HAZARDOUS
SITE CONTROL
DIVISION

# Remedial Planning/ Field Investigation Team (REM/FIT)

## ZONE II

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CH2M HILL
Ecology & Environment

EPA 908-K-85-001

HARRIMAN PARK ENVIRONMENTAL
INVESTIGATION INTERPRETATIVE REPORT

PRELIMINARY ASSESSMENT AND
SITE INSPECTION

SOUTH JEFFERSON COUNTY, COLORADO
TDD R8-8411-13

# HARRIMAN PARK ENVIRONMENTAL INVESTIGATION INTERPRETATIVE REPORT

## PRELIMINARY ASSESSMENT AND SITE INSPECTION

SOUTH JEFFERSON COUNTY, COLORADO
TDD R8-8411-13

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DATE SUBMITTED: MARCH 22, 1985

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## 1.0 INTRODUCTION

This report has been prepared to describe the results of the Region VIII Environmental Protection Agency's environmental investigation of the Harriman Park - Friendly Hills community, located in south Jefferson County, Colorado. This investigation was initiated by EPA at the request of local citizens in the community, hereafter referred to as Harriman Park. EPA undertook this investigation under its authority under the Comprehensive Environmental Response, Compensation and Liability Act (Superfund).

The investigation was directed by EPA staff scientists in conjunction with scientists from the EPA Field Investigation Team, (FIT), Ecology and Environment, Inc. The objective of the investigation was to determine the presence (if any) of environmental contaminants in the study area, with particular emphasis on locating any source(s) of hazardous wastes. A parallel investigation was conducted by EPA Radiation Programs staff to determine the presence, (if any) of unusual radioactivity in Harriman Park. This report summarizes the Superfund portion of the study.

The field investigations commenced on September 7, 1984 and continued until December 2, 1984. Officials from the Jefferson County Health Department and the Colorado Department of Health provided support to various aspects of the study. The field investigations consisted of a large-scale multimedia monitoring program for hazardous substances, as well as investigations of reports of illegal dumping activities and other miscellaneous complaints.

Due to the large analytical requirements, five laboratories participated in the analyses of the data, and normal delays were experienced in receiving the analytical data. In spite of these delays, the Environmental Protection Agency has expended every feasible effort to expedite analytical results and scientific interpretation of the data.

The report is organized to include sections on site location and history, information on the environmental setting of Harriman Park, the approach to the sampling activities, presentation of the analytical data and interpretation of the results. Sections are also provided discussing conclusions from the study and recommendations for community residents.

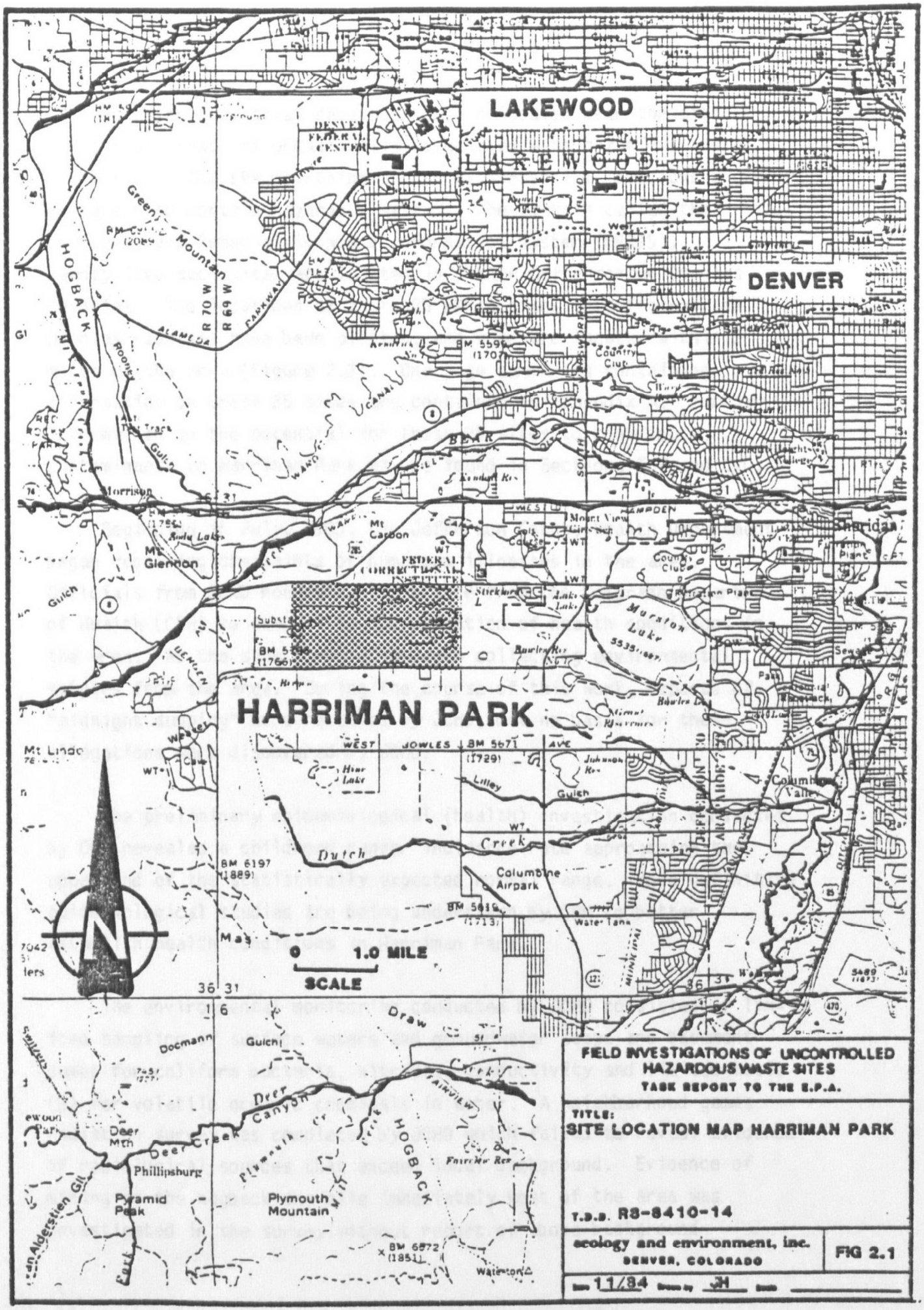
## 2.0 SITE LOCATION AND HISTORY

Figure 2.1 shows the location of the Harriman Park - Friendly Hills neighborhood and the boundaries of the immediate study area. The neighborhood as identified in the figure contains about 800 acres and approximately 8000 residents. These subdivisions are located in Sections 7 and 8, T5S, R69W of unincorporated Jefferson County and were developed approximately eight years ago. Examination of a 1968 aerial photograph indicates the lands were used for agriculture prior to development. The neighborhood is located approximately 0.5 miles east of the foothills of Turkey Creek Canyon of the Front Range of the Rocky Mountains.

Locational and historical data for Harriman Park were evaluated and found to be important background information for the environmental investigation and for the interpretation of the results. Locational characteristics include information on area water supplies and industrial developments. Recent historical data include preliminary data on health studies conducted by the Colorado Department of Health (CDH) and environmental studies conducted by the Jefferson County Health Department (JCHD).

Jefferson County Health Department has reported the occurrence of historic sewer line breaks in the area. Water and sewer services are provided by Lakehurst Water and Sanitation District and Willowbrook Water and Sanitation District. JCHD sampling revealed nitrate-nitrogen ($NO_3$-N) concentrations in a few sumps and basements which they attributed to past sewer line breaks and/or agricultural activities.

Drinking water to both districts is provided by the Denver Water Department, via Lakehurst Water and Sanitation District in the northern portion of the study area and Willowbrook Water and Sanitation District in the southern portion.




FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

TASK REPORT TO THE E.P.A.

TITLE:
SITE LOCATION MAP HARRIMAN PARK

T.D.S. R8-8410-14

ecology and environment, inc.
DENVER, COLORADO

FIG 2.1

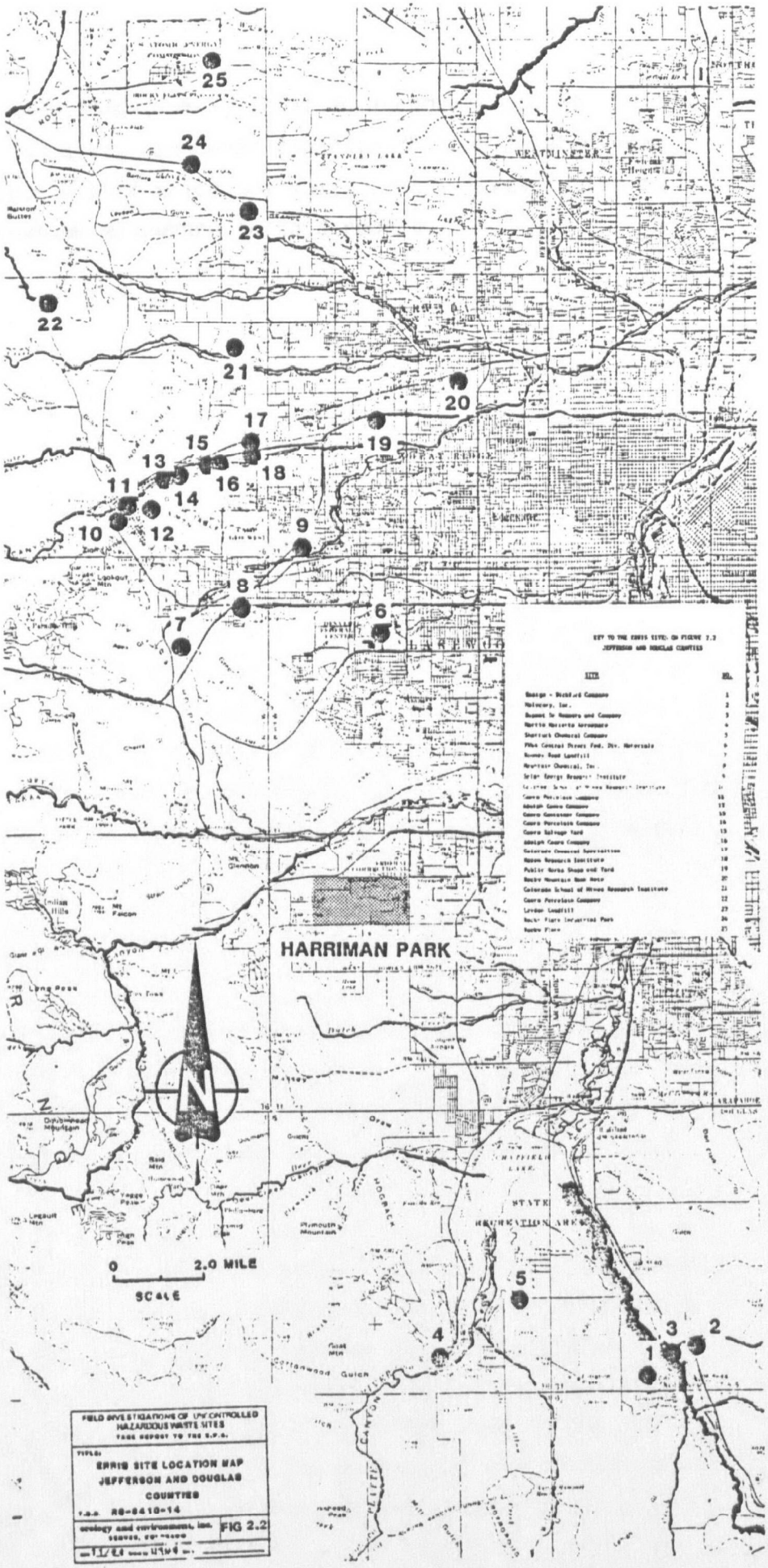
Date 11/84 Drawn by JH Date

No major industrial developments are located near the site. Industrial areas are occasionally associated with hazardous waste activities. The EPA maintains a list of industrial locations known or suspected to contain hazardous wastes. The list is called the Emergency and Remedial Response Information System (ERRIS). Twenty-five such sites are located in either Jefferson or Douglas Counties. The locations of these 25 ERRIS sites in Jefferson and Douglas counties have been plotted, and none are located within 5 miles of the area (Figure 2.2). One page summaries containing information on these 25 sites are contained in Appendix A. Further information on the potential for these 25 sites to contribute contaminants to Harriman Park may be found in Sections 5.3 and 6.0.

Beginning in July, 1983, the Jefferson County Health Department began receiving complaints of numerous illnesses in the area. Officials from JCHD requested assistance from the Colorado Department of Health (CDH) to conduct an investigation of health conditions in the area. At the same time, JCHD began collecting environmental samples from the area. During the course of this work, reports of "midnight dumping" were received by JCHD, but no basis for these allegations were discovered by JCHD.

The preliminary epidemiological (health) investigation conducted by CDH revealed a childhood cancer incidence rate approaching the upper end of the statistically expected normal range. More definitive epidemiological studies are being undertaken by CDH to better establish health conditions in Harriman Park.

The environmental monitoring conducted by JCHD consisted of limited sampling of surface waters and groundwater seeps and basement sumps for coliform bacteria, nitrates, conductivity and limited tests (2) for volatile organic chemicals in water. A neighborhood gamma radiation survey was completed by JCHD which failed to reveal evidence of radiological sources that exceed local background. Evidence of mining on the hogback one mile immediately west of the area was investigated in the survey without report of above-background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KEY TO THE ERRIS SITES ON FIGURE 2.2
JEFFERSON AND DOUGLAS COUNTIES
HARRIMAN PARK
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2.0 MILE
SCALE
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
FINAL REPORT TO THE E.P.A.
TITLE:
ERRIS SITE LOCATION MAP
JEFFERSON AND DOUGLAS COUNTIES
T.O.# R8-8410-14
ecology and environment, inc.
FIG 2.2

readings. Further investigation by local environmental health officials revealed a small, abandoned "homestead" dump located near West Bowles and South Alkire which was subsequently investigated by EPA FIT and is discussed elsewhere in this report.

## 3.0 ENVIRONMENTAL SETTING

EPA-FIT reviewed published reports and conducted field surveys as part of the environmental assessment for Harriman Park. A brief review of the topography, hydrogeology, and soil geology is a necessary part of environmental contamination studies and is used to define potential pathways of contaminant migration to and within the study area. In addition, discussion of site geology sheds light on the occurrence of uranium deposits west of Harriman Park.

### 3.1 Site Topography

Ground topography consists of flat to shallow slopes, sloping less than 5% to the east. The maximum elevation is 5800 feet above sea level on the western edge of the study area. The topographic low is 5400 feet above sea level at the eastern edge of Harriman Park. Local relief of about 450 feet maximum and occurs along the hogback to the west of the Harriman Park development. Shallow slopes reflect the outcropping bedrock formations and normal stream and drainage related erosion east of the hogback.

### 3.2 Regional Geology

The geologic setting of the study area is representative of the foothills of the Colorado Front Range. Three major geologic features are present in addition to the Rocky Mountains west of the study area: the hogback of the Dakota Group, the Denver basin, and the Golden fault.

The Dakota hogback is a sharp-crested ridge consisting of steeply dipping sedimentary beds that were tilted during the late Cretaceous Laramide Orogeny. The Denver basin, upon which the study area resides, is an asymmetrical double-plunging syncline and depositional basin. The deepest part of the basin lies to the west of the basin center near the Rocky Mountains. On the western margin of the basin at the base of the Front Range, beds dip steeply eastward at approximately 40°.

The third geologic feature in the area is the Golden fault shown in Figure 3.1. The Golden fault is a northwest - southeast trending high angle reverse fault. The total amount of displacement is not known, but at its greatest displacement nearly 11,000 feet of stratigraphic section is missing (Berg, 1962). The fault is inferred to be present below the alluvium in the study area where it is either parallel with strike, or grades into a line of squeezed but undisplaced beds. Well logs from two deep oil test holes in the extreme northern portion of the study area near Soda Lakes show the fault as a large anticlinal fold that has a faulted and overturned limb. The stratigraphic section may repeat up to four times in the fault zone (Berg, 1962). The Golden fault is a secondary bedrock controlled fault, not a major structure, significantly affecting topography and drainage.

## 3.3 Site Geology

Figure 3.2 shows the generalized surficial geology in the Harriman Park area. The most abundant surficial units in the Harriman Park development are alluvium and colluvium deposited during the Quaternary period. The deposits are present as thin sheets, pediments, and terraces masking the underlying bedrock units. Table 3.1 describes the general characteristics of the Quaternary and older rock units present in the Harriman Park area.

The youngest mapped bedrock unit in the study area is the undifferentiated Tertiary Denver and Cretaceous Arapahoe Formation. The unit outcrops north of Bowles and west of Kipling streets. An angular unconformity exists between the Denver-Arapahoe Formation and the underlying Upper Cretaceous Laramie Formation. The Laramie varies from sandstone to claystone within the study area. The marine Fox Hills Sandstone comformably underlies and is interbedded with the Laramie Formation. Both units are dipping to the east from 80° to near vertical and form a long topographic high between Simms and Kipling streets on the east side of Harriman Park.

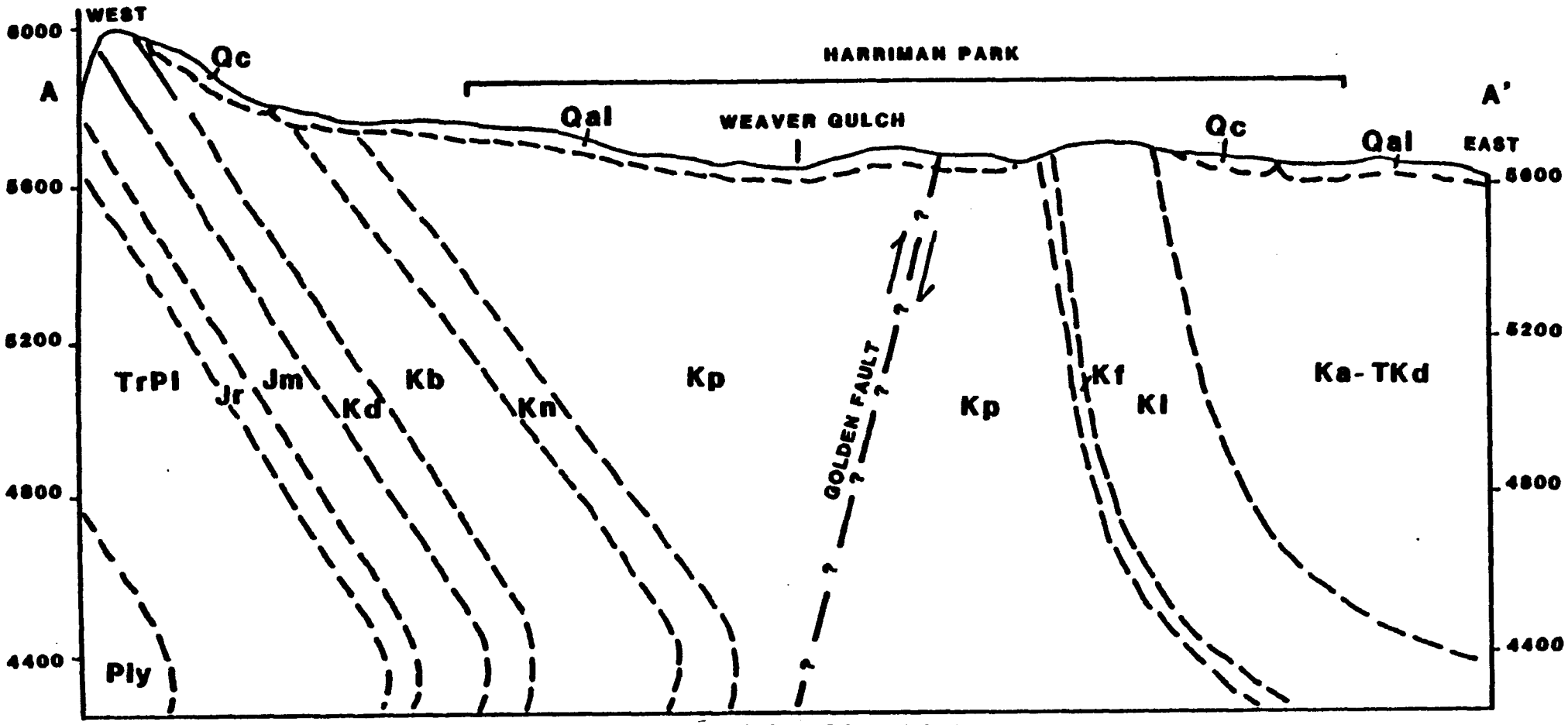



TABLE 3.1 FOR FORMATION NAMES AND GEOLOGIC DESCRIPTIONS

1"= 2000' HORIZONTAL SCALE

1"= 400' VERTICAL SCALE

VERTICAL EXAGGERATION 5 TIMES

SEE : GENERALIZED GEOLOGIC MAP FOR LOCATION

SOURCES: BERG, 1962
BRYANT AND OTHERS, 1973
KIRKHAM, 1979
LINDVALL, 1978
SCOTT, 1972

FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.

