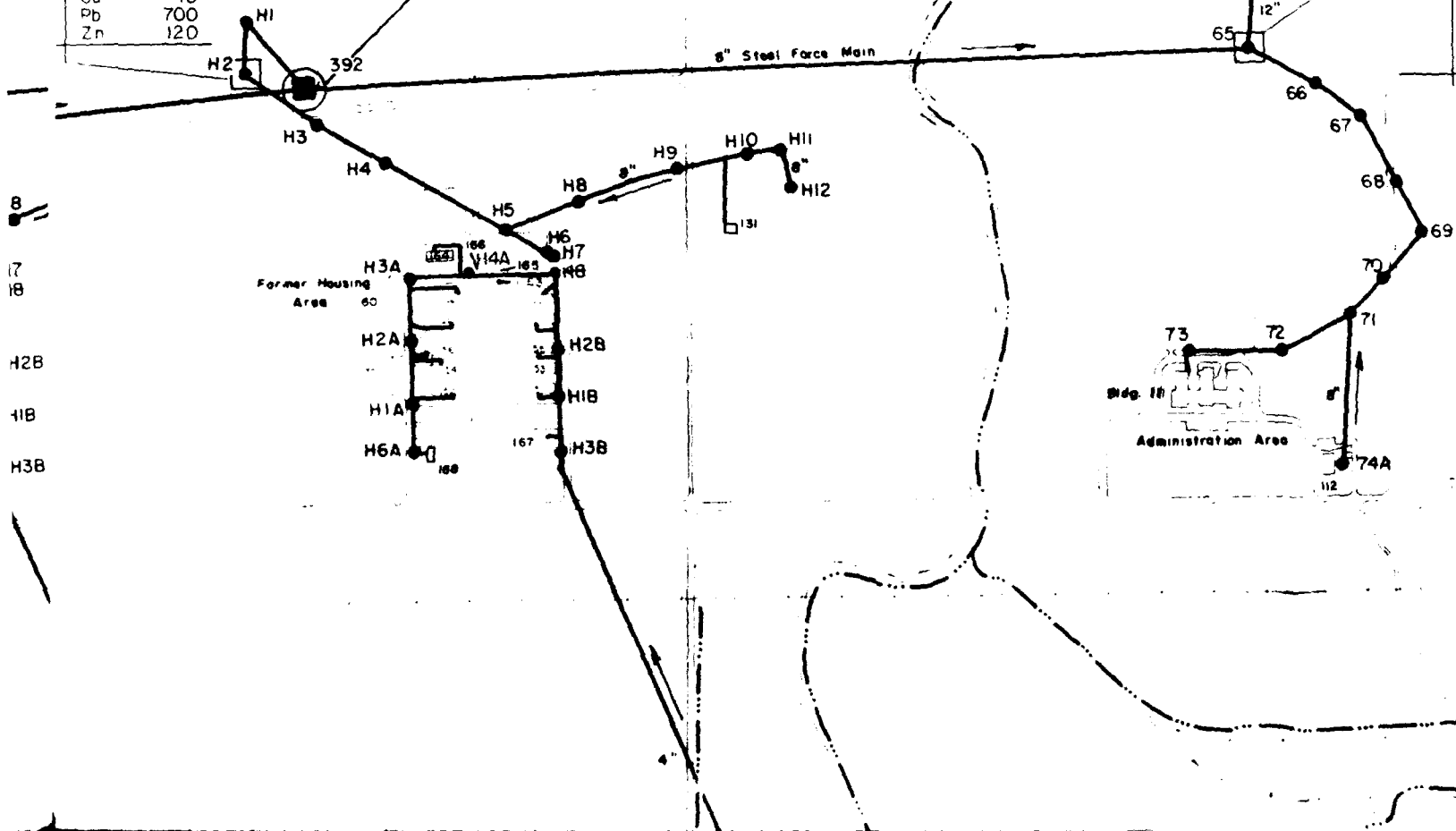
LS0002

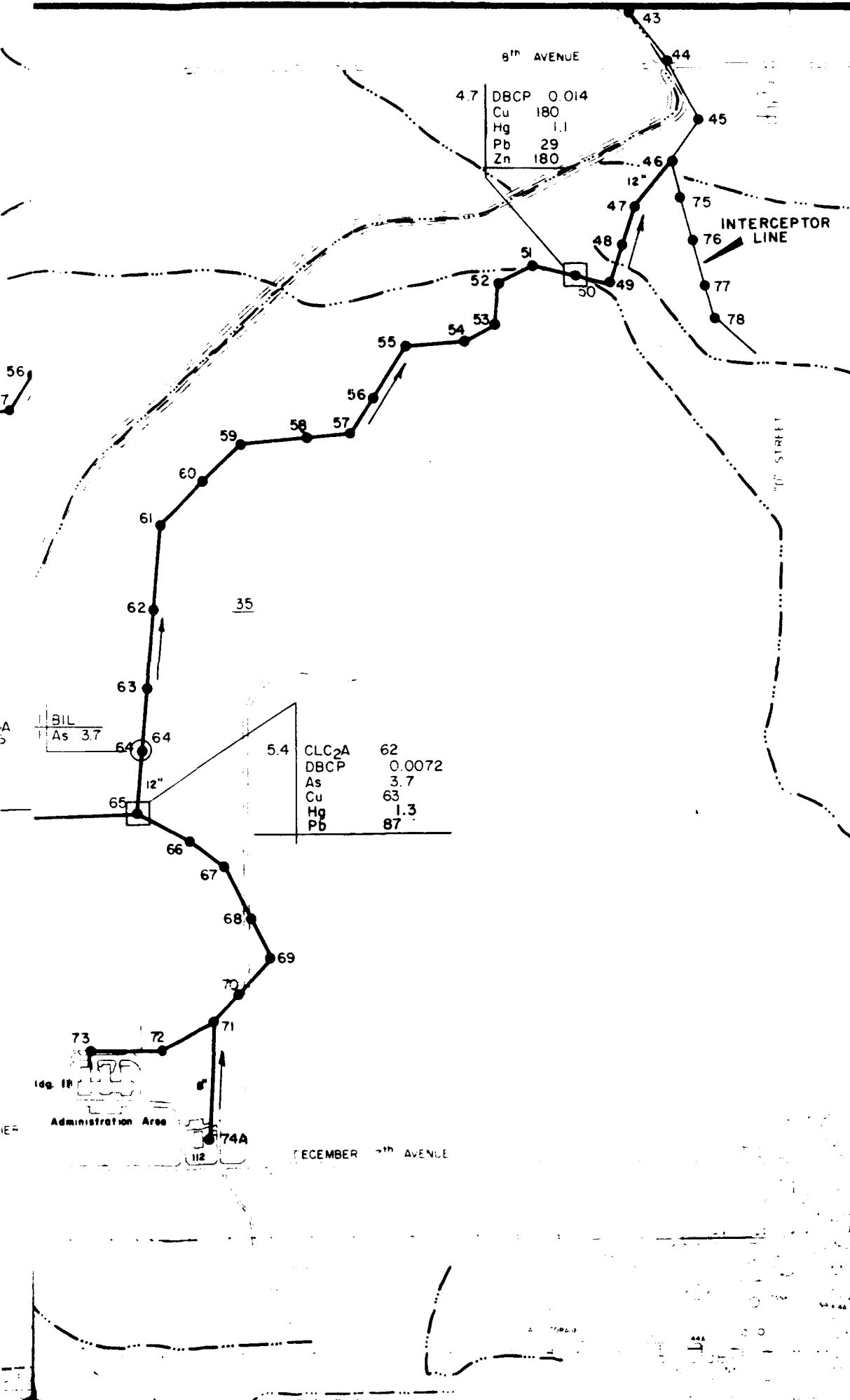
0-1	Cu 57
	Hg 1.1
	Pb 43
	Zn 89
4-5	BIL

CLC ₂ A	63
Cr	50
Cu	40
Pb	700
Zn	120

4.1-5.1	BIL
8.1-9.1	As 37

8" Steel Force Main