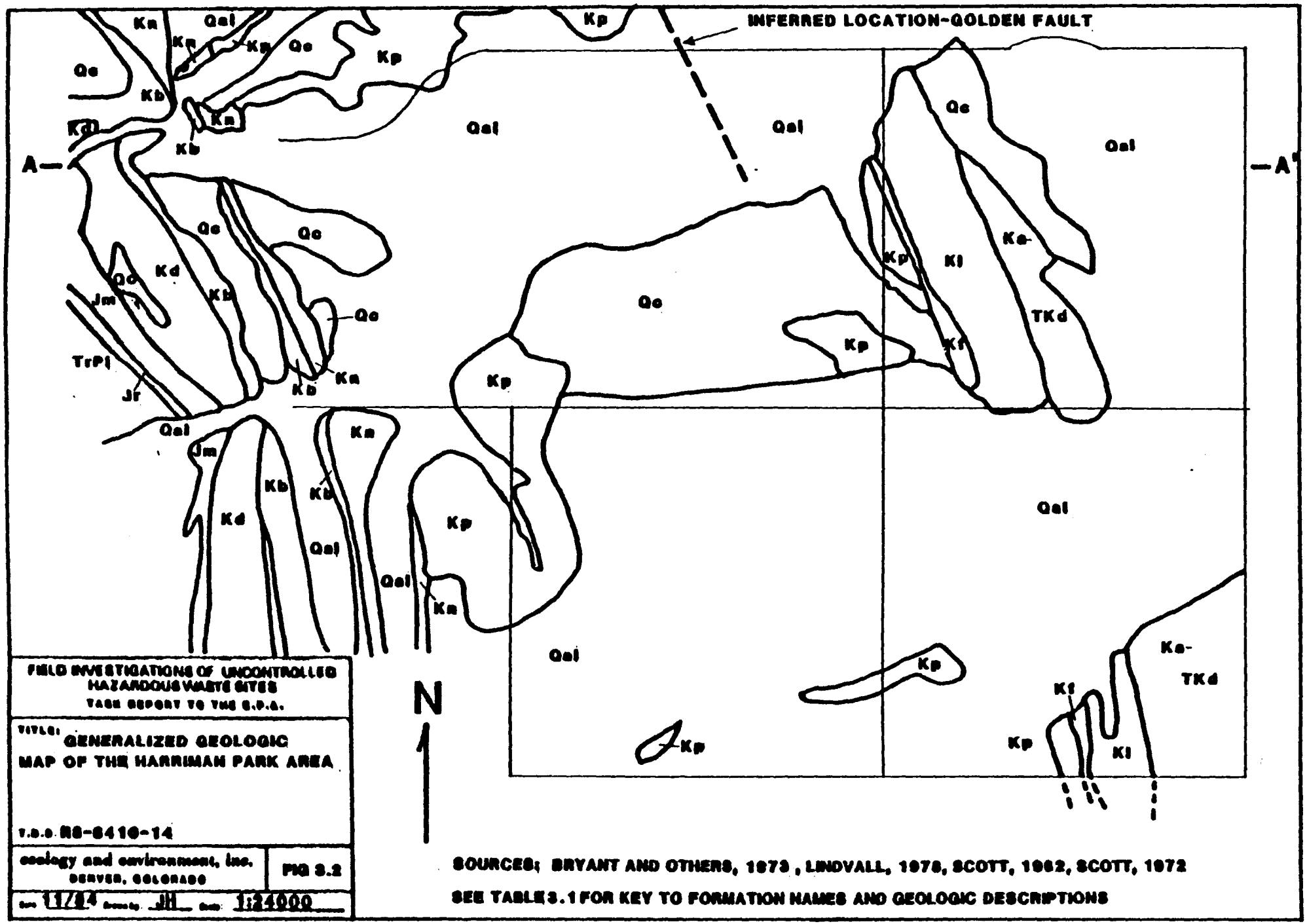
TITLE:
GENERALIZED GEOLOGIC CROSS SECTION

T.D.# RS-84010-14

ecology and environment, inc.
DENVER, COLORADO

FIG 3.1

Date 11/84 Drawn by JH Scale 1:24000


INFERRED LOCATION-GOLDEN FAULT
A
A'
Qal
Qc
Kp
Kn
Kb
Kd
Kl
Kf
Ka-
TKd
Jm
Jr
TrPl
N
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE: GENERALIZED GEOLOGIC MAP OF THE HARRIMAN PARK AREA
T.O.O. R8-8410-14
ecology and environment, inc.
DENVER, COLORADO
FIG 3.2
Date 11/84 Drawn by JH Scale 1:24000
SOURCES: BRYANT AND OTHERS, 1973, LINDVALL, 1978, SCOTT, 1962, SCOTT, 1972
SEE TABLE 3.1 FOR KEY TO FORMATION NAMES AND GEOLOGIC DESCRIPTIONS

The thickest and most abundant subcrop bedrock formation in the study area is the Cretaceous Pierre Shale. The unit is about 6200 feet thick, but the Golden Fault may reduce the apparent formation thickness in the northern portion of the study area. The Pierre overlies the Cretaceous Niobrara Formation in the western part of Harriman Park. The more erosionally resistant limestone in the Niobrara forms a low ridge parallel to the large Dakota hogback. The Benton Formation underlies the Niobrara and outcrops in limited areas to the west of the Niobrara ridge. Both the Niobrara and Benton Formation dip approximately 40° to the east. The Benton was deposited conformably on the Cretaceous Dakota Formation that forms the large hogback in the western portion of the study area. An erosionally resistant quartz sandstone forms the dipslope of the hogback dipping 40 to 45° to the east.

Formations of Jurassic and older ages unconformably underlie the Dakota and only outcrop on the west side of the hogback. The Jurassic rocks consist of Morrison and Ralston Creek formations and the Permian-Triassic units consist of the Lykins and Lyons formations.

The presence of old uranium mines adjacent to Harriman Park has caused some concern among the area residents. Documented uranium production has taken place in the outcropping of the Dakota Sandstone in the hogback region to the northwest of the study area. The mines are presently inactive. Other minor occurrences of radioactive elements are known to exist in the hogback sediment to the north of the study area. The next nearest production of uranium occurred more than four miles northwest of the study area near the town of Idledale in a different drainage system. This deposit is also a different mineralogical environment than the Dakota deposit.

EPA Region VIII has conducted a radiological investigation of the Harriman Park - Friendly Hills area. The report includes research and field verification of the known suspected uranium mining areas in the study area. Figure 3.3 shows the locations of the known uranium leases adjacent to Harriman Park. The ore deposits are influenced by

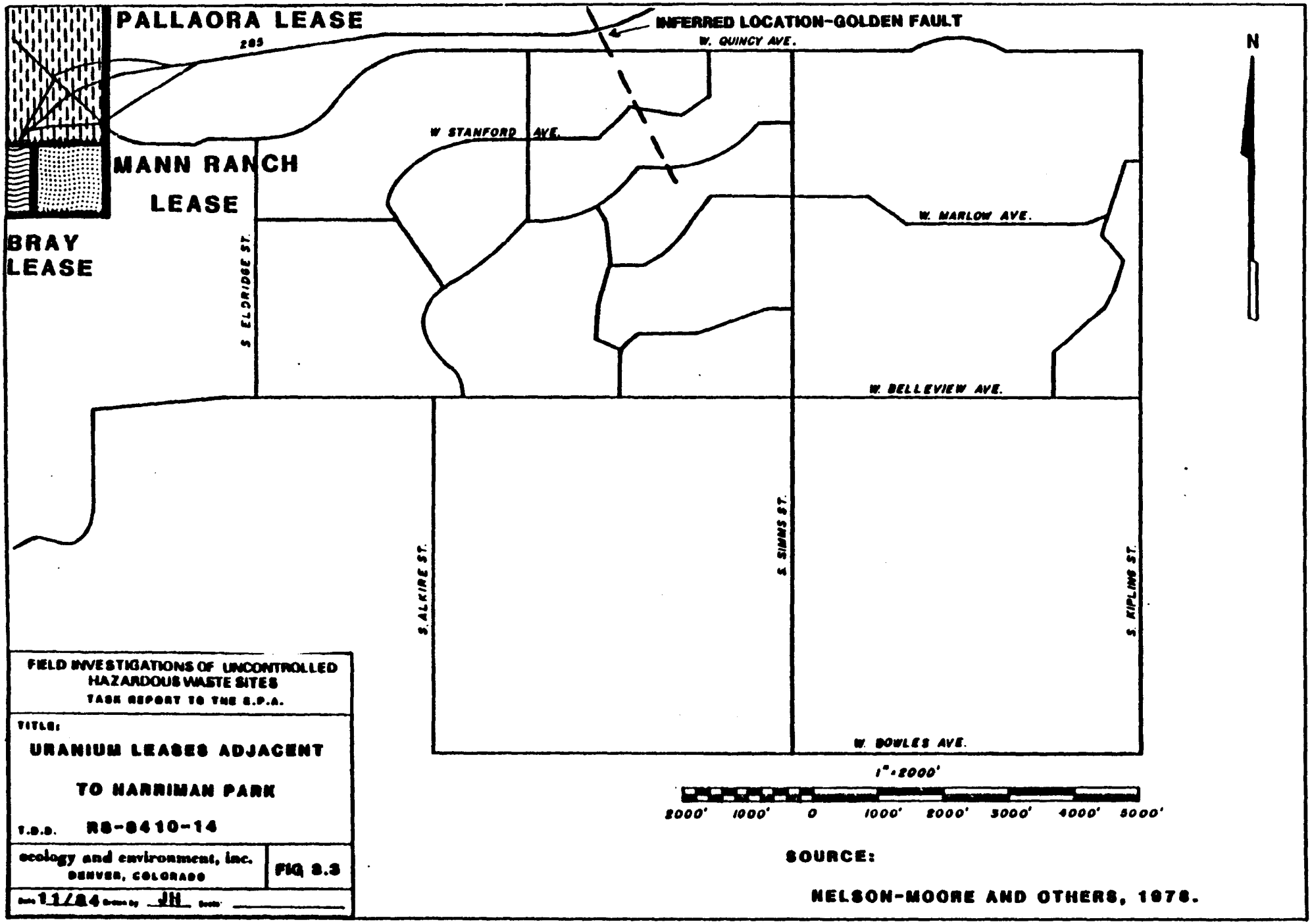
TABLE 3.1

GENERALIZED STRATIGRAPHIC COLUMN, HARRIMAN PARK

| ERA | PERIOD | | | FORMATION | MAP SYMBOL | APPX. THICKNESS (FT) | GENERAL CHARACTERISTICS |
|---|---|---|---|---|---|---|---|
| CENOZOIC | QUATERNARY | | | Alluvium | Qal | 5 to 25 | Poorly to well sorted gravel sand, silt and clay; some deposits part of a pediment cycle. May include colluvial material. |
| | | | | Colluvium | Qc | <5 to >25 | Bouldery to sandy silt and clay on slopes; deposited by gravity and sheet wash. May include alluvium. |
| | | | | UNCONFORMITY | | | |
| | TERTIARY | | PALEOCENE | Denver | Td | 550 | Interbedded sandstone, claystone, siltstone, shale and conglomerate; and andesitic sandstone is characteristic of the Denver Fm., and can be tuffaceous and montmorillonitic. Ironstone concretions and dinosaur bones may be common. |
| MESOZOIC | | | CRETACEOUS | Arapahoe | Ka | 300+ | |
| | | | | UNCONFORMITY AND UPLIFT | | | |
| | CRETACEOUS | | UPPER | Laramie Fm. | Kl | 600 | Micaceous siltstone, claystone, conglomerate, lignitic clay, friable sandstone, subbituminous coal beds to 8 ft. thick, fossil leaves, wood and other plant remains. |
| MESOZOIC | CRETACEOUS | | UPPER | Fox Hills Sandstone | Kf | Up To 180 | Silty shale and interbedded friable micaceous sandstone and limestone & sandstone concretions. Shaley near the base. |
| | | | | Pierre Shale | Kp | 6,200 | Shale with sandstone and siltstone layers and lenses; limestone and ironstone concretions and thin bentonitic beds; fossiliferous. |
| | | | | Niobrara Fm | Kn | 500 | Fissile, platy, and chalky shale and limestone; calcareous shale and bentonite beds; marine fossils abundant. |
| | UNCONFORMITY | | | | | | |
| | | | | Benton Fm | Kb | 500+ | Clayey calcareous and non-calcareous shale, limestone and silty sandstone; hard platy siltstone and base; some bentonite and ironstone concretions; fossiliferous. |
| | | | LOWER | Dakota Group | Kd | 300 | Well sorted, crossbedded sandstone in three to four distinct units. Separated by clay and shale with thin sandstone layers; conglomerate with chert and quartzite pebbles near base; contains some silicified plant parts. |
| | UNCONFORMITY | | | | | | |
| MESOZOIC | JURASSIC | | UPPER | Morrison Fm | Jm | 300+ | Siltstone and sandstone with limestone interbeds. Limestone can be massive, hard and crystalline and sandstone is commonly cemented with $CaCO_3$. |
| | | | | UNCONFORMITY | | | |
| | | | | Sundance Creek Fm | Jr | 100 | Sandstone and siltstone underlain by calcareous sandstone with some crystalline clayey limestone; may contain a thick bed (12') of gypsum. |
| | | | | UNCONFORMITY | | | |
| | TRIASSIC | | | Lykins Fm | TrPl | 400+ | Limestone, sandstone and shale with the middle limestone member containing algal stromatolites; crystalline limestone two feet above base. |
| PALEOZOIC | PERMIAN | | | Lyons Fm | Ply | 190 | Sandstone and conglomerate with distinct crossbedding and Precambrian detritus. May be friable and cemented by calcite and iron oxide. |

TABLE SOURCES:

1) SHTAFF AND OTHERS, 1973.
2) ETHERIDGE, 1979.
3) LINDVALL, 1978.
4) SCOTT, 1972.


PALLAORA LEASE
285
INFERRED LOCATION-GOLDEN FAULT
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N
W STANFORD AVE.
MANN RANCH
LEASE
BRAY
LEASE
S ELDRIDGE ST.
W. MARLOW AVE.
W. BELLEVIEW AVE.
S. ALKIRE ST.
S SIMMS ST.
S. KIPLING ST.
W. BOWLES AVE.
1" = 2000'
2000' 1000' 0 1000' 2000' 3000' 4000' 5000'
SOURCE:
NELSON-MOORE AND OTHERS, 1978.
FIELD INVESTIGATIONS OF UNCONTROLLED
HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE:
URANIUM LEASES ADJACENT
TO HARRIMAN PARK
T.D.D. RS-8410-14
ecology and environment, inc.
DENVER, COLORADO
FIG 2.3
Date 11/84 Drawn by JH Scale

a fault striking N40°W and dipping 30 to 55° southwest. The fault is a dam to mineralization (Nelson-Moore, 1978) and stops the movement of uranium down dip in the direction of the Harriman Park community.

A site visit conducted on November 19, 1984 by EPA-FIT, confirmed the presence of the mine workings as well as the strike slip fault cutting off the ore deposit (Grossman, 1957). The ultimate source for the uranium in this area was probably the Precambrian rock to the west of Harriman Park. Uranium occurs in mineral deposits in these rocks as uraninite and its microcrystalline form, pitchblende. The Precambrian rocks contain naturally high concentrations of uranium. In weathered rock, pitchblende and uraninite are converted to oxidized uranium minerals, one of which is carnotite. Because the oxidized uranium minerals are somewhat more soluble, uranium can be leached out and carried by either surface water or ground water from the original deposit. When reducing conditions are encountered, the uranium will reprecipitate as pitchblende or coffinite ($USiO_4 \times nH_2O$). Reducing conditions may occur in marshy environments for surface water or in rock formations that contain pyrite and/or carbonaceous material (in this case, the Dakota Sandstone). A geochemical barrier is formed where the host rock environment changes from oxidizing to reducing conditions. At that transition zone, uranium precipitates and forms a "roll-front" deposit commonly five to twenty-five feet wide. Other commonly precipitated elements may include molybdenum, selenium, and vanadium.

The geology of the area minimizes the potential for uranium in the Dakota Sandstone to be brought into direct contact with residents in the study area. Figure 3.2 shows that the Dakota is overlain by shaley and clayey sediments that would restrict the ground water flow across bedding planes and upwards toward Harriman Park. In addition, the Dakota has been dragged down to a depth of over 9,000 feet by movement along the Golden Fault. This is evidenced by deep oil well tests on the north boundary of the study area (Berg, 1962). Barring any other large-scale faulting acting as a mineral solution conduit, the uranium associated with the Dakota appears to be well isolated

from the near surface ground water and sediments underlying the Harriman Park development.

Due to the amount of carbonaceous material found in the rock, minor tar seeps are also characteristic of the Dakota Formation. Past production of tar has taken place along the hogback west of Harrriman Park. The extent of the excavation and size of the seep indicate past production was very limited and other economic or significant tar seeps are not known to exist near the study area.

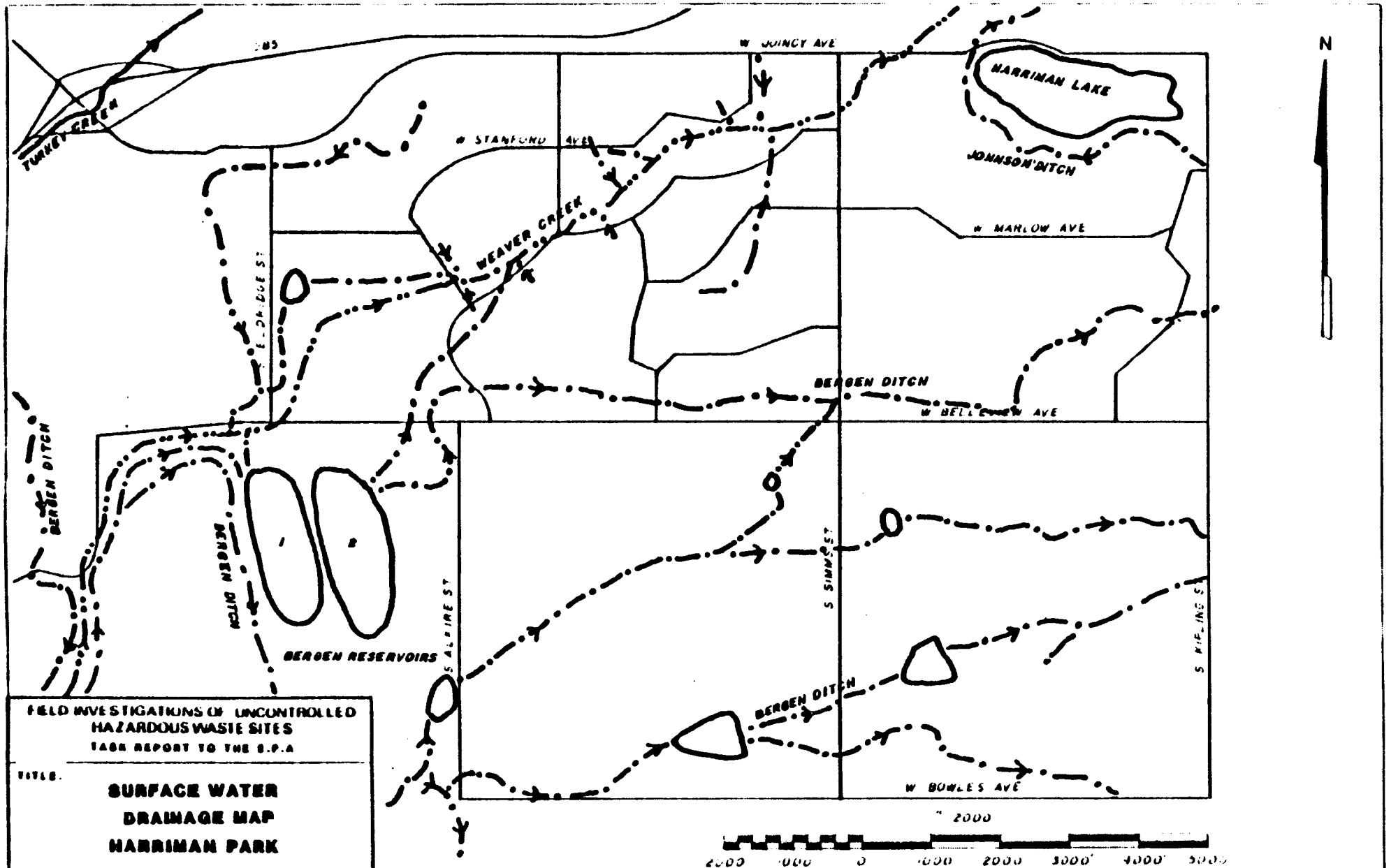
Uranium is also found in the Laramie Formation sediments located approximately 13 miles north of Harriman Park at the Old Leyden Mine. The mineralization is carnotite in a thin vertical coal seam. The Laramie Formation outcrops in the eastern portion of Harriman Park, but no known radioactive occurrences exist in that part of the study area (Grossman, 1957). Uranium deposits exist to the west of the study area in the Precambrian rocks as vein and pegmatite mineralization. As mentioned above, those geologic environments are not close to Harriman Park.

## 3.4 Hydrology

From a hydrologic standpoint, three distinct water systems are of interest: the surface water system, the shallow alluvial aquifer system, and the bedrock aquifer system.

### 3.4.1 Surface Water

The surface water in the study area is the Turkey - Bear Creek and South Platte River drainage basins, the only perennial streams in the area. There are numerous intermittent streams and ditches (Figure 3.4) that flow during times of high runoff and precipitation. The original drainage pattern of the study area is within the confines of Turkey Creek. The Bergen ditch system was constructed for agricultural purposes which altered the natural drainage pattern in the southern portion of the study area (Figure 3.4). Surface water




FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A

TITLE: **SURFACE WATER DRAINAGE MAP HARRIMAN PARK**

E.P.A. RS-8410-14

ecology and environment, inc.
DENVER, COLORADO

FIG 3.4

DATE 11/84 DRAWN BY JH SCALE 1:24000

**SOURCES:** JEFFERSON COUNTY PLANNING DEPT., 1984
NORTHWAY-GESTALT CORP., 1982
USGS, 1965a,b,c, & 4

PERENNIAL STREAM
INTERMITTENT FLOW
ARROWS DENOTE FLOW DIRECTION

flows are partially diverted by the ditch system into the South Platte River to the east of Harriman Park.

Weaver Gulch/Creek originates in the foothills to the southwest and flows northeasterly through Harriman Park. It is partially diverted into Bergen Ditch through the Willowbrook subdivision and golf course. The diversion flows into Bergen Reservoirs #1 and #2 and then easterly through Harriman Park along both Belleview and Bowles Avenues.

The reservoirs in the area are used for irrigation storage and flood control. According to local health officials, a locally high water table, probably influenced by these ditches, may be causing seepage into basements, residential yards, and basement sumps.

Harriman Lake is located in the northeast part of the study area and is owned by the Denver Water Board. Surface water runoff to the lake is limited to a relatively small area by surrounding natural topographic drainage divides and man-made diversions. The hydraulic relationship of the lake to the ground water system is unknown.

### 3.4.2 Ground Water

Ground water in the area is present in both the surficial material and bedrock units. Recharge of the aquifers occurs by precipitation, infiltration, reservoir release and leakage, and surface water infiltration.

The shallow alluvial aquifer is primarily comprised of sand and gravel in stream channels and gulches. Permeabilities (the rate of ground water movement) of alluvial materials are generally higher than the primary permeability of bedrock aquifers. A few shallow wells exist in the study area but no wells are known to be using the alluvium as a source of drinking water.

Ground water perched over impermeable clay materials occur in many parts of the study area, and it is probably the cause of locally high water tables and basement flooding. Due to its limited lateral extent and lack of consistent ground water yield, perched water has not been developed as a source for any domestic water supplies.

Water bearing bedrock units (the Dakota and the Hygiene member of the Pierre Shale) may exist in the study area at 8,000 and 6,000 feet respectively, below ground surface. No known wells use the bedrock ground water system at such depths as a source of potable water. A record search of water wells from the Colorado State Engineer's Office indicate that for the Harriman Park area, Sections 7 and 8, only 4 wells are permitted: two are located near the hogback, possibly completed in the Dakota, and two alluvial wells are permitted in the southeast corner of Section 8. One alluvial well yielded no water. All drinking water is provided by the Denver Water Board, via Lakehurst and Willowbrook Water Districts.

### 3.5 Soils

Soils are a potential pathway for migration or concentration of environmental contamination. The soil parent material, composition, texture, permeability, and thickness must be considered when assessing environmental problems.

The Harriman Park area soils were mapped and studied in detail by the U.S. Department of Agriculture - Soil Conservation Service (USDA-SCS) in cooperation with the Colorado Agricultural Experiment Station and Jefferson County during 1980. Prior to the development of Harriman Park as a residential area, the land was used primarily for irrigated and non-irrigated agriculture and pasture. Agricultural processes can have significant effects upon some soil characteristics, including trace element concentrations.

The natural soils within the study area generally have loamy textures with local variations of clay and sand content. Soils

developed on sandstone outcrops tend to be more stony and gravelly than the clayey loams developed on the other bedrock outcrops. The parent materials of the soils also determine other soil characteristics such as the calcareous and bentonitic (expansive) properties commonly found in Harriman Park.

The permeabilities of the soils vary considerably from specific site to site. The soil associations generally exhibit slow permeability (0.06 to 0.2 inches per hour) in more clayey units and moderately rapid permeability (2.0 to 6.0 inches per hour) in soils developed from bedrock with less shale and mudstone content. The soils are deep and well drained, except where they are developing on competent bedrock.

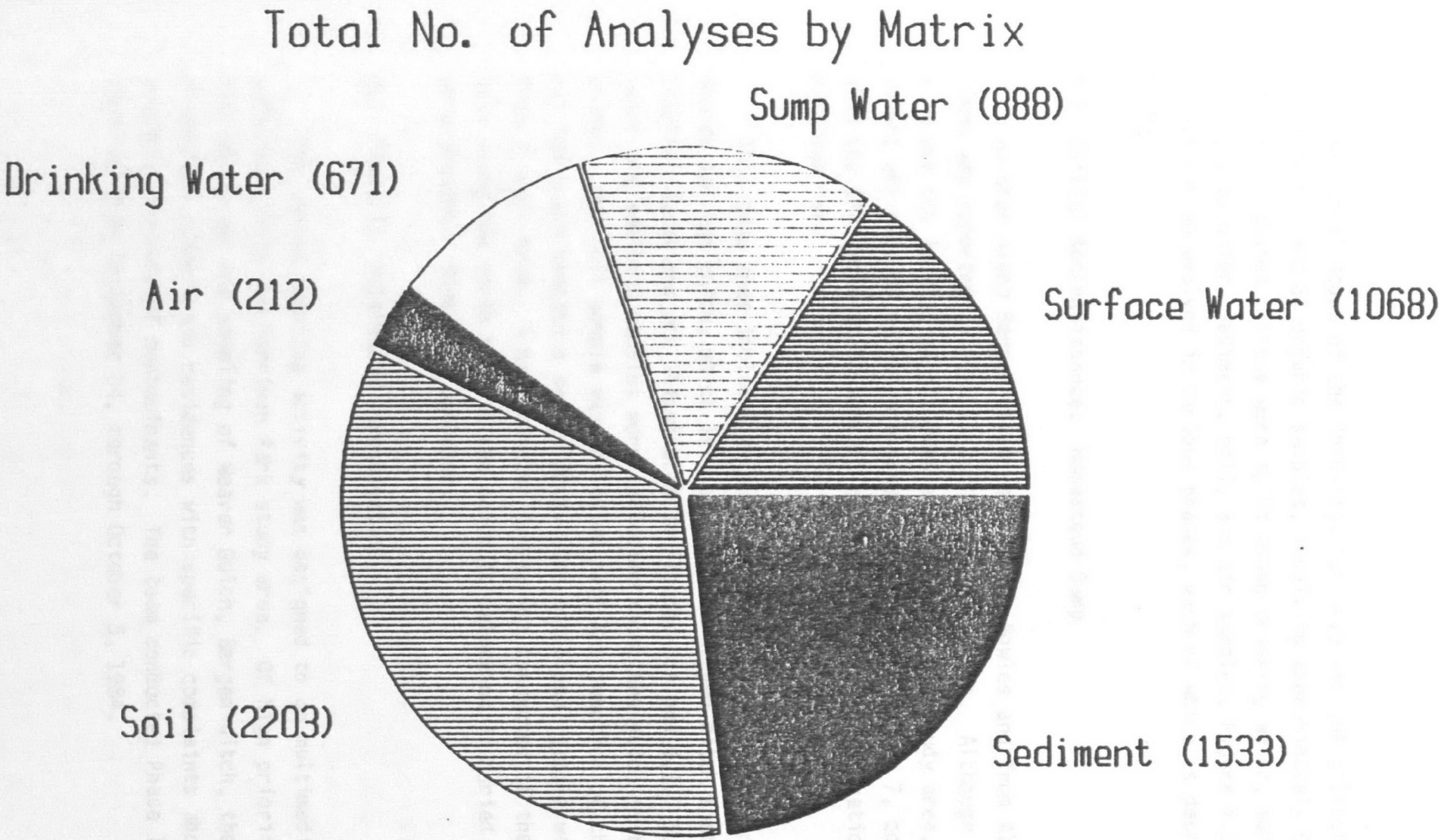
Artificial fill primarily associated with highway and dam construction is also found in the Harriman Park area. The fill is usually compacted at optimum moisture and maximum density to achieve a suitable base for heavy traffic, or low permeability for water impoundments.

## 4.0 SAMPLING METHODOLOGY

This section summarizes the sampling strategy employed in the Harriman Park environmental investigation. It must be noted at the outset that a biased sampling strategy was employed which means that samples were taken in locations with the highest probablility of contamination. While random study design provides the best statistically sound data, the sheer number of samples required for an area such as Harriman Park, and the high cost per sample precluded this approach.

The Harriman Park screening study concentrated efforts and resources on areas most likely to show contamination, if any existed. Studies of this kind are no less scientific since they serve to identify problems for further study, if required. In addition, samples were collected at the residences of certain families that have suffered unusual health problems, and at other residences where a specific complaint had been received. This is consistent with the study approach in looking for problems as part of the screening study.

Locations most suitable for accumulation of contaminants include drainages -- especially the streams and irrigation ditches that traverse Harriman Park. Soluble contaminants will leach and travel with surface runoff, while insoluble contaminants and heavy metals tend to sorb onto soil particulates high in organic matter or clay minerals. Particulates tend to also be transported to drainages by surface runoff and accumulate as sediment. Hence, by examining surface water and sediment in the drainages of Harriman Park, contaminants from upstream areas should accumulate there and be identified. Any contaminants originating from soils or paved areas would discharge into the storm sewer system and be conveyed into Weaver Gulch within the study area.




HARRIMAN PARK

FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.

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FIG. 4.1

The total scope of the investigation involved the collection of 41 inorganic and 64 organic samples, involving approximately 6575 separate analyses. These were split among drinking water, surface water, sump water, sediment, soil, and air samples, Figure 4.1. The investigation evolved in various phases, each of which is described below.

## 4.1 Initial Reconnaissance: Homestead Dump

An area along Bergen ditch north of W. Bowles and from Alkire to Simms was reported by JCHD to contain solid wastes. Although this site was not located within what was to become the study area, an effort was made to mobilize a sampling team on September 7, concurrent with the EPA decision to conduct an environmental investigation of Harriman Park.

This dump area included a four acre borrow pit near Alkire and W. Bowles and the gulch, which is a part of the Bergen ditch system. Sampling locations are illustrated in Figures 4.4 and 4.5. Surface water and sediment samples were collected along the gulch in two places. One soil sample was collected near the junction of the borrow pit and gulch beneath a sealed drum. One additional sample was taken from a small drum. A magnetometer survey was conducted of the debris pile along the north side of the gulch to determine if buried drums were present. None were detected.

## 4.2 Phase I: Multimedia Investigation

The second sampling activity was designed to do multimedia sampling within the Harriman Park study area. Of high priority in this phase was the sampling of Weaver Gulch, Bergen ditch, the elementary schools and residences with specific complaints about the possible presence of contaminants. The team conducted Phase I sampling from September 24, through October 5, 1984.

Six drinking water samples were collected from residences, three from Willowbrook Water District (DW-1, DW-4, DW-6) and three from Lakehurst Water District (DW-2, DW-3, DW-5). Figure 4.2 displays the sampling locations. A comparison sample was taken from the Denver Federal Center (DW-7). All samples are supplied from the same Denver water supply. All samples were analyzed for 40 volatile organics, while DW-1 and DW-2 were analyzed for the suite of substances called the "hazardous substance list" (HASL) including 130 organics and 24 inorganics.

Four underground seepage water samples were also collected for HASL analyses, three of which were basement sump waters (GW-2, GW-3, GW-4) and one from outdoor seepage from Bergen ditch (GW-1), Figure 4.3. These samples were collected to evaluate whether contaminants were present.

Five surface water samples were taken, two from Weaver Gulch (SW-1 and SW-2), one at the Bergen Reservoir #2 outlet (SW-3), one from Bergen ditch in Harriman Park (SW-4), and one from the Harriman Lake west shore (SW-6). Figure 4.4 displays these sampling locations. In addition, eight sediment samples were collected, five from Weaver Gulch (SE-1, SE-2, SE-5, SE-6, SE-7), two from Bergen ditch (SE-3, SE-4), and one at Harriman Lake (SE-8). All samples were subjected to HASL analyses. From Figure 4.4, it may be seen that some of the sediment sampling stations coincide with surface water stations.

Four composite surficial soil samples were taken from a two meter square grid, at the 0-5 cm depth. Sampling stations included playground sand at Kendallvue and Pfeiffer Elementary Schools (SO-1 and SO-2, respectively). A background sample of undisturbed soil was collected near W. Bowles and Simms (SO-3), and duplicate soil samples were taken near the substation at W. Marlow and Eldridge (SO-4 and SO-5). The soil sampling stations are shown in Figure 4.5. The SO-4 and SO-5 samples appeared to be in an area receiving some sheet runoff from the substation. No evidence of spills was observed at any of the locations. All samples were subject to HASL analyses.

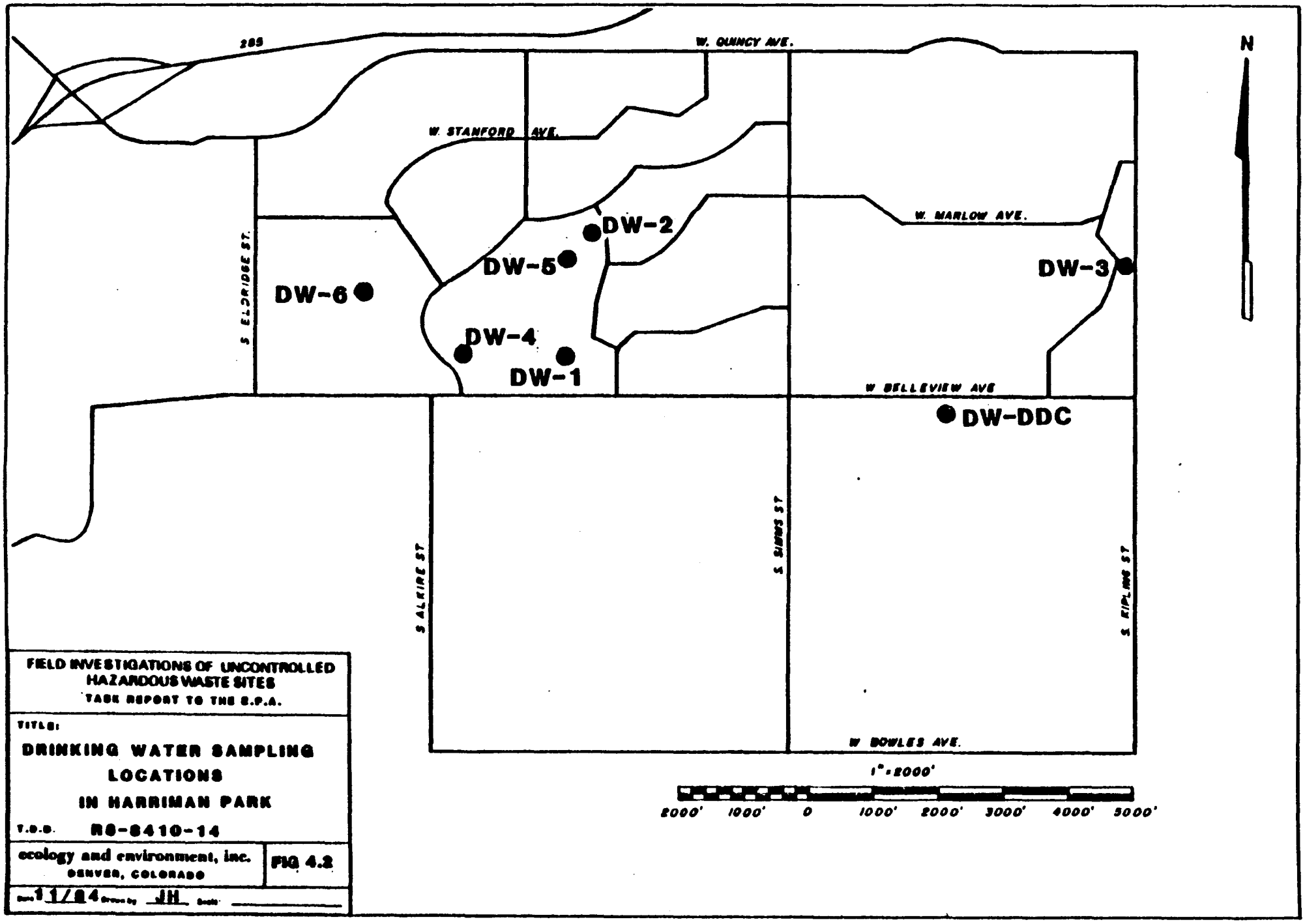
285
W. QUINCY AVE.
W. STANFORD AVE.
W. MARLOW AVE.
W BELLEVIEW AVE
W BOWLES AVE.
S ELDRIDGE ST.
S ALKIRE ST
S SIMMS ST
S KIPLING ST
DW-1
DW-2
DW-3
DW-4
DW-5
DW-6
DW-DDC
N
1" = 2000'
2000' 1000' 0 1000' 2000' 3000' 4000' 5000'
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE:
DRINKING WATER SAMPLING LOCATIONS IN HARRIMAN PARK
T.O.D. R8-8410-14
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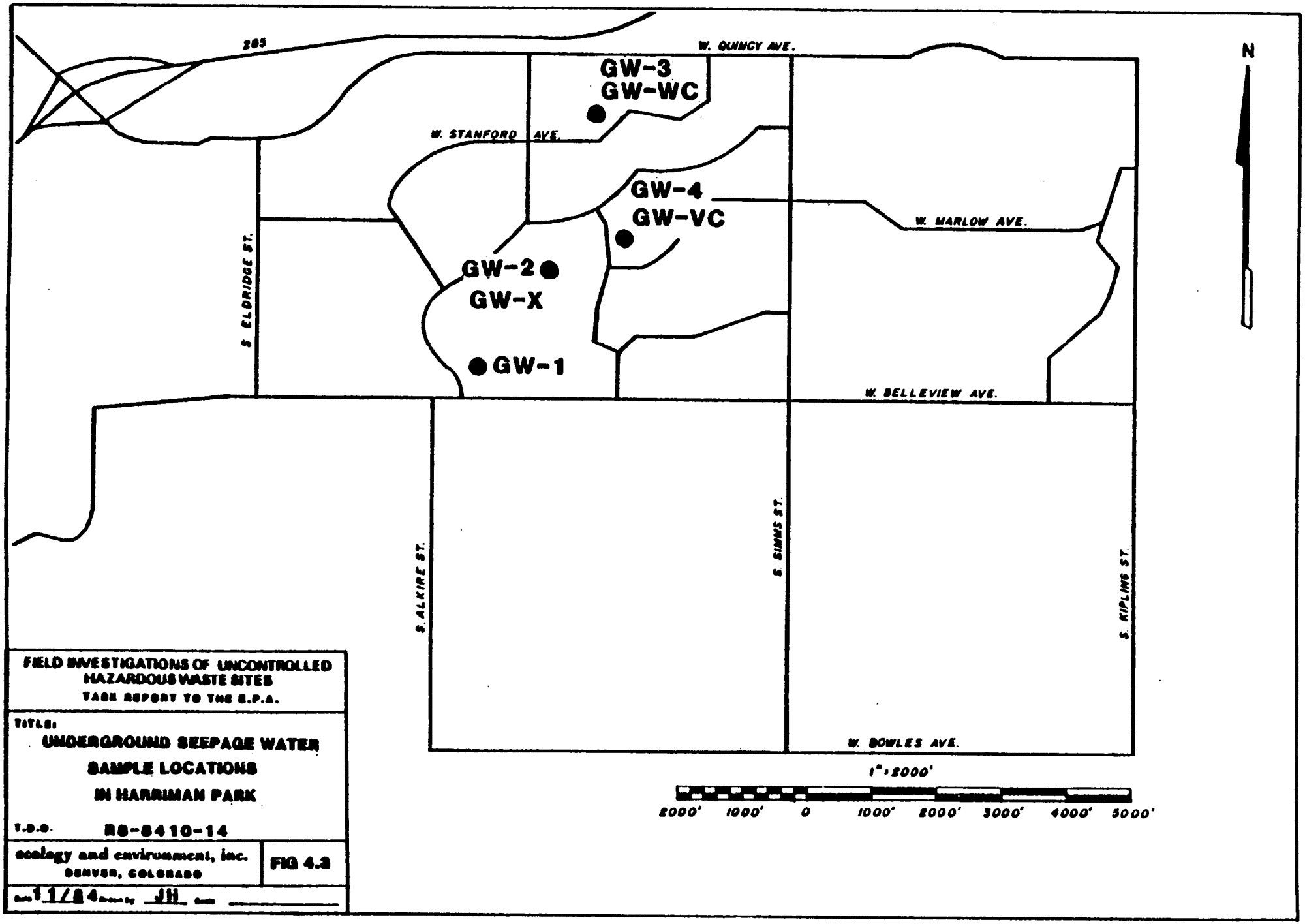
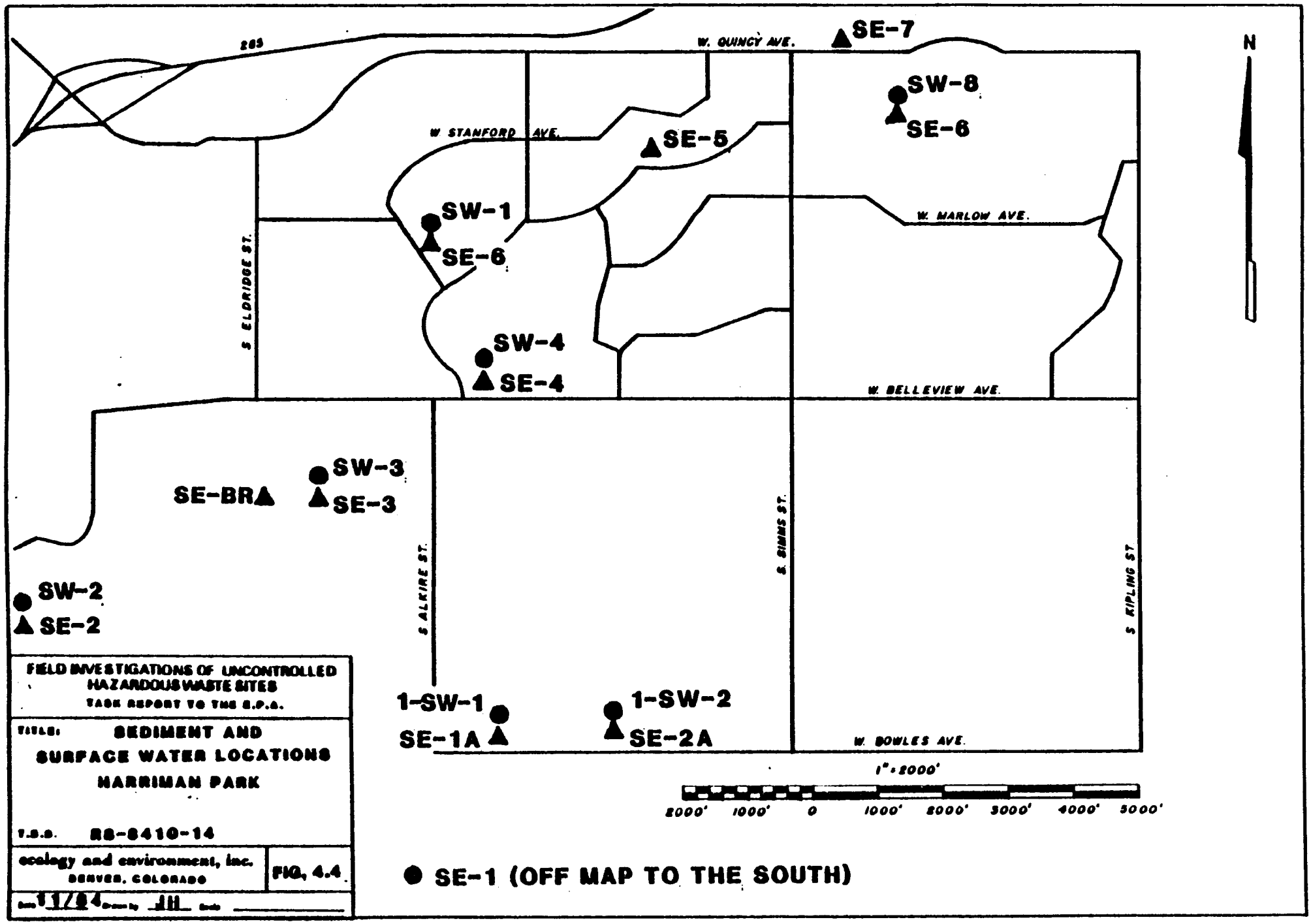
FIG 4.2
Date 11/84 Drawn by JH Scale


285
W. QUINCY AVE.
GW-3
GW-WC
W. STANFORD AVE.
GW-4
GW-VC
W. MARLOW AVE.
S. ELDRIDGE ST.
GW-2
GW-X
GW-1
W. BELLEVIEW AVE.
S. ALKIRE ST.
S. SIMMS ST.
S. KIPLING ST.
W. BOWLES AVE.
N
1" = 2000'
2000' 1000' 0 1000' 2000' 3000' 4000' 5000'
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE:
UNDERGROUND SEEPAGE WATER SAMPLE LOCATIONS IN HARRIMAN PARK
T.D.D. R8-8410-14
ecology and environment, inc.
DENVER, COLORADO
FIG 4.2
Date 11/84 Drawn by JH Date




FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.