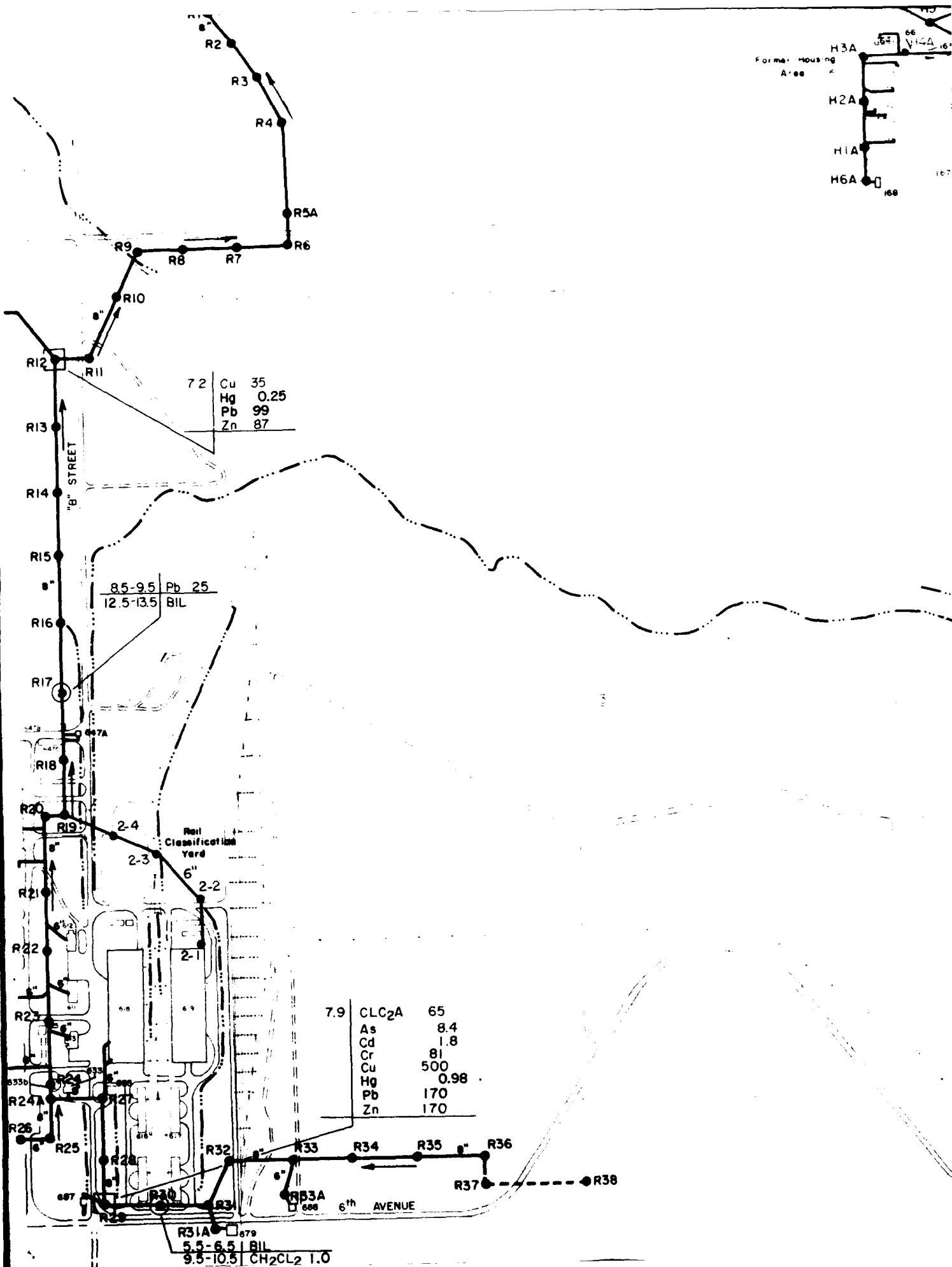


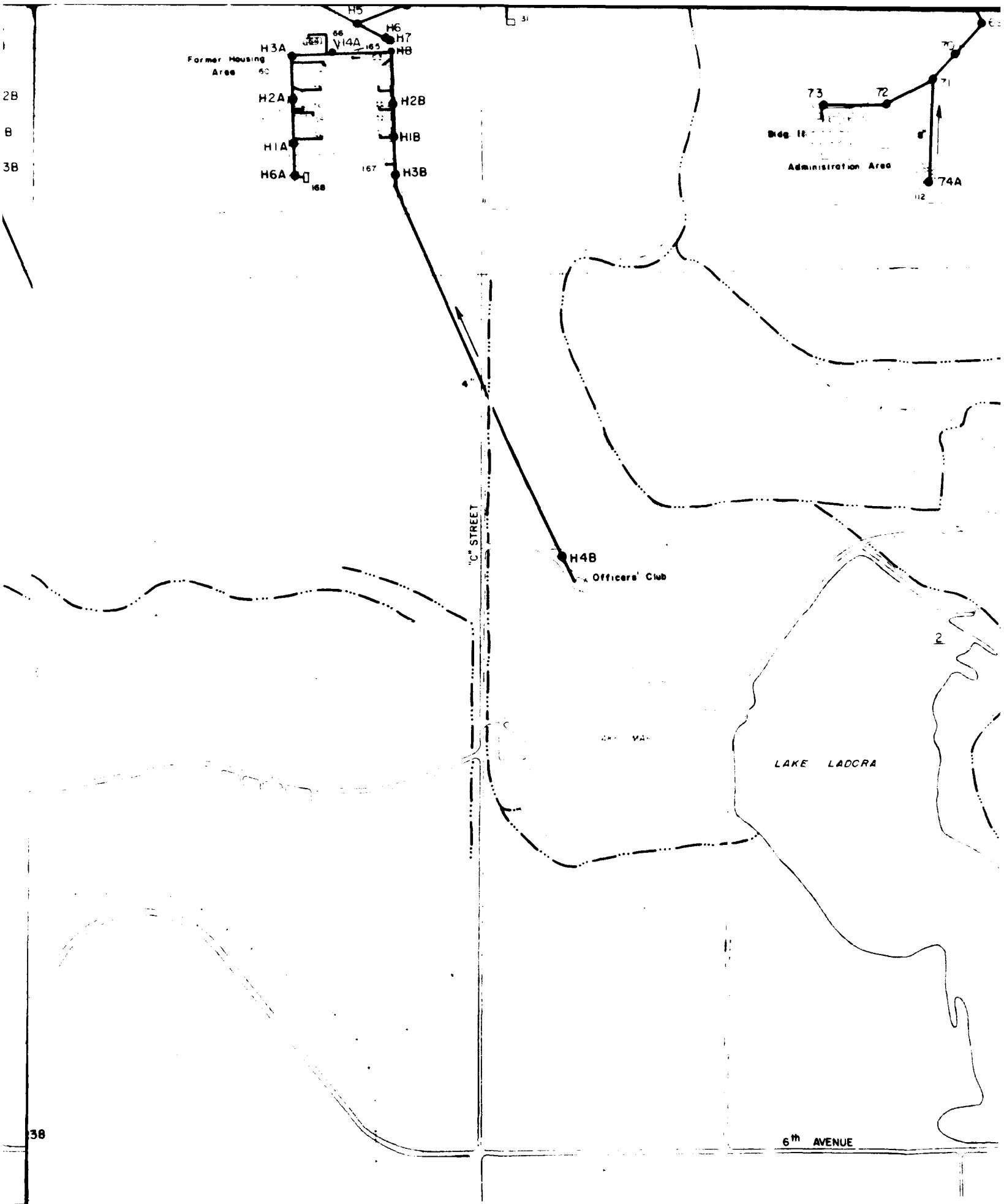
LEGEND

- Building, Existing
- Building, Removed
- Road, Paved
- Road, Unpaved
- 24 Section Number
- Railroad
- Stream or Drainage Ditch
- 10" Sewer Main, with Size
- Sewer Main, Abandoned
- Boring Sample Site
- Sediment Grab Sample Site
- Lift Station
- H3 Manhole, with Number

Sample Interval (ft) Analyte
 8.5-9.5 Pb 2.5 Level (ug/g)

- CH₂CL₂ - Methylene chloride
- CLC₂A - Chloroacetic acid
- DBCP - Dibromochloropropane
- As - Arsenic
- Cd - Cadmium
- Cr - Chromium
- Cu - Copper
- Hg - Mercury
- Pb - Lead
- Zn - Zinc
- BIL - Below Indicator Level