TITLE: SEDIMENT AND SURFACE WATER LOCATIONS HARRIMAN PARK

T.S.D. RS-8410-14

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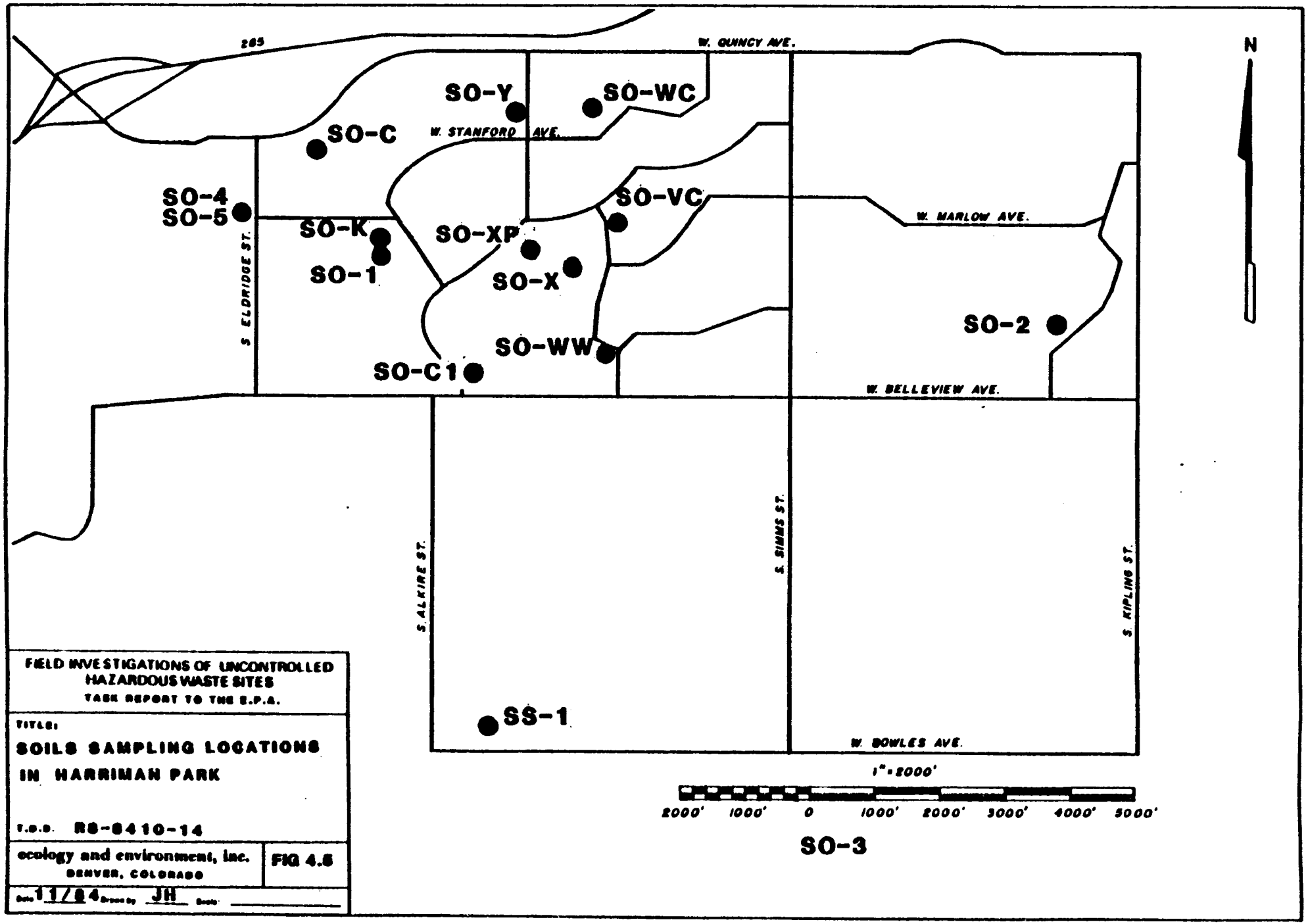
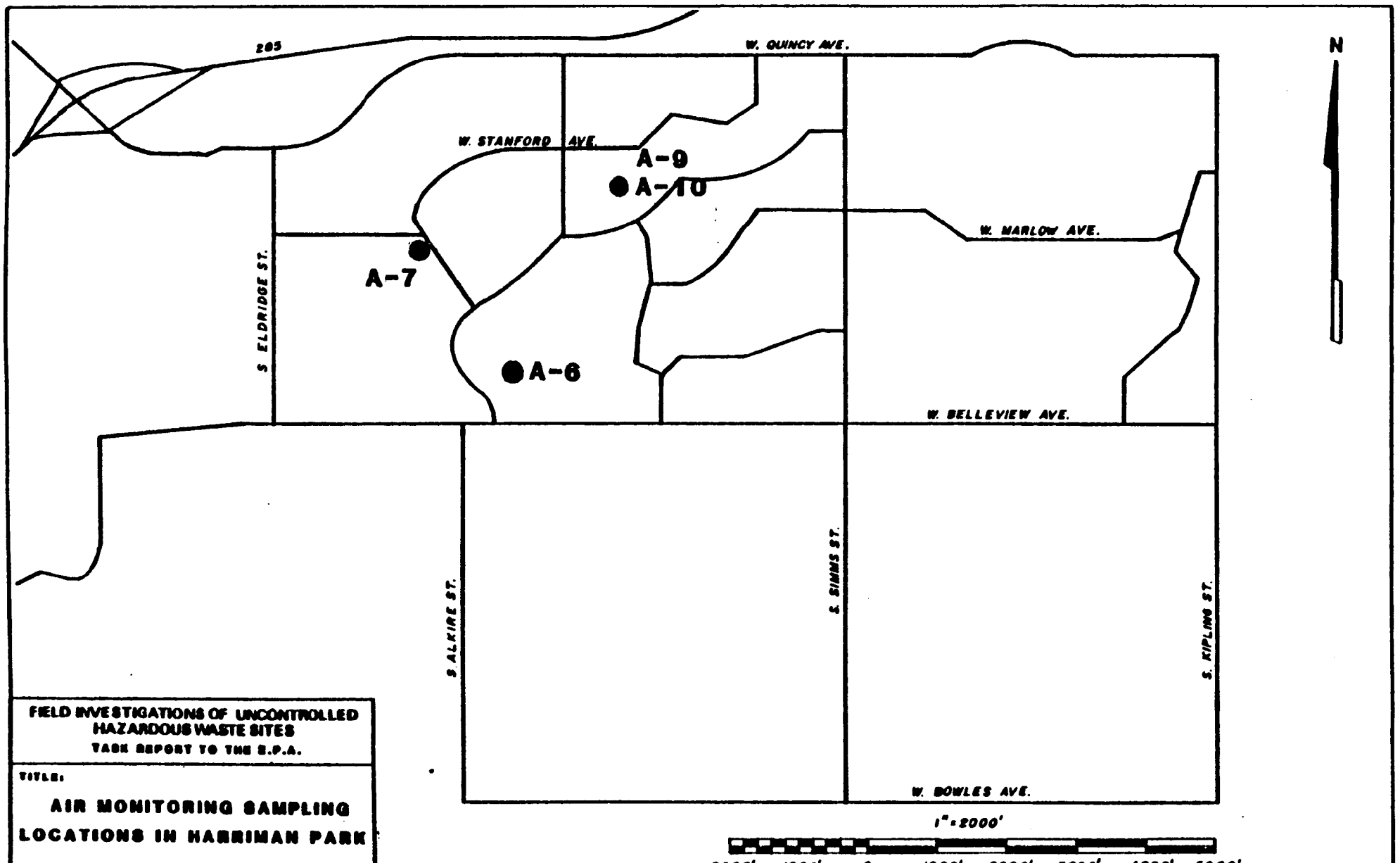
FIG. 4.4

Date 11/84 Drawn by JH Date


285
W. QUINCY AVE.
W. STANFORD AVE.
W. MARLOW AVE.
W. BELLEVIEW AVE.
W. BOWLES AVE.
S. ELDRIDGE ST.
S. ALKIRE ST.
S. SIMMS ST.
S. KIPLING ST.
N
SO-Y
SO-WC
SO-C
SO-4
SO-5
SO-K
SO-1
SO-XP
SO-VC
SO-X
SO-WW
SO-C1
SO-2
SS-1
SO-3
1" = 2000'
2000' 1000' 0 1000' 2000' 3000' 4000' 5000'
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE:
SOILS SAMPLING LOCATIONS IN HARRIMAN PARK
T.O.D. R8-8410-14
ecology and environment, inc.
DENVER, COLORADO
FIG 4.6
Date 11/84 Drawn by JH Date




FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.

TITLE:

AIR MONITORING SAMPLING LOCATIONS IN HARRIMAN PARK

T.D.D. RS-8410-14

ecology and environment, inc.
DENVER, COLORADO

FIG 4.6

Date 11/84 Drawn by JH Date:

SAMPLE LOCATION A-8 IS APPROX. 5 MILES NORTH AT 260 S. KIPLING

## 4.3 Phase IA: Investigation of Drum Site

During the course of the Phase I investigation, the EPA-FIT team identified a residence at 11195 W. Belleview with 62 drums stored in an unsafe manner. The site was discovered on September 24, 1984 and the drums appeared to have numerous warning labels on them, visible from W. Belleview.

On October 2, 1984, EPA-FIT received permission from the property owner to conduct a site inspection. The sampling team inspected the site, conducted a drum inventory and collected three drum samples, and four soil samples. The results of this investigation are reported in Section 5.3, although the soil data are reported in Section 5.2.

To determine if contamination had occurred from the drum storage area, one drinking water sample was collected from the underground water storage tank located near West Belleview and Simms (DW-PDC) Figure 4.3. The storage tank is adjacent to the illegal drum storage area located during the Phase IA investigation. The tank, owned by the Denver Water Department and constructed in 1980, supplies drinking water to much of Harriman Park. This sample was analyzed for the hazardous substance list contaminants.

## 4.4 Phase II: Continued Multimedia Sampling

As preliminary laboratory results became available, additional drinking water, sump water, soil samples, and air monitoring was intiated during Phase I. In addition, residences of certain families with unusual health problems were also sampled. These activities were conducted from October 22 to October 27, 1984.

Four sump water samples were collected from local residences: (GW-X), (GW-WC), and (GW-VC), and (GW-Y), see Figure 4.4 for locations. The first three samples listed above were analyzed for nitrate, phosphate and uranium. These analytes were selected to try to determine whether lawn fertilizer was infiltrating the sump waters.

The remaining sump sample (GW-Y) was taken from a backyard sump not previously sampled and was analyzed for HASL contaminants.

Eight soil samples and one sediment sample (Bergen Reservoir) were collected. Three soil samples (SO-X, SO-WC and SO-VC) corresponded to residences with sumps which were sampled and described above. These samples were to be analyzed for heavy metals, nitrate, phosphate and uranium. The remaining soil samples (SO-C1, SO-WW, SO-K, SO-Y, and SE-BR) were analyzed for HASL contaminants. Refer to Figure 4.5 for sample locations. All soil samples were composites of surface soil (0-5 cm) from a 2 meter square grid, except SO-K which was sampled at 16 inches depth in a berm northwest of the Kendallvue School building.

One fertilizer sample (F-1) was collected from a residence with a sump. This sample was analyzed for phosphate, nitrate, heavy metals, and uranium.

Three neighborhood air sampling locations (A-2, A-3, A-4) were selected for characterization of ambient levels of organic compounds, and a comparison air sample (A-1) was collected at the Jefferson County Health Department Building. The locations are shown on Figure 4.6.

All stations consisted of four devices using the distributed volumes Tenax cartridge procedure recommended by EPA (Research Triangle Park). These samples trains were calibrated before and after each run using a Buck Calibrator (a primary flow standard). Total approximate sample volumes sampled at each station included 12 liters, 24 liters, 48 liters, and 96 liters.

Also during the Phase II field activities, EPA-FIT investigated various complaints of reported dumping and residential chemical odors. The results of these investigations are discussed in Section 5.3. No new sources of hazardous wastes were identified.

## 4.5 Phase III: Continued Multimedia Sampling

Field activities in this phase took place between November 29 through December 5, 1984. Due to analytical difficulties encountered with the initial air sampling, these activities involved a repeat of the initial air sampling (Section 5.2.2). Using similar methodology, four new samples were taken from the same locations as before, Figure 4.6.

An additional set of sump water samples was collected for the EPA radiation study. These samples were collected outside of the study area in an effort to gain more information on the occurrence of uranium in basement sump waters. These results are discussed in more detail in the companion EPA radiation survey report. Two additional complaints were investigated pertaining to sump odors at one residence and unexplained thermal hot spots at another. Nothing unusual was discovered at either home.

# 5.0 ANALYTICAL RESULTS AND DISCUSSION

This chapter discusses results from sampling activities. The data are divided into inorganic results in Section 5.1 and organic results in Section 5.2. A quality assurance review of the data is provided in their respective sections. Section 5.3 discusses the results of other field investigations at Harriman Park.

## 5.1 Inorganic Data

### 5.1.1 Analytical Results

Samples of drinking water, surface water, sump water, soils, sediments and fertilizer were collected. Table 5.1 presents the inorganic data from three drinking water sources. These data will be discussed in Subsection 5.1.2 by comparing their concentrations with the National Interim Primary and Secondary Drinking Water Criteria (EPA, 1976a).

Table 5.2 contains data from surface water and sump water samples. The sample of water from the drum found on Bergen ditch is included in this table. Table 5.3 provides data from analyses of soil and sediment samples. A sample of fertilizer is included in this table. Finally, Table 5.4 presents the data from analyses of several different types of media for ortho-phosphate, nitrate plus nitrite and uranium, together with gross alpha radiation.

### 5.1.2 Evaluation of Drinking Water Data

The EPA National Interim Primary and Secondary Drinking Water Criteria appear in Table 5.1 for comparison with the drinking water results. The health criteria used were the drinking water standards (USEPA, 1976a), regulated by the Safe Drinking Water Act, and drinking

TABLE 5.1. INORGANIC ANALYTICAL RESULTS OF DRINKING WATER (DW) SAMPLES. (ANALYSES PERFORMED BY ROCKY MOUNTAIN ANALYTICAL LABORATORY UNLESS OTHERWISE NOTED.) Units are ug/l.

| SAMPLE NO.<br>DATE | DW-1<br>9/25/84 | DW-2<br>9/25/84 | DW-PDC[1]<br>10/23/84 | CRITERIA/<br>STANDARDS |
|---|---|---|---|---|
| Aluminum | [131] | [103] | 77 | 5000(c) |
| Antimony | 51 | 51u | 100u | 146(b) |
| Arsenic | 3u | 3u | 50u | 50(a) |
| Barium | [36] | [35] | 35 | 1000(a) |
| Beryllium | 0.6u | 0.6u | 10u | 0.037(b) |
| Boron | NR | NR | 14 | -- |
| Cadmium | 5u | 5u | 5u | 10(a) |
| Calcium | 29,000 | 32,000 | NR | -- |
| Chromium | 4u | 4u | 5u | 50(a) |
| Cobalt | 6u | 6u | 5u | -- |
| Copper | 57 | [1] | 24 | 1000(b) |
| Iron | 10u | 10u | 47 | 300(d) |
| Lead | [3.3] | [2.6] | 30u | 50(a) |
| Magnesium | 8170 | 8170 | NR | -- |
| Manganese | [4.4] | 4u | 8 | 50(d) |
| Mercury | 0.1u | 0.1u | 0.1u | 2.0(a) |
| Nickel | 7u | 7u | 30u | 13.4(b) |
| Potassium | [2350) | [2350] | NR | -- |
| Selenium | 2u | 2u | 50u | 50(a) |
| Silver | 5u | 5u | 5u | 50(a) |
| Sodium | 25,200 | 27,200 | NR | -- |
| Thallium | 10u | 10u | 100u | 13(b) |
| Tin | 28u | 28u | NR | -- |
| Vanadium | 5u | 5u | 10u | -- |
| Zinc | 10 | 3u | 14 | 5000(b) |

1 = Analyses performed by EPA Region VIII Analytical Laboratory.
[ ] = Values are near detection limit; therefore error associated with the value is greater than other reported values.
u = Value of detection limit, indicating the sample is below detection.
R = Analysis not run.
a = USEPA, 1976a.
b = USEPA, 1980.
c = Safe Drinking Water Committee, 1982.
d = USEPA, 1976b; based on aesthetics.

Table 5.2. Inorganic Analytical Results of Surface Water (SW), Sump Water (SW), and Drum Water (D) Samples.
(Analyses performed by Rocky Mountain Analytical Laboratory unless otherwise noted.)

Units are ug/l

| Sample No. | 1/SW-1 * | 1/SW-2 * | SW-1 | SW-2 | SW-3 | SW-4 | SW-6 | BL-1 | SW-1 | SW-2 | SW-3 | SW-4A | SW-4B | SW-Y * | D01 * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | 9-7-84 | 9-7-84 | 9-24-84 | 9-25-84 | 9-24-84 | 9-25-84 | 9-24-84 | | 9-25-84 | 9-25-84 | 9-26-84 | 9-26-84 | 9-26-84 | 10-24-84 | 9-7-84 |
| aluminum | 275000 | 180 | 435 | [146] | [70] | 226 | 401 | 303 | 28900 | 12500 | [81] | 350u | 350u | 65 | 30u |
| antimony | 1000u | 100u | 51u | 81 | 51u | 51u | 51u | 51u | 51u | 102u | 51u | 510u | 510u | 100u | 100u |
| arsenic | 910 | 50u | 3u | 3u | 3u | 3u | 3u | 3u | [2.5] | 10u | 3u | 3u | 24 | 50u | 50u |
| barium | 7500 | 112 | [71] | [82] | [54] | [59] | [62] | 12u | 307 | [108] | [39] | 120u | 120u | 110 | 20 |
| beryllium | 100u | 10u | 0.6u | 0.6u | 0.6u | 0.6u | 0.6u | 0.6u | [1.6] | 1.2u | 0.6u | 6u | 6u | 10u | 10u |
| boron | 300 | 225 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 402 | 36u |
| cadmium | 325 | 5u | 5u | 5u | 5u | 5u | 5u | 5u | 5u | 10u | 5u | 50u | 50u | 5u | 5u |
| calcium | NR | NR | 52600 | 40400 | 41300 | 43500 | 28500 | [492] | 138000 | 469000 | 153000 | 191000 | 339000 | NR | NR |
| chromium | 374 | 5u | 4u | 4u | 4u | 4u | 4u | [4.1] | 43 | [18] | 4u | 282 | 40u | 5u | 5u |
| cobalt | 212 | 5u | 6u | 6u | 6u | 6u | 6u | 6u | [13] | 12u | 6u | 60u | 60u | 5u | 5u |
| copper | 776 | 5u | [16] | [18] | [14] | [9.9] | [13] | [20] | 43 | [25] | [12] | 50u | 50u | 8 | 43 |
| iron | 753000 | 455 | 600 | 346 | [26] | 208 | 552 | 536 | 37900 | 10600 | [29] | 866 | 100u | 127 | 10u |
| lead | 1400 | 30u | [2.8] | 2u | 2u | [2.1] | [2.8] | 2u | 69 | 2u | 2u | 50u | 50u | 30u | 30u |
| magnesium | NR | NR | 1170 | 13400 | 20600 | 23900 | 9860 | 390u | 118000 | 352000 | 113000 | 725000 | 680000 | NR | NR |
| manganese | 15200 | 464 | 98 | 95 | [12] | 36 | 46 | [4.2] | 444 | 128 | 4u | [52] | 40u | 5u | 100 |
| mercury | 0.05u | 0.05u | 0.1u | 0.1u | 0.1u | 0.1u | 0.1u | 0.1u | 0.13 | 0.11 | 0.22 | 0.32 | 0.1u | 0.1u | NR |
| nickel | 716 | 30u | 7u | 7u | 7u | 7u | 7u | 7u | [29] | [15] | 7u | [81] | 70u | 30u | 30u |
| potassium | NR | NR | 8480 | [3700] | [2610] | [2800] | [4350] | 1200 | 10300 | 21300 | [2760] | 12000u | 12000u | NR | NR |
| selenium | NR | 50u | [3.1] | [3.6] | [3.7] | 2u | [4.0] | 2u | 2u | NR | 50u | 2000 | 2000 | 50u | 50u |
| silver | 50u | 5u | 5u | 5u | 5u | 5u | 5u | 5u | 5u | 10u | 5u | 50u | 50u | 5u | 5u |
| sodium | NR | NR | 35200 | 11000 | 26600 | 27700 | 26200 | [1490] | 79400 | 814000 | 260000 | 2360000 | 2280000 | NR | NR |
| thallium | 1000u | 100u | 10u | 10u | 100u | 10u | 10u | 6u | 10u | 10u | 100u | 60u | 10u | 100u | 100u |
| tin | NR | NR | 28u | [33] | [29] | [28] | 28u | [32] | 28u | 56u | 28u | 422 | 280u | NR | NR |
| vanadium | 1150 | 10u | 5u | 5u | 5u | 5u | 5u | 54 | 86 | [25] | 5u | 50u | 50u | 10u | 10u |
| zinc | 4230 | 5u | 20 | 17 | [3.8] | [9.0] | [8.8] | 145 | 140 | 44 | [8.2] | 30u | 30u | 13 | 65 |

* = Analyses performed by EPA Region VIII Analytical Laboratory.
[ ] = Values are near detection limit; therefore error associated with the value is greater than other reported values.
u = Value of detection limit.
NR = Analysis not run.