Former Housing Area

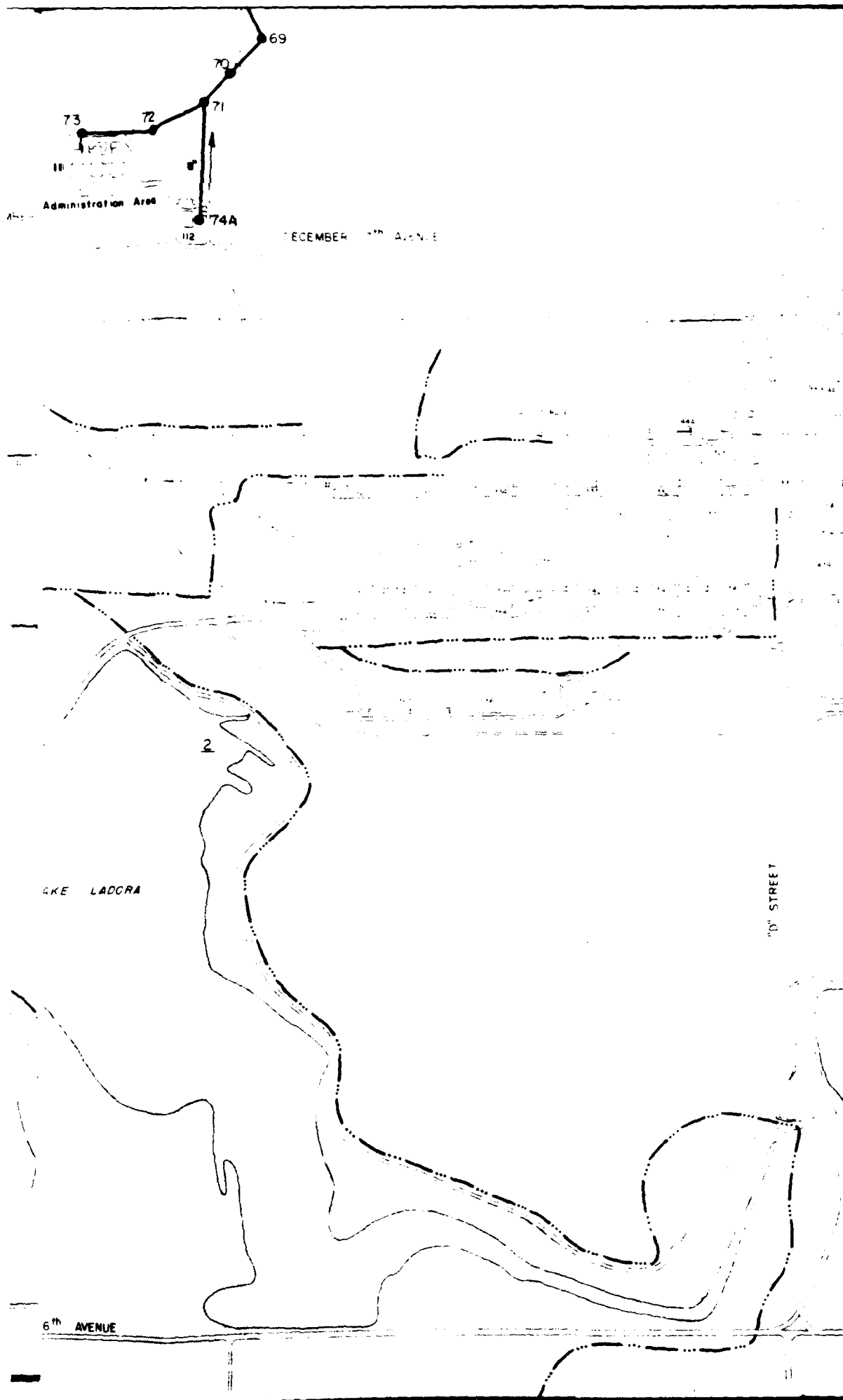
Administration Area

Officers' Club

LAKE LADCRA

6th AVENUE

"C" STREET



USCIS - Environmental Monitoring

As - Arsenic

Ba - Barium

Cr - Chromium

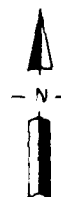
Cu - Copper

Hg - Mercury

Pb - Lead

Zn - Zinc

BIL - Below Indicator Level



0 300 600
FEET

Prepared for:

Program Manager's Office for
Rocky Mountain Arsenal Cleanup
Aberdeen Proving Ground,
Maryland

By: Ebasco Services Incorporated

PLATE SS-RA-4

Analytes Detected Within
or Above Indicator Levels

Rocky Mountain Arsenal, Task 10

Drafted: 6/17/87

(6)