* Interferences by very high iron concentrations may affect analyses of arsenic, antimony, cadmium, tin, selenium and manganese using Inductively coupled argon plasma.

TABLE 5.3. INORGANIC ANALYTICAL RESULTS OF SOIL (SO & SS) SEDIMENT (SE & SED) AND FERTILIZER (F) SAMPLES
(ANALYSES PERFORMED BY ROCKY MOUNTAIN ANALYTICAL LABORATORY UNLESS OTHERWISE NOTED.)
Units are ug/g dry weight unless otherwise noted.

| SAMPLE NO. | SS-1[1*] | SO-1 | SO-2 | SO-3 | SO-4 | SO-5 | SO-WW | SO-C | SO-K | SO-Cl | SO-4 | SO-WC[1*] | SO-VC[1*] | SO-X[1*] | F-WC[1*] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE SAMPLED | 9/7/84 | 9/24/84 | 9/24/84 | 9/24/84 | 9/24/84 | 9/24/84 | 10/23/84 | 10/23/84 | 10/23/84 | 10/23/84 | 10/24/84 | 10/24/84 | 10/24/84 | 10/24/84 | 10/24/84 |
| Aluminum | 6550 | 1000 | 1300 | 12,500 | 8800 | 7670 | 6880 | 9510 | 5600 | 6300 | 11,400 | 17,850 | 28,200 | 25,450 | 1240 |
| Antimony | 9.6u | 26u | 26u | 27u | 26u | 26u | 0.2u | 0.2u | 0.2u | 0.2u | 0.2u | 15u | 15u | 15u | 15u |
| Arsenic | 37.1 | 1.5u | 1.5u | 10 | 7.1 | 7.1 | 4.6 | 7.4 | 3 | 4.6 | 9.2 | 93 | 150 | 137 | 15 |
| Barium | 172 | [16] | 24 | 119 | 130 | 138 | 99 | 152 | 70 | 105 | 199 | 129 | 247 | 133 | 2 |
| Beryllium | 1u | 0.3u | [0.4u] | [0.87] | [0.75] | [0.86] | 0.24 | 0.28 | 0.24 | 0.05u | 0.3 | 2u | 1 | 1 | 2u |
| Boron | 1u | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 20 | 37 | 37 | 20 |
| Cadmium | 7.8 | 2.5u | 2.5u | 2.6u | 2.5u | 2.7 | 1.2 | 1.5 | 0.92 | 1.1 | 2.0 | 9 | 11 | 9 | 15 |
| Calcium | NR | [606] | [609] | 6580 | 46,200 | 44,800 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Chromium | 12 | 2u | [2.5] | 19 | 12 | 11 | 9.2 | 14 | 10 | 11 | 14 | 21 | 31 | 24 | 61 |
| Cobalt | 6.1 | 3u | [3.1] | [10] | [6.6] | [5.6] | 5.1 | 6.8 | 5.2 | 5.7 | 9.1 | 7 | 10 | 8 | 1u |
| Copper | 19.3 | [3.4] | [4.8] | 18.0 | 18 | 20 | 9.1 | 14 | 9.9 | 9.8 | 20 | 16 | 22 | 17 | 1 |
| Iron | 17,600 | 2740 | 4430 | 23,500 | 16,900 | 17,100 | 10,500 | 16,000 | 9670 | 13,600 | 19,900 | 18,600 | 23,250 | 17,350 | 649 |
| Lead | 20.4 | [2.2] | 3.3 | 30 | 26 | 27 | 16 | 16 | 7.6 | 12 | 23 | 127 | 38 | 38 | 5u |
| Magnesium | NR | [316] | [530] | 3420 | 3700 | 3800 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Manganese | 192 | 49 | 477 | 265 | 251 | 303 | 218 | 237 | 260 | 149 | 405 | 252 | 352 | 204 | 11 |
| Mercury | 0.73 | 0.05u | 0.05u | 0.05u | 0.05u | 0.05u | 0.05u | 0.05u | 0.05u | 0.05u | 0.14 | NR | NR | NR | NR |
| Nickel | 19.3 | 3.5u | 3.5u | [20] | [16] | [16] | 11 | 15 | 8.4 | 11 | 21 | 13 | 21 | 17 | 16 |
| Potassium | NR | 600u | [732] | 4390 | 3520 | 3740 | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Selenium | NR | 1u | 1u | 1u | 1u | 1u | 1u | 1u | 1u | 1u | 1u | NR | NR | NR | NR |
| Silver | 0.5u | 2.5u | 2.5u | 2.6u | [3.2] | 2.5u | 0.15u | 0.15u | 0.15u | 0.15u | 0.15u | 1u | 1u | 1u | 1u |
| Sodium | NR | [1360] | [1200] | [658] | [1270] | [977] | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Thallium | 9.6u | 3u | 3u | 3.1u | 3u | 3u | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Tin | NR | 14u | [15] | 14u | 14u | 14u | 2.2 | 2.0 | 1.5u | 2.5 | 3.0 | NR | NR | NR | NR |
| Vanadium | 33.6 | 2.5u | [4.8] | 40 | 36 | 33 | 16 | 26 | 15 | 14 | 27 | 49 | 79 | 56 | 106 |
| Zinc | 68.8 | [8.9] | 15 | 59 | 106 | 109 | 46 | 58 | 35 | 51 | 84 | 43 | 43 | 43 | 168 |

1 = Analyses performed by EPA Region VIII Analytical Laboratory. Units are ug/g wet weight.
[ ] = Values are near detection limit; therefore error associated with the value is greater than other reported values.
u = Value of detection limit.
NR = Analysis not run.
* Interferences by very high iron concentrations may affect analyses of arsenic, antimony, cadmium, tin, selenium and manganese using Inductively coupled argon plasma.

TABLE 5.3 CONT.

| SAMPLE NO.<br>DATE SAMPLED | SED-1 1*<br>9/7/84 | SED-2 1*<br>9/7/84 | SE-1<br>9/24/84 | SE-2<br>9/24/84 | SE-3<br>9/25/84 | SE-4<br>9/24/84 | SE-5<br>9/26/84 | SE-6<br>9/24/84 | SE-7<br>9/26/84 | SE-8<br>9/25/84 | SE-8R<br>10/23/84 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 3870 | 3750 | 1780 | 4560 | 15,500 | 20,500 | 7220 | 3470 | 9300 | 4200 | 5990 |
| Antimony | 4.8u | 8.6u | 26u | 41u | 59u | 40u | 32 | 36u | 55u | 36u | 0.24 |
| Arsenic | 21.3 | 31.2 | 1.5u | 2.4u | 16 | 22 | 4.2 | 2.1u | 6 | 2u | 3.6 |
| Barium | 97.4 | 47.5 | [25] | [83] | 241 | 186 | [72] | [47] | [89] | [60] | 180 |
| Beryllium | 0.5u | 0.9u | [0.40] | [0.71] | [1.2] | [1.1] | [0.56] | 0.4u | [0.74] | 0.4u | 0.05u |
| Boron | 0.5u | 0.9u | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Cadmium | 5.1 | 3.1 | 2.5u | 4u | 5.7u | 3.8u | 3.1u | 3.5u | 5.3u | 3.4u | 5.5 |
| Calcium | NR | NR | [791] | [2840] | 50,200 | 17,700 | 5300 | 3750 | 23,600 | 9320 | NR |
| Chromium | 6.5 | 6.2 | [4.4] | 8.7 | 25 | 31 | 12 | 8.3 | 16 | [5.5] | 13 |
| Cobalt | 3.2 | 2.6 | 3u | [4.9] | [10] | [13] | [5.4] | [5.0] | [6.6] | 4.1u | 6.2 |
| Copper | 11.6 | 7.6 | [12] | [13] | 41 | 26 | [15] | [14] | [21] | [60] | 12 |
| Iron | 11,400 | 7420 | 5570 | 13,800 | 27,300 | 31,500 | 12,500 | 9170 | 16,300 | 6770 | 12,700 |
| Lead | 18.3 | 17.3 | 7 | 7.3 | 36 | 17 | 30 | 31 | 57 | 8.2 | 24 |
| Magnesium | NR | NR | [755] | [2640] | 8400 | 6880 | [2740] | [2220] | [4340] | [1220] | NR |
| Manganese | 230 | 148 | 165 | 421 | 277 | 337 | 142 | 79 | 115 | 282 | 447 |
| Mercury | 0.24 | 0.2 | 0.05u | 0.084 | 0.18 | 0.084 | 0.06u | 0.07u | 0.11u | 0.07u | 0.05u |
| Nickel | 10 | 6.7 | 3.5u | [7.6] | [36] | [25] | [10] | [8.5] | [13] | 4.8u | 24 |
| Potassium | NR | NR | [885] | [2620] | [5250] | 5720 | [2920] | [1750] | [3490] | [1200] | NR |
| Selenium | NR | NR | 1u | 1.6u | 7.5 | 1.5u | 1.2u | 1.4u | 2.1u | 1.4u | 1u |
| Silver | 0.2u | 0.4u | 2.5u | 4u | 5.7u | [4.6] | 3.1u | 3.5u | 5.3u | 3.4u | 0.15u |
| Sodium | NR | NR | [534P | 571u | [1580] | [1720] | [742] | 500u | [1030] | [549] | NR |
| Thallium | 4.8u | 8.6u | 3u | 4.8 | 6.8u | 4.6u | 3.8u | 4.2u | 6.4u | 4.1u | NR |
| Tin | NR | NR | 14u | 22u | 32u | 22u | 18u | 19u | 30u | 19u | 1.5u |
| Vanadium | 19.8 | 14.5 | [6.6] | 13 | 100 | 68 | [22] | [17] | [28] | [12] | 22 |
| Zinc | 60.1 | 83.4 | 14 | 57 | 143 | 83 | 41 | 44 | 121 | 22 | 68 |

* Interferences by very high iron concentrations may affect analyses of arsenic, antimony, cadmium, tin, selenium and manganese using Inductively coupled argon plasma.

TABLE 5.3 CONTINUED
NORMAL RANGES OF ELEMENTAL CONCENTRATIONS
IN SOILS OF THE WESTERN UNITED STATES*.
ALL MEASUREMENTS ARE IN ppm (mg/kg).

| ELEMENT | MEAN** | NORMAL RANGE MEAN ± 1 s.d.** |
|---|---|---|
| Aluminum | 58,000 | 29,000 - 116,000 |
| Antimony | 0.47 | 0.22 - 1.01 |
| Arsenic | 5.5 | 2.8 - 10.9 |
| Barium | 580 | 337 - 998 |
| Beryllium | 0.68 | 0.30 - 1.56 |
| Cadmium | 0.2 | 0.1 - 0.5 |
| Chromium | 41 | 19 - 90 |
| Cobalt | 7.1 | 3.6 - 14.0 |
| Copper | 21 | 10 - 43 |
| Iron | 21,000 | 10,800 - 41,000 |
| Lead | 17 | 9 - 31 |
| Manganese | 380 | 192 - 752 |
| Mercury | 0.05 | 0.02 - 0.11 |
| Nickel | 15 | 7 - 32 |
| Selenium | 0.23 | 0.09 - 0.56 |
| Silver | 0.2 | 0.1 - 0.5 |
| Thallium | 0.2 | 0.1 - 0.4 |
| Tin | 0.9 | 0.4 - 1.9 |
| Vanadium | 70 | 36 - 136 |
| Zinc | 55 | 31 - 98 |
| Molybdenum | 0.85 | 0.39 - 1.85 |
| Thorium | 9.1 | 6.1 - 13.6 |
| Uranium | 2.5 | 1.7 - 3.6 |
| Yttrium | 22 | 13 - 37 |

* Data From: Shacklette, H.T., and Boerngen, J.G.; 1984: Element Concentrations in Soils and other Surficial Materials of the Co terminous United States. U.S. Geol. Surv. Professional Paper 1270. 105pp.

** Means and Standard Deviations are Geometric to account for log-normal distributions.

Table 5.4. Special Analyses of Aqueous and Solid Samples for Fertilizer-Related Parameters. (Analyses performed by EPA Region VIII Laboratory.)

| | Sample | Type | Date | U 238 (ug/l) | Gross Alpha (pCi/l) | NO3-NO2 (mg/l) | O-Phosphate (mg/l) |
|---|---|---|---|---|---|---|---|
| Aqueous Samples | DW-1 | drinking water | 9-25-84 | 1.6 | NR | 0.11 | 0.01u |
| | DW-2 | drinking water | 9-25-84 | 1.3 | NR | 0.14 | 0.01u |
| | DW-3 | drinking water | 10-01-84 | 2.1 | NR | NR | NR |
| | DW-4 | drinking water | 10-01-84 | 1.8 | NR | NR | NR |
| | DW-5 | drinking water | 10-01-84 | 2.0 | NR | NR | NR |
| | DW-6 | drinking water | 10-01-84 | 1.9 | NR | NR | NR |
| | DW-7 | drinking water | 10-01-84 | 0.8 | NR | NR | NR |
| | DW-PDC | drinking water | 10-23-84 | 1.5 | NR | NR | NR |
| | DW-PDC2 | drinking water | 10-23-84 | 1.4 | NR | NR | NR |
| | SW-1 | surface water | 9-24-84 | 2.0 | NR | 0.1u | 0.773 |
| | Sw-2 | surface water | 9-24-84 | 0.7 | NR | 0.1u | 0.016 |
| | SW-3 | surface water | 9-25-84 | 1.1 | 2 | 0.1u | 0.010 |
| | SW-4 | surface water | 9-24-84 | 1.1 | NR | 0.1u | 0.013 |
| | SW-6 | surface water | 9-25-84 | 1.3 | NR | 0.1u | 0.018 |
| | BL-1 | s. water blank | | 0.1u | NR | 0.1u | 0.01u |
| | GW-1 | sump water | 9-26-84 | 30 | 30 | 0.37 | 0.981 |
| | GW-2 | sump water | 9-25-84 | 495 | 270 | 5.7 | 0.234 |
| | GW-3 | sump water | 9-26-84 | 80 | 40 | 12.3 | 0.01u |
| | GW-4A | sump water | 9-26-84 | 187 | NR | 89.3 | 0.053 |
| | GW-4B | sump water dup 4A | 9-26-84 | 173 | 150 | 83.3 | 0.049 |
| | 2 GW-4 | sump water | 10-24-84 | 66 | NR | NR | NR |
| | 2 GW-42 | sump water dup 4 | 10-29-84 | 50 | NR | NR | NR |
| | GW-VC | sump water | 10-24-84 | 63 | 44 | 31.8 | 0.036 |
| | GW-X | sump water | 10-24-84 | 130 | 242 | 4.3 | 0.01u |
| | GW-NC | sump water | 10-24-84 | 56 | 44 | 0.023 | 0.01u |

| | Sample | Type | Date | U 238 (ug/g) | Gross Alpha (pCi/g) | NO3-NO2 (mg/g) | O-Phosphate (mg/g) |
|---|---|---|---|---|---|---|---|
| Solid Samples | SO-NC | soil | 10-24-84 | 1.9 | 17 | 14 | 0.34 |
| | SO-VC | soil | 10-24-84 | 1.8 | 17 | 0.043 | 0.45 |
| | SO-X | soil | 10-24-84 | 2.0 | 17 | 0.01u | 0.47 |
| | F-NC | fertilizer | 10-24-84 | 11.0 | 8 | 19.2 | 18.1 |

1 = Duplicate sample
u = Value of detection limit.
NR = Analysis not run

2 = Samples collected outside of study area

water criteria (Safe Drinking Water Committee, 1983; USEPA, 1976b, 1980). There is an important distinction between a standard and a criterion. Standards are legally enforceable, while criteria are recommended levels. Many elements, such as calcium, magnesium and sodium, do not have national criteria.

The comparison indicates that no parameters exceeded their criteria in the three drinking water samples that received total analysis.

Nine drinking water samples were analyzed for uranium (Table 5.4). The concentrations ranged from 0.8 to 2.1 ug/l with an average of 1.6 ug/l. The drinking water criteria recommended by the Safe Drinking Water Committee of the National Academy of Sciences is 35 ug/l (1983).

### 5.1.3 Evaluation of Surface Water, Sump Water and Drum Water Data

Eight surface water samples were analyzed for major cations and trace metals. Analyses are reported as total concentrations, meaning that both dissolved and suspended concentrations were measured. As Table 5.2 indicates, most heavy metals are observed to be near or below detection limits. Other major cations such as calcium, potassium and sodium may appear to be present at high concentrations, however these major cations are non-toxic and are within the normal range. Most trace metal concentrations, with the exceptions of iron, manganese and zinc, are reported to be below analytical detection limits.

Some minor changes of surface water quality parameters are noted as streams flow through the area. A background sample (SW-2) was collected from Weaver Gulch, near the stables at the Willowbrook Golf Course. This sample is upstream of the Harriman Park division. Most comparisons in water quality of surface waters will be made to this sample. The water at SW-2 is good, with moderately low concentrations of major cations.

Water is diverted from Weaver Gulch to Bergen Reservoir west of the Dakota hogback (See Figure 3.4). One branch of Bergen ditch flows into the Bergen reservoirs and exits the dam on the north shore of Bergen Reservoir No. 2. A sample (SW-3) collected from the outlet showed a decrease in concentrations of iron, manganese, and zinc with no changes in other trace metal concentration. Further downstream at SW-4, concentrations of iron, manganese and aluminum had increased slightly.

A second branch of Bergen ditch turns south after cutting through the hogback and then heads east approximately paralleling West Bowles Avenue. When EPA-FIT sampled this branch (Initial Reconnaissance), there was no flow being released from Weaver Gulch to the branch. The water sampled apparently resulted from ground water discharge into the ditch. Flow at I-SW-1 was very low, and a considerable amount of sediment was brought up with the sample. An analysis for total constituents, dissolved and suspended, was performed. It is the sediment that contributes to the high concentrations of some trace metals that are observed in I-SW-1.

A second sample (I-SW-2) was collected further downstream on this branch below the waste dumping area. Flow was estimated at one gallon per minute. The sediment load in this sample was greatly diminished, and the analyses show a significant decrease of all parameters. This surface water has water quality similar to samples collected in the northern part of the study area, although manganese is present at a greater concentration. The analysis indicates that no contaminants are present in the stream after it passes through the dumping area when compared with concentrations in the other stream samples.

Two additional surface water samples were collected in the northern section of Harriman Park. Sample SW-1 was from a ditch receiving storm drainage prior to entry into Weaver Gulch. This sample contained the highest concentrations of aluminum and iron of all surface waters sampled except I-SW-1 which was discussed above. Calcium, potassium and sodium were all present in greater concentrations than

the background sample. Manganese and zinc were similar to background. No other trace metals were present in detectable concentrations. The higher concentrations in SW-1 may be due to the fact that this ditch drains a developed area. Sample SW-6 was collected from the west shore of Harriman Lake. This lake does not receive direct flow from Weaver Gulch. Because the sample was collected near the surface and near shore, the water appeared to contain visible amounts of algae, and may be somewhat different in content than water from the center of the lake. Concentrations in this sample are not significantly different from the other stream sample concentrations.

Five samples of sump water were collected from basements in the site area. Two of these samples (GW-4A and GW-4B) were duplicates. These samples contained visible suspended solids. The sump samples were not filtered, and analyses were performed as totals. Due to the large amount of visible suspended solids, the samples are likely to contain higher values of trace elements. The data are presented in Table 5.2. Approximately one month after these samples were collected, three more sump samples (GW-VC, GW-X, GW-WC) were taken at the same locations and were analyzed for uranium, ortho-phosphate, nitrate plus nitrite and gross alpha activity. Those results are presented in Table 5.4. One additional sump sample (GW-Y) was collected from a new location at this time and analyzed for the same suite of parameters as the first five samples, but not uranium, nitrate plus nitrite, ortho-phosphate, and gross alpha.

Because sump water does not fit into any category for which health standards or criteria have been recommended, evaluation of sump water quality to any criteria is not appropriate. Sump water is not technically ground water because the water has been in contact with the house foundation and exposed to the atmosphere and debris or liquids in the basement that could enter the sump. Therefore, comparison with background ground water quality is also not applicable. Because sump water is not routinely ingested, application of drinking water standards could be misconstrued in terms of health impacts. But drinking water standards may provide a yardstick for measuring water

quality, if applied with the understanding that exceeding the standard does not mean there is a health hazard because the water is not being consumed on a regular or long-term basis.

Using this approach, it appears that some parameters (e.g nitrates) in one or more of the sumps are greater than the concentrations generally considered safe for routine consumption. However, given the worst case situation of a young child ingesting large quantities of sump water (e.g. one liter in a single or infrequent episode), it is the opinion of EPA-FIT toxicologists that no adverse health effects would result from such an exposure.

None of the parameters analyzed in sample GW-Y were greater than the criteria. Uranium concentrations were found to be greater than the criterion (35 ug/l) in all other samples but GW-1. Only GW-4 had nitrate/nitrite, chromium, and selenium in concentrations greater than their criteria (10 mg/l, 50 ug/l and 10 ug/l, respectively). Other parameters with concentrations greater than the criteria were manganese, aluminum and iron in GW-1 and GW-2. These three metals may also have been associated with the sediment in these samples.

The sump analyses that appear in Table 5.4 were the resampling of three sumps. The pairs of samples are GW-2 and GW-X, GW-3 and GW-WC, and GW-4A/4B and GW-VC. Using Table 5.4, a comparison between the two sampling periods can be made. Concentrations of nitrate/nitrite, organo-phosphate and uranium 238 decreased in each sump. The reason for this decrease may be attributed to dilution. The first sampling took place on September 24, 1984, and the second sampling occurred on October 24, 1984. In the interim the Denver area received a heavy snowfall, with accumulations of 18 inches in some areas of Harriman Park. The snowfall was followed by a warming period. Melt water percolated into the ground and moved into sumps. The rapid introduction of fresher water could lead to short-term dilutions of ground water concentrations and sump waters.

A water sample (D#1) was also collected from a drum found along Bergen ditch near West Bowles Avenue. The analysis of the sample provided in Table 5.2, shows very low concentrations of all inorganic parameters. Only zinc, copper, manganese and barium were detected, but their concentrations do not indicate the presence of any inorganic wastes.

### 5.1.4 Evaluation of Soil, Sediment and Fertilizer Data

Thirteen soils and nine stream sediment samples were collected for analyses. Soils were collected from yards, and sediments were collected from ditches at the same locations that surface water samples were taken. Analyses were performed on nitric acid digestates of the soils. Soils and sediment concentrations appear in Table 5.3 and are reported on a dry weight basis, except SO-WC, SO-VC, SO-X, SS-1, SED-1 and SED-2 which are reported on a wet weight basis. To prepare samples for a dry weight determination, the samples are dried in an oven to remove the moisture. When samples are analyzed on a wet weight or field condition basis, the percent moisture affects the reported concentrations so that concentrations of soils on a dry weight basis cannot be compared to them. For example, a soil which has a moisture content of 50 percent and a concentration of 200 mg/kg manganese (wet weight) will have a concentration of 400 mg/kg when the sample is dried. Since most references for soil concentrations report values as dry weight basis, concentrations are not converted to wet weight concentrations. The reported wet weight soils cannot be converted to dry weight because percent moistures were not available.

Soil and sediment samples are difficult to evaluate on the basis of whether the material contains too much of any inorganic chemical. There are no standards or criteria in the United States with which analyses may be compared. The concentrations of elements in soils and sediments are affected by many factors: the mineralogical compositon of the source rock, the pH of the soil or sediment, whether the environment of the deposition is oxidizing or reducing, the quantity of clay in the soil, the amount of rainfall, whether the soil is

permeable and allows water to readily infiltrate, the chemistry of water in streams and in contact with the soil, to name several. In addition to these natural factors, chemical compositions may be influenced by the activity of man. Application of fertilizers and pesticides, breaking up or compacting the earth for building, and particulate fallout from urban industrial activities are some ways in which soil chemistries can be altered.

There are several ways of evaluating the impact to soils and sediments of an area. If the area has not been developed, samples can be collected prior to development. If the location of the contaminating source is known, then samples can be collected from an area that is geologically and climatologically similar but known to be outside of the impact of the source. Comparative data may also be used from published reports and references.

In the case of this investigation, a background soil sample (SO-3) was collected from a fallow field approximately 1 1/4 miles south of Belleview. The concentrations in this soil can be compared to other soil concentrations (dry-weight basis only). Very few trace metal concentrations in the soils from the site area exceeded the observed concentrations in the background soil. When greater concentrations were observed, the values were within twenty percent of the background soil concentration which is good agreement for soils analyses. Many metals could not be detected in any soil. These metals were antimony, mercury, selenium, and silver. Other metals with concentrations near their detection limits were beryllium and thallium. In the case of cadmium, the concentration in SO-3 was below detection (2.6 mg/kg) while several soils had concentrations above this value. This situation makes the evaluation of cadmium difficult.

Although the United States does not have recommended criteria for metal concentrations in soils, the United Kingdom (U.K.) Department of Environment has recommended acceptable concentrations for arsenic, lead, cadmium, selenium, mercury, chromium and boron (Smith, 1981). The Department has stated that these recommendations are applicable to

urban schools, playgrounds, recreational areas, and around residential areas, where there may be regular contact by small children. These recommendations are as follows:

| | | | | | |
|---|---|---|---|---|---|
| Arsenic | - As | 20 mg/kg | Mercury | - Hg | 1.5 mg/kg |
| Lead | - Pb | 550 mg/kg | Chromium | - Cr | 600 mg/kg |
| Cadmium | - Cd | 5 mg/kg | Boron | - B | 3 mg/kg |
| Selenium | - Se | 3 mg/kg | | | |

Concentrations are expressed on a dry weight basis for samples prepared by acid extraction samples. Comparison with these values indicates that there are no cases where trace metals concentrations exceed the U.K. recommendations, except for those expressed as wet weight basis. Furthermore, unpublished U.S. Geological Survey (personal communication, U.S.G.S.) indicate that Harriman Park soil trace elements vary within the expected limits for the Front Range. An additional basis for comparison of the inorganic constituents of Harriman Park soils is provided in Table 5-3 where the normal ranges for these constituents are reported for the western United States.

The background sediment sample, (SE-2) was collected upgradient in Weaver Gulch west of the Dakota hogback. Several metals are found at higher concentrations in downstream sediments. These metals are aluminum, arsenic, lead, and to some extent chromium and zinc. In only two cases do concentrations slightly exceed the recommendations - selenium in SE-3 (Bergen Reservoir #2) and arsenic in SE-4 (ditch leading into Weaver Gulch).

Sediment lead concentrations appear to be higher in the developed areas than upstream in SE-1 and SE-2 where the concentration is about 7 mg/kg. The concentrations appear to increase to the east with concentrations in SE-4 through SE-7 at levels two to eight times greater than background. The highest lead concentration was found in SE-7, collected from Weaver Gulch where it is crossed by West Quincy Avenue. This distribution suggests that there is a relationship between occurrence of lead and development. Although certainly not conclusive by these data, sediment lead concentrations could be related to automobile emissions. However, no lead concentrations even approach the UK recommendation of 550 mg/kg.

A sample of fertilizer (F-WC) was also sampled during the investigation. Phosphate fertilizers often have trace metals such as uranium, arsenic and cadmium associated with them. The analysis indicated concentrations of 11 mg/kg uranium, 15 mg/kg arsenic and 15 mg/kg cadmium. Other trace metals such as chromium, vanadium, nickel and thallium were identified in the fertilizer, and with the exception of uranium, these metals, due to their low solubilities are likely to be bound to the soil rather than leached through. In oxidizing conditions, as in an aerated lawn which receives sprinkled water, uranium is more likely to be in solution and move into the ground water.

### 5.1.5 Quality Assurance Review of Inorganic Data

Two laboratories were used in the analyses of inorganic parameters. Both laboratories have internal checks for quality assurance that include checks on calibration criteria, matrix spike recoveries, percent differences of duplicates, interference checks and blank results. The laboratories use EPA approved methods in analytical determinations, however, method sensitivities may vary between laboratories. Data met the applied QA criteria before being used in this report.

In reviewing soils data, EPA-FIT noted that one set of data had arsenic values that appeared to be higher than expected. Communication with the laboratory indicated that the method of analysis was sometimes subject to interferences by very high concentrations of iron which could affect the analysis of arsenic, as well as antimony, selenium, tin, cadmium and manganese. Such interferences can occur in soils and sediments which are mostly comprised of silica, iron and manganese and in waters containing suspended inorganic material. The interference can cause the measurement to be greater than the actual value.

A reanalysis was requested of both laboratories for six soils in question (SO-C, SO-4, SO-WW, SO-C1, SE-BR and SO-K). The laboratories applied more sensitive techniques of analyses that either avoided or

TABLE 5.5: COMPARISON OF ARSENIC CONCENTRATION IN SOILS USING DIFFERENT ANALYTICAL METHODS
(concentrations in mg/kg -wet weight basis)

| | ICP Method | ICP/Hydride Method | Graphite Furnace |
|---|---|---|---|
| SO-Y | 57.9 | 6.4 | 6.5 |
| SO-K | 31.2 | 2.3 | 2.7 |
| SO-Cl | 65.6 | 5.8 | 2.5 |
| SO-C | 63.3 | 4.9 | 6.0 |
| SO-WW | 61.9 | 6.1 | 3.7 |
| SO-BR | 27.8 | 3.9 | 2.1 |

diminished the interference. The reanalyzed arsenic results are shown in Table 5.5 in comparison to the first set of results. There is very good agreement between the two sets of reanalyzed data.

In preparation of this report, the arsenic data from the first set of analytical data are provided in Appendix B for review. To maintain consistency in reporting, only data from the more sensitive reanalyzed set are used in the interpretation. These are the data that appear in Table 5.3.

For checks on field procedures, a blank and duplicate were collected. The blank (BL-1) was collected with the surface water samples by pouring metals free water into the sampling bucket that was used to collect the samples. Since some inorganics appeared in the blank that were otherwise not detected in any other samples, it appears that the water used to prepare the blank was slightly contaminated. Hence, this finding does not affect the quality of the total body of inorganic results.

One set of duplicate analyses was collected. Samples GW-4A and GW-4B came from a basement sump. Large percent deviations are noted for several parameters, notably calcium, arsenic, chromium and lead. However, as previously noted, these unfiltered samples contained considerable suspended matter which could affect the reproducibility of results by increasing sample heterogeneity.

## 5.2 Organic Data

### 5.2.1 Analytical Results

Table 5.6 provides the organic data results from the aqueous sampling conducted under all phases. Table 5.7 provides the organic data tabulations from soil and sediment samples collected during all phases. Table 5.8 provides a complete list of organic substances monitored in water, soil and sediment samples at Harriman Park. Tables 5.9 and 5.10 provide the organic data tabulations from the air sampling conducted under Phase III. In each case, only those compounds detected are reported; however, the number of parameters analyzed are also reported in the tables. In general, a full suite of parameters included 130 analytes; however, volatiles and PCB's were not analyzed in approximately one-third of the soil samples. For certain drinking water samples (DW-3 through DW-7), only volatile organics (40 parameters) were analyzed. In addition to these analyses, the laboratories are required to report tentatively identified compounds, should they appear in the sample. Sampling locations may be found in Figures 4.2 through 4.5.

### 5.2.2. Quality Assurance of Organic Data

The organic analyses for aqueous and soil/sediment samples were conducted by three separate laboratories. Each laboratory submitted quality assurance specifications which were reviewed by the FIT Quality Assurance Officer. As a whole, all of the data were of good quality, and were accepted as suitable for interpretation.

The organic data from the initial air monitoring were rejected due to extensive laboratory contamination. While these data are of no use whatsoever, as a matter of record, it should be noted that EPA-FIT

compared these tentative data to similar air monitoring data for Denver (Singh, 1983) and found levels reported for Harriman Park to be generally lower than levels reported for Denver. In addition, the concentrations of contaminants observed were lower than occupational health standards for workers by 1,000-10,000 times.

The data from the repeat organic air monitoring were received and subjected to a quality assurance review. The field blank was not excessively contaminated with these samples. Some disagreement between the duplicate results A-9 and A-10 was observed with certain compounds being undetected in one or the other duplicate. However, the compounds common to both duplicates were generally detected within a factor of two, indicating adequate precision for the method.

### 5.2.3 Evaluation of Water Data

Drinking water sample concentrations were compared to water quality standards and criteria. No exceedances were found (Table 5.6).

Similar suitable standards are not available for surface waters and sump waters. It is recognized that some persons may be tempted to compare surface water and sump water data with the drinking water standards and criteria; however, this is of dubious value since these waters are not routinely ingested. In order to properly apply drinking water standards and criteria to surface water or sump water, individuals would have to be ingesting these waters as their total water intake for their entire lifetime. Even young children without parental supervision are not likely to ingest these waters on a regular basis.

Even if this technically inappropriate comparison is made, no exceedances of health criteria are observed.

Table 5.6 displays the contaminants identified and their observed concentrations. As may be seen, only chloroform and bromodichloromethane appeared with any frequency in drinking water; however, the

TABLE 5.6 ORGANIC ANALYTICAL RESULTS FOR WATER SAMPLES (ug/l or ppb)

| | DW-1 | DW-2 | DW-3 | DW-4 | DW-5 | DW-6 | DW-7 | DW-PDC | GW-Y | GW-1 | GW-2 | GW-3 | GW-4A | GW-4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analytes | 130 | 130 | 40 | 40 | 40 | 40 | 40 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| chloroform | 25.0 | 24.0 | 18.7 | 22.4 | 21.2 | 16.5 | 3.9 | 5.0 | -- | -- | -- | -- | -- | -- |
| chlorodibromethane | -- | -- | 1.1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| bromodichloromethane | 9.0 | 8.0 | 6.7 | 7.2 | 6.6 | 5.6 | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-butanone | -- | -- | -- | -- | -- | -- | -- | 2.5 | -- | 11 | -- | -- | -- | -- |
| 1,3,2 oxazaborolidine | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6J | -- | -- | -- |
| 1,1 bicyclohexyl | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2J | -- | -- | -- |
| 1,2 benzenedicarboxylic acid | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4J | -- | -- | -- |
| di-N-butylphthalate | 15J | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 14J | 14J | -- |
| 2-pentanone | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| pyrene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| bis2ethylhexylphthalate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| benzo(k)fluoranthene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| methyl benzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| toluene | 3J | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| methylene chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

J Indicates tentatively identified compound and concentration
-- Not Detected

NOTE: For the entire list of parameters analyzed, see Table 5.8.

TABLE 5.6 ORGANIC ANALYTICAL RESULTS FOR WATER SAMPLES CONT. (ug/kg or ppb)

| | SW-1 | SW-2 | SW-3 | SW-4 | SW-6 | HEALTH CRITERIA | 1-SW-1 | 1-SW-2 |
|---|---|---|---|---|---|---|---|---|
| Analytes | 130 | 130 | 130 | 130 | 130 | | 122 | 122 |
| chloroform | -- | -- | -- | -- | -- | 100.0[a] | -- | -- |
| chlorodibromethane | -- | -- | -- | -- | -- | 100.0[a] | -- | -- |
| bromodichloromethane | -- | -- | -- | -- | -- | 100.0[a] | -- | -- |
| 2-butanone | -- | -- | -- | -- | -- | no criteria | -- | -- |
| 1,3,2 oxazaborolidine | -- | -- | -- | -- | -- | no criteria | -- | -- |
| 1,1 bicyclohexyl | -- | -- | -- | -- | -- | no criteria | -- | -- |
| 1,2 benzenedicarboxylic acid | -- | -- | -- | -- | -- | no criteria | -- | -- |
| di-N-butylphthalate | -- | -- | -- | -- | -- | 34,000.0[b] | -- | -- |
| 2-pentanone | 120J | -- | -- | -- | -- | no criteria | -- | -- |
| pyrene | -- | 9J | -- | -- | -- | 0.028[b] | -- | -- |
| bis2ethylhexylphthalate | -- | 11J | -- | -- | -- | 15,000.0[b] | -- | -- |
| benzo(k)fluoranthene | -- | 25J | -- | -- | -- | 0.028[b] | -- | -- |
| methyl benzene | -- | 98J | -- | -- | -- | no criteria | -- | -- |
| toluene | -- | -- | -- | -- | -- | 14,300.0[b] | 15 | -- |
| methylene chloride | -- | -- | -- | -- | -- | 150.0[c] | 3 | -- |

J Indicates tentatively identified compound and concentration
-- Not Detected
a EPA National Interim Primary Drinking Water Regulations.
b EPA Ambient Water Quality Criteria, 1980.
c EPA Health Advisory, undated.

NOTE: For the entire list of parameters analyzed, see Table 5.8.

TABLE 5.7 ORGANIC ANALYTICAL RESULTS FOR SOIL AND SEDIMENT SAMPLES (ug/kg or ppb)

(Did not do volatiles (40) or PCB's (8) = 82 analytes

| | SO-1[1] | SO-2[1] | SO-3 | SO-4 | SO-5 | SO-6 | SO-7 | SO-8 | SO-9 | SO-XW1 | SO-XW2 | SE-BR | SO-K | SO-C2 | SO-WW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analytes | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 82 | 82 | 82 | 82 | 82 | 82 |
| methylene chloride | -- | -- | -- | -- | -- | 73 | 8.3 | 6.5 | 4.7 | -- | -- | -- | -- | -- | -- |
| benzene | -- | -- | -- | -- | -- | 1.8 | 1.6 | 2.1 | 2.1 | -- | -- | -- | -- | -- | -- |
| b2EH phthalate | -- | -- | -- | -- | -- | 400 | 133 | 73 | -- | -- | -- | -- | -- | -- | -- |
| dnOctyl phthalate | -- | -- | -- | 480 | -- | 3200 | 1200 | 1600 | -- | -- | -- | -- | -- | -- | -- |
| BHC | -- | -- | -- | -- | -- | .6 | 13.5 | 3.4 | -- | -- | -- | -- | -- | -- | -- |
| dBHC | -- | -- | -- | -- | -- | .2 | -- | 1.2 | -- | -- | -- | -- | -- | -- | -- |
| heptachlor | -- | -- | -- | -- | -- | 36.9 | -- | -- | 2.0 | -- | -- | -- | -- | -- | -- |
| endosulfan 1 | -- | -- | -- | -- | -- | 3.6 | 1.1 | 2.8 | 2.9 | -- | -- | -- | -- | -- | -- |
| dieldrin | -- | -- | -- | -- | -- | 5.3 | -- | 13.7 | -- | -- | -- | -- | -- | -- | -- |
| 4,4,DDE | -- | -- | -- | -- | -- | 3.1 | 1.2 | 16.8 | 29.2 | -- | -- | -- | -- | -- | -- |
| 4,4,DDD | -- | -- | -- | -- | -- | 3.2 | -- | 3.7 | 5.5 | -- | -- | -- | -- | -- | -- |
| endosulfan sulfate | -- | -- | -- | -- | -- | 123.9 | 4.8 | 149.3 | -- | -- | -- | -- | -- | -- | -- |
| 4.4 DDT | -- | -- | -- | -- | -- | 18.7 | -- | 18.8 | 45.7 | -- | -- | -- | -- | -- | -- |
| acetone | -- | -- | -- | -- | -- | -- | -- | 3.7 | -- | -- | -- | -- | -- | -- | -- |
| gasoline constituents | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | $>1x10^6$ | -- | -- | -- | -- |
| toluene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,methyl phenol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| di-N-butyl phthalate | -- | -- | -- | 391 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

-- Not Detected
1 Sample matrix not analyzed by laboratory due to unacceptable particle size (pea gravel).

NOTE: For the entire list of parameters analyzed, see Table 5.8.

TABLE 5.7 ORGANIC ANALYTICAL RESULTS FOR SOIL AND SEDIMENT SAMPLES, CONT. (ug/kg or ppb)

| | SO-C | SO-Y | SE-1 | SE-2 | SE-3 | SE-4 | SE-5 | SE-6 | SE-7 | SE-8 | SS-1 | 1-SED-1 | 1-SED-2 | D-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analytes | 82 | 82 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 122 | 122 | 122 | 122 |
| methylene chloride | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4 | 12 | 25 | -- |
| benzene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| b2EH phthalate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| dnOctyl phthalate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| bHC | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| dBHC | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| heptachlor | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| endosulfan 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| dieldrin | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,4,DDE | -- | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- | -- | -- | -- |
| 4,4,DDD | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| endosulfan sulfate | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4.4 DDT | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| acetone | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| gasoline constituents | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| toluene | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 6 | -- | -- |
| 4,methyl phenol | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 990 | -- | -- |
| di-n-butyl phthalate | -- | -- | 163 | -- | -- | -- | 400 | -- | -- | 510 | -- | -- | -- | -- |

NOTE: For the entire list of parameters analyzed, see Table 5.8.

TABLE 5.8

LIST OF ORGANIC CONTAMINANTS MONITORED AT HARRIMAN PARK

## VOLATILES

acrolein
acrylonitrile
benzene
carbon tetrachloride
chlorobenzene
1,2-dichloroethane
1,1,1-trichloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
chloroethane
2-chloroethylvinyl ether
chloroform
1,1-dichloroethene
trans-1,2-dichloroethene
1,2-dichloropropane
trans-1,3-dichloropropene
cis-1,3-dichloropropene
ethylbenzene
methylene chloride
chloromethane
bromomethane
bromoform
bromodichloromethane
fluorotrichloromethane
dichlorodifluoromethane
chlorodibromomethane
tetrachloroethene
toluene
trichloroethene
vinyl chloride
acetone
2-butanone
carbondisulfide
2-hexanone
4-methyl-2-pentanone
styrene
vinyl acetate
total xylenes
2-PENTANONE

## PESTICIDES

aldrin
dieldrin
chlordane
4,4'-DDT
4,4'-DDE
4,4'-DDD
α-endosulfan
β-endosulfan
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
α-BHC
β-BHC
δ-BHC
γ-BHC (lindane)
PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016
toxaphene

## SEMI-VOLATILES

2,4,6-trichlorophenol
p-chloro-m-cresol
2-chlorophenol
2,4-dichlorophenol
2,4-dimethylphenol
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dinitro-2-methylphenol
pentachlorophenol
phenol
benzoic acid
2-methylphenol
4-methylphenol
2,4,5-trichlorophenol
acenaphthene
benzidine
1,2,4-trichlorobenzene
hexachlorobenzene
hexachloroethane
bis(2-chloroethyl)ether
2-chloronaphthalene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3'-dichlorobenzidine
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
fluoranthene
4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
bis (2-chloroisopropyl) ether
bis (2-chloroethoxy) methane
hexachlorobutadiene
hexachlorocyclopentadiene
isophorone
naphthalene
nitrobenzene
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodipropylamine
bis (2-ethylhexyl) phthalate
benzyl butyl phthalate
di-n-butyl phthalate
di-n-octyl phthalate
diethyl phthalate
dimethyl phthalate
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(k)fluoranthene
chrysene
acenaphthylene
anthracene
benzo(ghi)perylene
fluorene
phenanthrene
dibenzo(a,h)anthracene
indeno(1,2,3-cd)pyrene
pyrene
aniline
benzyl alcohol
4-chloroaniline
dibenzofuran
2-methylnaphthalene
2-nitroaniline
3-nitroaniline
4-nitroaniline

TABLE 5.9 ORGANIC ANALYTICAL RESULTS FOR AIR SAMPLES (ug/m$^3$)
POSITIVELY IDENTIFIED COMPOUNDS

| | A-6 | A-7 | A-9 | A-10 | HARRIMAN PARK RANGE | JCHD A-8 | NIOSH* | ACGIH* | SINGH |
|---|---|---|---|---|---|---|---|---|---|
| ,butanone | 32.8 | | 24.2 | | 24.2-32.8 | 0.6 | 590,000 | 590,000 | NR |
| ,1,1-trichlorethane | 1.4 | 0.1 | 1.7 | 0.1 | 0.1-1.7 | 0.1 | 1,900,000 | 1,900,000 | 4.0 |
| richloroethylene | 0.4 | 0.2 | 0.2 | 0.2 | 0.2-0.4 | 0.3 | 540,000 | 270,000 | 1.4 |
| enzene | 0.7 | 0.2 | | | 0.2-0.7 | 0.4 | 30,000 | 30,000 | 13.4 |
| oluene | 30.6 | 20.3 | 17.1 | 24.5 | 17.1-30.6 | 18.6 | 750,000 | 375,000 | 22.2 |
| thyl benzene | 3.5 | 1.2 | 2.6 | 2.1 | 1.2-3.5 | 1.4 | 435,000 | 435,000 | 8.5 |
| ylenes | 22.2 | 6.6 | 21.1 | 11.5 | 6.6-22.2 | 8.2 | 435,000 | 435,000 | 16.8 |
| ethylene chloride | | 0.2 | | 0.1 | 0.1-0.2 | | 1,750,000 | 350,000 | 3.3 |
| tyrene | | 1.1 | | 3.1 | 1.1-3.1 | | 430,000 | 215,000 | NR |
| cetone | | | | 0.1 | | | 2,400,000 | 1,750,000 | NR |
| hlorobenzene | | | | | | | 350,000 | 350,000 | NR |
| otal volatiles | 91.6 | 29.4 | 66.9 | 41.7 | 29.4-91.6 | 29.6 | | | |

8 hour time-weighted average

TABLE 5.10 ORGANIC ANALYTICAL RESULTS FOR AIR SAMPLES ($ug/m^3$)
TENTATIVELY IDENTIFIED COMPOUNDS

| | A-6 | A-7 | A-9 | A-10 | HARRIMAN PARK RANGE | JCHD A-8 | ACGIH TLV |
|---|---|---|---|---|---|---|---|
| Methylcyclohexane[1] | 13.6 | 30.2 | | 44.8 | 13.6-44.8 | | 1,600,000 |
| 3-methylhexane[1] | 3.6 | | | 11.9 | 3.6-11.9 | | -- |
| benzaldehyde | 5.7 | | 11.1 | 6.6 | 5.7-11.1 | | -- |
| 1-methylethylbenzene[1] | | | 12.5 | 4.7 | 4.7-12.5 | | -- |
| dichlorobenzene | | 7.5 | 8.4 | 5.8 | 5.8-8.4 | 6.9 | 300,000 |
| 1-phenylethanone[1] | | | | 5.6 | | | -- |
| hexane[1] | | | | | | 2.4 | 180,000 |
| pentane[1] | 6.2 | 13.4 | | | 6.2-13.4 | | 180,000 |
| methylcyclopentane[1] | 4.3 | | | | | 26.3 | -- |
| 4-ethyl-2,2 dimethylhexane[1] | 2.1 | | | | | | -- |
| 2-methylhexane[1] | 8.3 | | | | | | -- |
| 2-ethyl-1-hexanol[1] | 7.5 | 15.1 | 21.0 | 17.8 | 7.5-21.0 | | -- |
| cyclohexane[1] | | 1.0 | | | | | 1,050,000 |
| 2,3 dimethylpentane[1] | | 4.1 | | | | | -- |
| phenol | | -- | | | | 9.9 | 19,000 |
| 2-ethyl,4-ethyl 1-pentanol[1] | | | | | | 14.8 | -- |
| 1,3 dimethylcyclopentane[1] | | | 25.5 | | | | -- |
| heptanol[1] | | | 10.6 | | | | -- |
| octane[1] | | | 8.2 | | | | 1,450,000 |
| gasoline (not specifically analyzed) | | | | | | | 900,000 |
| Total | 38.6 | 71.3 | 97.3 | 97.2 | | 60.3 | |

1 Indicates a gasoline constituent

concentrations of these substances, by-products of the chlorination process, are well below the applicable EPA drinking water health standard. The only positively identified organic contaminant in sump or surface waters was 2-butanone. This compound is also often associated with laboratory contamination.

Remarkably few tentatively-identified compounds appeared in surface and sump waters and these were present at very low concentrations. As may be seen from the table, no positively identified contaminant exceeded health criteria.

### 5.2.4 Evaluation of Soil/Sediment Data

No health criteria or standards exist for organic contaminants in soil or sediment. Of the 26 soil and sediment samples for which data have been received, only 10 showed the presence of detectable levels of contaminants. Four of the 10 samples were taken from the drum site investigated by FIT at 11195 W. Belleview. One sample, (SO-XW2) was taken from a very localized suspected gasoline spill at a residence in Harriman Park.

Four soil samples and one sediment sample showed detectable levels of organochlorine pesticides such as DDT and dieldrin. Four of these were soil samples collected from the drum site at 11995 W. Belleview. This finding is not unusual given the former agricultural use of the area and the extreme persistence of these compounds in the soil.

Research was conducted to help interpret the siginificance of the organochlorine levels found in the soil at 11995 W. Belleview. Organochlorine pesticide soil residues were studied for agricultural soils in Colorado by Mullins and others (1971). Table 5.11 compares the mean of Colorado analytical results and the mean of 11195 W. Belleview analytical results.

TABLE 5.11

Comparison of Pesticide Residues for Colorado and 11995 W. Belleview. (ug/kg)

| Pesticide | Mean Analytical Results-Colorado | W. Belleview Mean Results |
|---|---|---|
| DDT | 5.57 | .041 |
| Dieldrin | 0.07 | .010 |
| Heptachlor | 0.01 | .020 |
| Endosulfan | 0.04 | .072 |

Mullins (1971) indicated that the residue levels reported for Colorado are lower than those reported for other areas of the United States. Given this fact, given the residue concentrations from W. Belleview, and given the isolation of the W. Belleview site, these residues do not present a health hazard to community residents. In addition, other soil samples in the actual Harriman Park area do not exhibit similar concentrations of organochlorine pesticide residues, indicating that the W. Belleview residues are probably confined to this property.

### 5.2.5 Evaluation of Air Data

No health standards exist for volatile organics in ambient air. However, the National Institutes of Occupational Safety and Health (NIOSH) and the American Conference of Governmental and Industrial Hygienists (ACGIH) have issued health standards and criteria for occupational exposure to air contaminants. Table 5.9 not only includes the observed contaminant concentrations for Harriman Park, but also includes the NIOSH standards and the ACGIH criteria for workers.

Occupational health criteria refer to airborne concentrations of substances and represent conditions under which workers may be repeatedly exposed day after day without adverse effect (ACGIH, 1983). It is not strictly appropriate to compare occupational health criteria to ambient air pollution levels for several reasons:

1) Workers are generally among the healthiest members of the general population and can tolerate greater exposure than the very old or very young and other members of the general population with pre-existing health conditions.

2) Workers are exposed only during the 40 hour work week, whereas the general public is continuously exposed to ambient air pollution.

Inclusion of these occupational health criteria in Table 5.9 is provided for comparison purposes only. The Harriman Park samples were found to be less than occupational health criteria by 1,000 to 100,000 fold.

Another method of assessing the significance of the reported air contaminant concentrations is to compare with other Denver-area monitoring data for airborne organic compounds. This was accomplished by comparison of the off-site air sample collected at the Jefferson County Health Department, 260 S. Kipling (A-8) with the remaining Harriman Park samples. In addition, the Harriman Park sample concentrations were compared with the reported values from a study of ambient levels of volatile organics found in Denver (Singh, 1981).

Comparison of the Harriman Park samples (A-6, A-7, A-9 and A-10) with the off-site sample A-8 indicates that most of the positively identified compounds were observed with similar frequency and concentration range in both the Harriman Park and the off-site air sample. Comparison of tentatively-identified compounds between the Harriman Park and the off-site sample. (Table 5.10), failed to establish any pattern since the tentatively-identified contaminants were dissimilar.

The Harriman Park data were also compared to air concentrations observed for Denver in the Singh study. The mean concentrations observed by Singh (1981) are shown in Table 5.9. In each case, the Singh results are greater than the Harriman Park sample results.

### 5.2.6 Discussion of Findings

No exceedances of health criteria were observed for any of the organic analytical sample results. This is quite remarkable given the large number of analyses (over 5000) performed.

Water Samples: The presence of chloroform and bromodichloromethane, collectively part of a larger group of compounds referred to as trihalomethanes, was observed in drinking water samples from Harriman Park. This occurs as the result of the chlorination process used by municipal water supplies to disinfect water and has been documented to occur routinely throughout the world. National surveys of water supplies have indicated that 95-100% of the finished (treated) drinking waters surveyed contained chloroform. The mean concentration at Harriman Park was 22.8 ug/l which is well below the EPA drinking water standards of 100 ug/l.

In summary the trihalomethanes detected in drinking water at Harriman Park are not unique to Harriman Park, but are known to occur throughout the Denver water system indeed in most drinking water supplies.

A finding of pyrene and benzo(k)fluoranthene at SW-2 at trace concentrations below the offical detection limit indicates one of two things: 1) the substances may actually not be present, or 2) SW-2 was located downstream from the Willowbrook Stables where fence poles likely have been treated with creosote preservatives, a very small amount of which may have entered Weaver Gulch at that location. No other occurrences of these contaminants were observed.

Phthalates were tentatively identified in some of the sump and surface waters. Phthalates are ubiquitous in the environment (Versar, 1979) and are a common constituent in plastic products, hence a finding of trace levels of phthalate acid esters in sumps is consistent with the plastic construction of sumps observed in Harriman Park.

Soil Samples: Sample SO-XW2 revealed numerous gasoline constituents as a result of a leaking five gallon gasoline can that caused gasoline vapors to infiltrate into a residence in Harriman Park. Approximately 1-3 gallons seeped into the ground before the problem was identified and corrected by the EPA Field Investigation Team.

The soil contaminants observed at the drum site, 11995 W. Belleview, do not appear to be consistent with the type of materials stored on the property. This indicates that little, if any spillage of drum material has occurred. It is not likely that the pesticides detected in the soil originated from the drums, based on drum label information. Instead, they are likely the result of past pesticide applications. Given the age of the dwelling on this site, and the long-lived nature of the chlorinated hydrocarbon pesticides, it is likely that the pesticides were used routinely around the dwelling during the last 20 years, yielding the residues observed.

The only other contaminants detected more than once in soil (one sample) and sediment (three samples) were the phthalate acid esters. These contaminants are widely distributed in the environment. In fact, sump waters also contained trace levels of phthalates suspected to leach from plastic-lined sumps. Field inspection of sumps in Harriman Park revealed that many sumps discharge to the street and sump water is conveyed to Weaver Gulch and its tributaries in Harriman Park via the storm sewer system. It is suspected that sump discharges serve as a source of phthalates and that, due to the physical-chemical properties of phtalates (high organic carbon affinity and persistence), stream sediments accumulate low levels of phthalates.

Air Samples: The nature of most of the air contaminants detected is consistent with gasoline vapors and the likely combustion products from gasoline. Among the positively-identified compounds, benzene, toluene, and xylenes are present in gasoline (ACGIH, 1983; Maynard and Sanders, 1969) and would be likely to be present in automobile exhaust. Among the tentatively-identified compounds, methylcyclohexane, 2-methyl hexane, 3-methylhexane, cyclohexane, hexane, pentane, dimethylpentane, methylcyclopentane, phenol and others are also found in gasoline and probably automobile exhaust emissions, (ACGIH, 1980; Maynard and Sanders, 1969). It appears highly probable that the air monitoring for Harriman Park detected a large number of compounds associated with gasoline vapors and automobile exhaust emissions. In fact, the bulk of the total quantity of vapors detected appears to associated with these sources, Table 5.9.

The other class of compounds detected are organic solvents typically used in surface coatings, adhesives and degreasing activities (ACGIH, 1980; NIOSH 1981). This group includes 2-butanone, methyl ethyl ketone), acetone, trichloroethylene, 1,1,1 trichloroethane, methylene chloride, ethyl benzene and styrene. These compounds are typically found in urban air at concentrations exceeding those observed in the Harriman Park study (Singh, 1981; Clark, et al, 1984).

## 5.3 Other Investigations

This section summarizes information collected as a result of other investigations of dumping and or suspected hazardous waste activities. These activities may be divided into: the drum site at 11195 W. Belleview, data compilation for the ERRIS sites, and other miscellaneous investigations.

### 5.3.1 Drum Site

As described earlier, 62 drums were inventoried, 3 drums were sampled, and 4 soil samples collected. Soil sample data are presented with the rest of the organic data in 5.7. Drum inventory data are

presented in Table 5.12. These drums apparently contained raw and/or waste products associated with hot tub manufacturing activities that occurred onsite during the period 1982 to 1984. Most of the materials are associated with polyester or polyurethane foam and resin products. Drum samples indicated that the samples were ignitable and hence hazardous waste by definition under CFR 261, regulations of the Resource Conservation and Recovery Act.

On October 25, 1984, EPA-FIT observed the attempted unsafe and illegal removal of these drums. The removal was halted with the assistance of Jefferson County Sheriff's Department and spilled material was noted. EPA-FIT alerted the Bancroft Fire Department and supporting agencies hazardous material emergency response team as well as the EPA Emergency Response Team. EPA officials directed the safe and immediate removal of the drums and spilled material under the Agency's Superfund authority later that same day.

### 5.3.2 ERRIS Site Data Compilation

As described earlier, EPA lists 25 known or suspected hazardous waste sites in Jefferson and Douglas counties under its Emergency and Remedial Response Information System (ERRIS). These sites have been mapped (Figure 2.2), and none are nearer than 5 miles from Harriman Park. Also, Harriman Park does not lie in the drainage patterns potentially affected by any of the 25 ERRIS sites.

In response to public comments about the potential for offsite ground water contamination from Martin Marietta and its possible relationship to Harriman Park, EPA-FIT has included an analysis of this question. The contaminant source areas in question at Martin Marietta are located in the valley west of the Dakota Hogback. The Fountain Formation, an arkosic conglomerate, is the principal bedrock unit underlying the area. This valley is also covered with alluvial and colluvial deposits. Thus, there are two potential ground water routes for contaminant movement. One is via the alluvium of Brush Creek into the Platte River valley, and the second is into the

TABLE 5.12

DRUM INVENTORY 11195 W. BELLVIEW

| NUMBER | COMMENT |
|---|---|
| 62 | Total |
| 36 | Contain material |
| 19 | Empty, 7 undetermined |
| 15 | Open to air via bung |
| 41 | Upside down or on side |
| 5 | Have residue outside drum |
| 27 | Marked DOT Flammable Liquid |
| 24 | Marked with other cautions |
| 25 | Labelled as "polyester resin" or "resin" |
| 5 | Labelled as polyurethane foam |
| 7 | Labelled as containing vinyl toluene and styrene |
| 3 | Labelled as Isocyanates |
| 2 | Labelled as Acetone |
| 6 | Dented or rusted |

Fountain aquifer. The relationship between the Brush Creek route and Harriman Park is discussed in a later paragraph.

The Fountain Formation extends more or less continuously from Wyoming to Canon City, Colorado, lying unconformably on the Precambrian granites and gneisses of the Front Range. The thickness of the Fountain Formation varies but, in general, the unit is 1,500 to 3,000 feet thick. It dips approximately 56° to the east. The Fountain is overlain by the following stratigraphic sequence, Figure 3.1 (with thicknesses): Lyons Sandstone (300 feet), Lykins Formation (500 feet), Morrison Formation (400 feet), the Dakota Group (400 feet), Benton Shale (550 feet), Niobrara Formation (400 feet) and the Pierre Shale (greater than 7,000 feet). This sequence is also present at Harriman Park, although there is some increase in thickness of the Pierre Shale due to repetition of the section along the Golden Fault. Ground water movement in the Fountain Formation probably follows the direction of dip along bedding planes. This direction is not towards Harriman Park. Even if Harriman Park were directly downgradient and in a similar stratigraphic location, it would be separated from the Fountain Formation by a thickness of <u>two miles</u> of stratigraphic section, most of which is comprised of tight shales.

In summary, the stratigraphic separation, the direction of ground water flow and the linear distance between the locations preclude the possibility of the Fountain Formation serving as a migration route for contaminants between Martin Marietta and Harriman Park.

Ground water contamination in the Brush Creek alluvium can potentially move into the Platte River alluvium. This route is currently being investigated by EPA-FIT. A portion of the concern about contaminant presence at Martin Marietta focuses on whether contaminants could enter the Kassler Water Treatment Plant. The plant is located immediately upstream from the confluence of Brush Creek and the Platte River. Another ephemeral stream, Filter Gulch, leads from Martin Marietta into the filtration galleries of the plant. Recently, information has come to light in a report by Woodward-Clyde

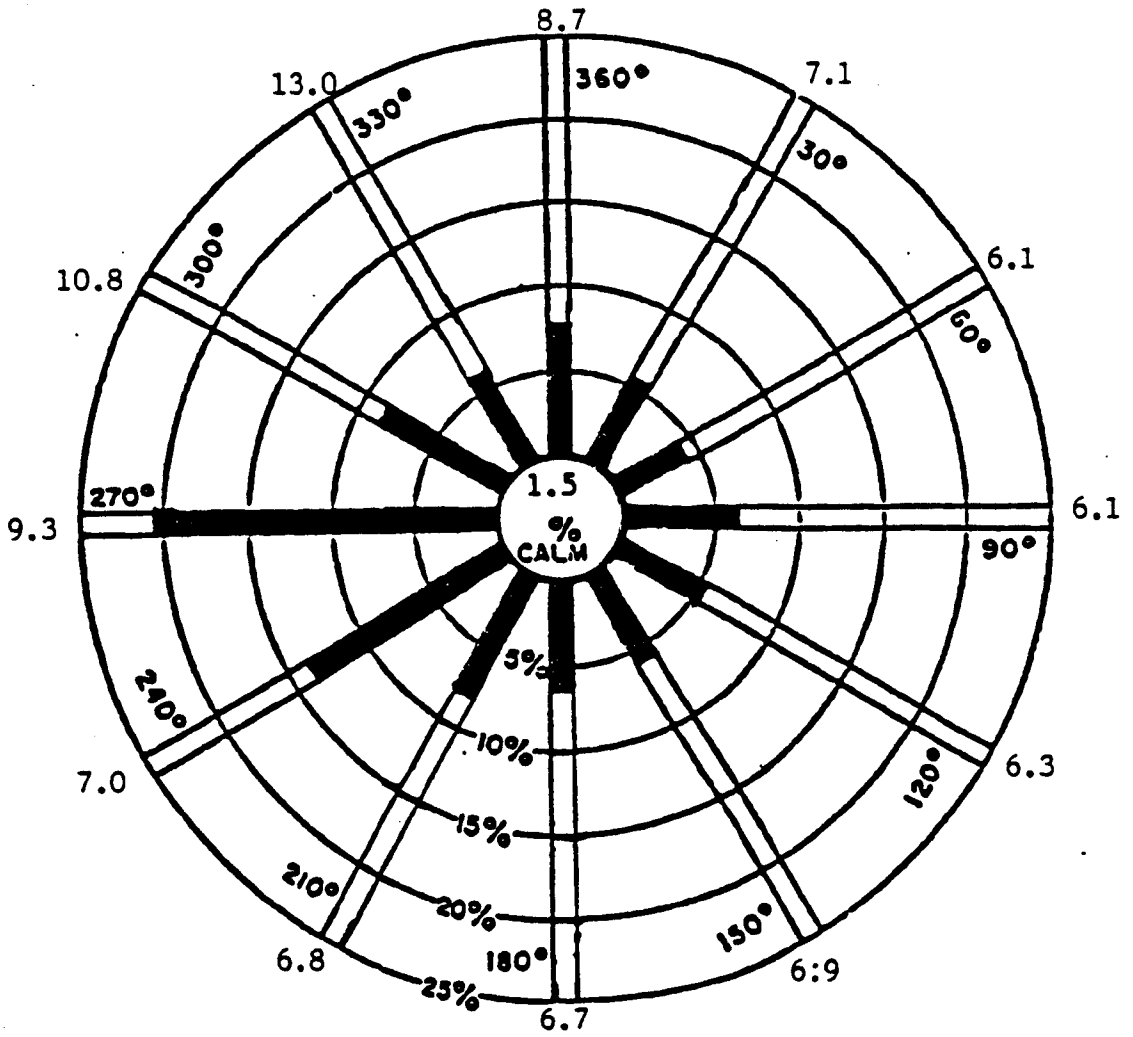
Consultants to Martin Marietta that high levels of contaminants exist in the ground water of Filter Gulch.

A water supply distribution system connection exists between the Kassler plant and the Harriman Park area. This potential exposure route has been sampled, although at the time FIT was not aware of the potential problems at the Martin Marietta. A portion of the water from the Kassler plant may be fed to the Belleview and Simms storage tank where it is blended with water from Marston Reservoir, affording an extremely large dilution factor. Water is then pumped to the Willowbrook Water tank. This tank is located south of the Willowbrook area. Water from the tank was sampled on 10/23/84 by EPA-FIT. The analyses for the sample DW-PDC were published in the FIT report on Harriman Park. No evidence of contamination was found.

In addition, EPA-FIT collected wind data from the Colorado Highway Department for a location near W. Quincy and S. Youngfield, Figure 5.1. These data were collected daily from 1974 through 1977 and indicate that the prevailing wind directions are from the west and the west-southwest. These directional vectors, plus the large dilution achieved by virtue of distance, greatly reduces the probability of windborne air contaminants emitted from Martin Marietta or other ERRIS sites reaching Harriman Park in detectable concentrations.

### 5.3.3 Miscellaneous Investigations

Potential dumpsites reported by residents at Harriman Park and investigated by EPA-FIT included: (1) Hine Lake, (2) Zinnia Ct. and Alkire, (3) the frontage road at U.S. 285 and (4) the area 1/2 mile NE of Bowles and Alkire. The Hine Lake area had about 12 empty, rusted barrels and an old homestead dump reported to contain a mineshaft. No evidence of a mineshaft could be found. Zinnia Ct. and Alkire has evidence of 1-2 gallons of motor oil dumped in the corner of the horse pasture. The frontage road area contained auto parts, furniture and other solid waste. The Bowles and Alkire area was not specifically identified, however the Initial Reconnaissance - Harriman Park inves-




| FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES<br>TASK REPORT TO THE E.P.A. | |
|---|---|
| TITLE: WIND ROSE<br>HARRIMAN PARK | |
| T.S.S. R8-8410-14 | |
| ecology and environment, inc.<br>DENVER, COLORADO | FIG. 5.1 |
| Date 11/84 Drawn by JH Date | |

tigation surveyed a gully with some 5 gallon drums and mostly household debris in this area.

The residence at one address (SO-XW), complained of chemical odors in the basement. EPA-FIT investigated with CDH and verified the odors and CDH collected an air sample. On November 2, 1984, EPA-FIT excavated outside the foundation and recorded organic vapors at the 4 foot depth in a french drain. Subsequent site inspection revealed a leaking 5 gallon gasoline can which had seeped into the soil and penetrated the house's french drain. The CDH air sample also revealed gasoline as did an EPA-FIT soils sample. The leaking can was removed.

EPA-FIT also conducted other support activities including a review of historical aerial photography for the area. Aerial photographs dating back to 1972 were reviewed at the Jefferson County Courthouse, National Cartographic Information Center and at the Jefferson County Planning department in Golden, Colorado. Data from the photos indicated the presence of borrow excavations in the form of gravel pits and clay pits. There was no evidence of mining in the Harriman Park development. Aerial photographs were also used to compile the surface water drainage patterns of the study area.

## 6.0 CONCLUSIONS

This chapter provides a brief statement of the conclusions that may be drawn from the investigation. The conclusions may be divided into three categories paralleling the organization of the report: (1) importance of the environmental setting as it relates to public health, (2) major findings relating to the inorganic data, (3) major findings relating to the organic data. Recommendations are presented in 7.0.

### 6.1 The Environmental Setting and Public Health

An in-depth review of the geology and mineral history of the area has been conducted and briefly summarized in the report. It has been determined that two small inactive uranium leases are located on the hogback west of Harriman Park in the Dakota Formation. No evidence points to off-lease migration or disposal of uranium ore. The residents of the Harriman Park community are protected from the uranium-bearing Dakota Formation by 9,000 feet of shale and clayey sediments.

### 6.2 Major Findings - Inorganic Data

Water analyses indicate that drinking water is of very high quality, far exceeding drinking water health standards and criteria. Surface waters are also of high quality, showing very little degradation as they flow through the community. Although these waters do not entirely meet the rigid drinking water criteria, this is typically the case throughout the world.

Sump waters evidence some degree of mineralization as water percolates through the soil and enters the sump. Sump waters are not fit for consumption, nor are they expected to be. However, incidental contact between children and sump waters should not be considered a health hazard, since the health standards are for lifetime ingestion of the total or near total water requirement. It must be emphasized

that children would have to ingest very large quantities on a daily basis for any possible health hazards to occur. There are innumerable consumer products around the home that present far greater health hazards for exploring children than sump water.

Soils and sediments concentrations of trace elements in Harriman Park were found to be consistent with the offsite soil sample collected south of Harriman Park. Although there are no U.S. health criteria for trace elements in soils, the United Kingdom has published recommended criteria for residential areas and schools. Harriman Park soils do not even approach these levels.

## 6.3 Major Findings - Organic Data

Drinking waters did not exceed any water standard or health criteria. Chloroform and other trihalomethanes were detected at levels below the health standard in drinking water. This is a routine finding in nearly all public water systems throughout the country, occurring as a result of the water disinfection process.

No positively identified organic compounds were found in surface or sump water.

Soils and sediment did not evidence any unusual findings. Very low levels of organochlorine pesticides and phthalates were detected in some soil and sediment samples, which is not unusual considering the extreme persistence of these compounds and the past agricultural land uses of Harriman Park.

Air quality data did not indicate presence of any unusual concentrations of organic compounds. Compounds detected were observed to be in lower concentration than in studies of Denver and other urban areas. Most of the contaminants appear to be attributed to gasoline vapors or automobile exhaust emissions.

## 6.4 Other Investigations

Numerous complaints of illegal dumping and other problems were investigated. Only two locations required further investigation. A drum site was discovered and investigated at 11995 W. Belleview. The drums were removed by EPA on October 25, 1984. Site sampling has failed to detect residual contamination. Another address was determined to have a leaking 5 gallon gasoline can, the vapors from which were infiltrating the home. The can was removed and the homeowner advised on how to remedy the problem. No other sources of hazardous substances were identified.

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# 8.0 APPENDIX A

# ERRIS SITE SUMMARIES

**SITE NAME:** Ensign-Bickford Co.

**MAP NUMBER:** 1

**EPA ID NUMBER:** COD075754663

**TDD:** R8-8405-04

**SITE INVESTIGATION:** 11-5-81 and 4-23-82, EPA

**PRELIMINARY ASSESSMENT DATE:** 5-23-84

**LOCATION:** 7800 N. Moore Rd; Louviers, CO 80131

**FACILITY:** Manufacturing/Processing of Explosives

**CONDITIONS:** An estimated 3,200 pounds of wastewater and 36,000 pounds of reactive waste is generated each year.

**REPORT:** The wastes are disposed of by open burning and are in compliance with RCRA (40 CFR 265.302).

**STATUS:** No change in waste treatment and disposal has been reported. Air monitoring equipment, procedures, and records will be checked during site inspections. Ground water sampling may be necessary to determine if site operations are causing nitrate contamination.

SITE NAME: Molycorp, Inc.

MAP NUMBER: 2

EPA ID NUMBER: COD076448794

TDD:

SITE INVESTIGATION: July, 1980

PRELIMINARY ASSESSMENT DATE: November, 1979

LOCATION: 4 1/2 miles north of Sedalia, CO

FACILITY: Metals and Ore Processing

CONDITIONS: Drums of inorganic and radioactive materials are stored at the site. The site began operation in 1966 as a refinery of RAR 1/2 earth compounds using a solvent extraction process. Yttrium oxide, lanthanum oxide praeseoclymium oxide, neodymin carbonate, and liquid radioactive material are produced and handled at the 75 acre site.

REPORT:

STATUS: The site was still active in August, 1983.

**SITE NAME:** DuPont DeNemours and Co.

**MAP NUMBER:** 3

**EPA ID NUMBER:** COD980499149

**TDD:**

**SITE INVESTIGATION:** August, 1980

**PRELIMINARY ASSESSMENT DATE:** November, 1979

**LOCATION:** Northwest edge of Louviers, CO

**FACILITY:** Landfill - Municipal Chemical Storage

**CONDITIONS:** Manufacturing of nitroglycerine took place between 1915 and 1970. The types of hazardous materials stored at DuPont include Petn (Pentaerythritol tetra-nitrate) a detonator, which was stored in two evaporation ponds.

**REPORT:**

**STATUS:** The 10 acre site was discovered in October, 1979 and the site inspection and preliminary assessment were completed within the following year.

**SITE NAME:** Martin Marietta Corp.

**MAP NUMBER:** 4

**EPA ID NUMBER:** CO000010012

**TDD:** R8-8410-17

**SITE INVESTIGATION:** 4-7-80 EPA, 8-13-80 EPA/CDH, 12-11-84 E&#

**PRELIMINARY ASSESSMENT DATE:** 8-13-80 and update 3-85

**LOCATION:** West of Chatfield Dam; Waterton, CO 80201

**FACILITY:** Aerospace Products & Research

**CONDITIONS:** One active and one inactive waste disposal site (ponds) have ground water monitoring systems. Over 50 monitor wells exist at the Waterton facility. The types of hazardous materials handled, treated or disposed at Martin Marietta Aerospace were general chemicals, metal sludge, aluminum sludge, domestic and industrial sludge, sewage, cutting oils, and some machine oils and fluorine dyes, chemical milling and metals finishing residue, sodium metabisulfide, sulfuric acid, hexavalent chromium, Radium 228 and phosphorus, and various solvents. The two ponds containing waste were approximately 14,000 and 10,000 square feet. The active RCRA regulated site is currently being inspected by the State and EPA for compliance with applicable regulations.

**REPORT:** Ground water samples from the alluvial aquifer indicate that contamination due to alluvial aquifer leakage from the ponds has occurred.

**STATUS:** FIT sampled the site in February, 1985 to confirm past results and specifically identify hazards. Recent findings indicate that trichloroethylene has migrated off-site in groundwater from the RCRA facility and possibly from inactive areas and has been detected in the infiltration gallery at the Denver Water Board's Kassler Plant. Further EPA, State and responsible party investigations are continuing at this site.

**SITE NAME:** Shattuck Chemical Company

**MAP NUMBER:** 5

**EPA ID NUMBER:** COD000716647 or 54

**TDD:**

**SITE INVESTIGATION:** None

**PRELIMINARY ASSESSMENT DATE:** None

**LOCATION:** Northeast of Waterton, CO

**FACILITY:** Chemical Storage, Treater, Recycler

**CONDITIONS:** 56,000 drums of inorganics are stored at the 30 acre treatment-recycling site. The material includes spent petroleum catalysts and molybdenum dissolution by-products, nickel and cobalt.

**REPORT:**

**STATUS:** The site began operation in February, 1979 as a drum storage area and recycling facility. The site was discovered in August 1980 and it may still be active.

**SITE NAME:** FHWA-Central Direct Federal Division Material Co.

**MAP NUMBER:** 6

**EPA ID NUMBER:** C04690090010

**TDD:** R8-8405-04

**SITE INVESTIGATION:** August 12, 1983 EPA

**PRELIMINARY ASSESSMENT DATE:** May 24, 1984

**LOCATION:** Federal Center, Bldg 52, Denver, CO

**FACILITY:** Laboratory that tests road materials

**CONDITIONS:** Lab uses and generates small quantities (less than 250 gallons per year) of trichloroethane. It is a vapor hazard with highly toxic fumes.

**REPORT:** Waste solvent is stored in an underground tank. It is possible some solvent goes into a drain system.

**STATUS:** Information available indicates the "low" priority is legitimate. Wastes in storage should be identified during next site inspection.

**SITE NAME:** Rooney Road Landfill

**MAP NUMBER:** 7

**EPA ID NUMBER:** COD980666598

**TDD:** F8-8101-1

**SITE INVESTIGATION:** June, 1980

**PRELIMINARY ASSESSMENT DATE:** May, 1980 EPA

**LOCATION:** Roosevelt Road and I-70; Golden, CO

**FACILITY:** Municipal Landfill

**CONDITIONS:** The types of hazardous materials disposed at the 60 acre Rooney Rd Landfill were solid household and commercial wastes, methane, septic tank waste and Coors wastewater.

**REPORT:**

**STATUS:** The landfill was closed in 1981.

**SITE NAME:** Mountain Chemical Company

**MAP NUMBER:** 8

**EPA ID NUMBER:**

**TDD:** R8-8405-04

**SITE INVESTIGATION:**

**PRELIMINARY ASSESSMENT DATE:** May 11, 1984

**LOCATION:** 16035 W. Fourth Ave.; Golden, CO (Pike and 4th Street)

**FACILITY:** Chemical Processing/Recycling

**CONDITIONS:** Industrial solvents, (flammable and non-flammable) from non-specific sources are treated and stored at the facility. 300 to 500 drums or 40,000 gallons are stored, recycled or sent off site.

**REPORT:** The facility is in close proximity to a residential area. No hazardous conditions or incidents have been observed.

**STATUS:** The quantity of wastes and proximity to the residential area support a "medium" priority rating for the 1 acre site.

**SITE NAME:** Solar Energy Research Institute

**MAP NUMBER:** 9

**EPA ID NUMBER:** C04890000017

**TDD:** R8-8405-04

**SITE INVESTIGATION:**

**PRELIMINARY ASSESSMENT DATE:** May 23, 1984

**LOCATION:** 2 Sites - #1 I-70 and Hwy. 40; Golden, CO
#2 Camp George West; Golden, CO

**FACILITY:** Research and Manufacturing of Solar Energy Equipment - Chemical Storage

**CONDITIONS:** Small amounts (less than 150 gallons) of ignitable and reactive wastes are generated and stored for recycling. Site #1 is in the Lena Gulch Drainage that drains into Maple Grove Reservoir - the reservoir is part of a municipal water supply system. The site covers 75 acres.

**REPORT:** Wastes are stored in drums and collected weekly. Solvents are recycled by Oil Solvent Processing Co.

**STATUS:** Adequate waste handling and practices have been reviewed. FIT concurs with "low" priority. Protection measures should be outlined for Lena Gulch relavent to an uncontrolled release.

**SITE NAME:** Colorado School of Mines Research Institute

**MAP NUMBER:** 10

**EPA ID NUMBER:** COD00823401

**TDD:** R8-8408-23

**SITE INVESTIGATION:** October 11, 1984 E&E, EPA, CDH

**PRELIMINARY ASSESSMENT DATE:** November 5, 1984

**LOCATION:** Far west end of 12th Street; Golden, CO

**FACILITY:** Ore Processing & Research

**CONDITIONS:** The 10 acre site is adjacent to Clear Creek ground and surface water are potentially threatened by migrating wastes. Old tailings pond covers less than 1 acre. Drum disposal area with about 100 drums. March 1984 kerosene/tarspill.

**REPORT:** Tailings pond is bermed but no design criteria are available and is being decommissioned. It is regulated and monitored by RCRA. Most drums are empty. A few are being held for shipment and off-site disposal. The March, 1984 spill of Tar Sands and kerosene (several hundred gallons) into a ditch locally destroyed vegetation and was cleaned up by June, 1984.

**STATUS:** The site is regulated by RCRA and monitored by CDH. FIT recommended comprehensive on-site monitoring.

**SITE NAME:** Coors Porcelain Co.

**MAP NUMBER:** 11

**EPA ID NUMBER:** COD007057334

**TDD:**

**SITE INVESTIGATION:** None

**PRELIMINARY ASSESSMENT DATE:** October, 1980

**LOCATION:** 600 9th Street; Golden, CO

**FACILITY:** Chemical Production (inorganic)

**CONDITIONS:** Ceramic products are manufactured at the site. Berylium oxide and lead compounds have been generated in the past.

**REPORT:**

**STATUS:** The 5 acre site is still active but the hazards and size of hazard areas are unknown.

**SITE NAME:** Adolf Coors, Inc.

**MAP NUMBER:** 12

**EPA ID NUMBER:** COD980499107

**TDD:**

**SITE INVESTIGATION:** None: Discovery January, 1980

**PRELIMINARY ASSESSMENT DATE:** February, 1980

**LOCATION:** Hwy 72 & Hwy 93; Golden, CO

**FACILITY:** Chemical Disposal

**CONDITIONS:** Cleaning solvent (Rapadine), grain and water have been disposed of on the 80 acre site.

**REPORT:**

**STATUS:** The site may still be active.

**SITE NAME:** Coors Container Co.

**MAP NUMBER:** 13

**EPA ID NUMBER:** COD054929989

**TDD:**

**SITE INVESTIGATION:** August, 1980

**PRELIMINARY ASSESSMENT DATE:** April, 1983

**LOCATION:** 17755 W. 35th Ave.; Golden, CO

**FACILITY:** Chemical Storage (organic)

**CONDITIONS:** The site began as a container producing location for Coors.

**REPORT:**

**STATUS:** Glue waste, cold cleaner - 456 and spent non halogenated solvents were present at the site. It was still active in December, 1983.

**SITE NAME:** Coors Porcelain Co. - Clear Creek

**MAP NUMBER:** 14

**EPA ID NUMBER:** COD000818179

**TDD:**

**SITE INVESTIGATION:**

**PRELIMINARY ASSESSMENT DATE:**

**LOCATION:** 17750 W. 32nd Ave.; Golden, CO

**FACILITY:** Plastic & Porcelain Products

**CONDITIONS:** Manufactures for the micro-circuit industry and generates lead acid waste and spent solvents from machinery maintenance. The site covers 14 acres.

**REPORT:**

**STATUS:** No action has been conducted at this site.

**SITE NAME:** Coors Salvage Yard

**MAP NUMBER:** 15

**EPA ID NUMBER:** COD980951107

**TDD:**

**SITE INVESTIGATION:**

**PRELIMINARY ASSESSMENT DATE:** July 12, 1984

**LOCATION:** 1/2 Mile West of McIntyre; Golden, CO

**FACILITY:** Unknown

**CONDITIONS:** Unknown

**REPORT:**

**STATUS:**

SITE NAME: Adolf Coors Co.

MAP NUMBER: 16

EPA ID NUMBER: COD007057342

TDD:

SITE INVESTIGATION: None

PRELIMINARY ASSESSMENT DATE: None

LOCATION: 6500 W. 35th Ave.; Golden, CO

FACILITY: Chemical Storage (unknown material with drums)

CONDITIONS: The one acre site began operation as a salvage yard and was still active during November, 1983.

REPORT:

STATUS: No action has been conducted.

**SITE NAME:** Colorado Chemical Specialties

**MAP NUMBER:** 17

**EPA ID NUMBER:** COD056566441

**TDD:** F8-8105-1

**SITE INVESTIGATION:** May 15, 1984

**PRELIMINARY ASSESSMENT DATE:** September, 1980

**LOCATION:** 4295 McIntyre; Golden, CO

**FACILITY:** Chemical Company

**CONDITIONS:** The types of hazardous materials stored at Colorado Chemicals Company are styrenes and benzenes and formulations of 1,2-vinylpolybutyldiene.

**REPORT:**

**STATUS:** 11-80 the site had a release of butadiene and in 4-81 the site had a fire. The site may still be active.

**SITE NAME:** Hazen Research, Inc.

**MAP NUMBER:** 18

**EPA ID NUMBER:** COD048742175

**TDD:** R8-8405-04

**SITE INVESTIGATION:** March 11, 1982 EPA & CDH

**PRELIMINARY ASSESSMENT DATE:** May 24, 1984 and September 13, 1984

**LOCATION:** 4601 Indiana; Golden, CO 80401

**FACILITY:** Processing Laboratory and Mining Research

**CONDITIONS:** Toxic and corrosive wastes in drum storage of solvents and organic chemicals (and wastewater treatment systems) are stored (or operated) on site. Lead chloride, arsenic, phosphoric acid and mercury contaminated soil have been reported on the site.

**REPORT:** No hazardous conditions were observed and the facility was in compliance with RCRA standards. Up to 1800 gallons of waste may be stored in drums on the site.

**STATUS:** The adjacent surface water (Croke Canal, Wannamaker Ditch) is either protected from contamination by the local geology or treatment procedures used at the facility. FIT concurs with the "low" priority assessment if the outlined procedures and protection is maintained.

**SITE NAME:** Wheatridge Public Works Shop and Yard

**MAP NUMBER:** 19

**EPA ID NUMBER:** C00980634836

**TDD:** R8-8405-04

**SITE INVESTIGATION:** None

**PRELIMINARY ASSESSMENT DATE:** May 23, 1984

**LOCATION:** 11220 W. 45th Ave.; Wheatridge, CO 80033 (45th & Robb Street)

**FACILITY:** Municipal Public Work Shops/Yard

**CONDITIONS:** 400 gallons of fluid was stored in 8 drums above ground on the 1.8 acre site.

**REPORT:** Content of drums was analyzed and found to contain waste oil and antifreeze with rust inhibitor. The drums have been moved off site for recycling/disposal.

**STATUS:** City has installed an underground 500 gallon storage tank to store waste oil for recycling. FIT concurs with CDH on "low" priority rating.

**SITE NAME:** Rocky Mountain Bank Note

**MAP NUMBER:** 20

**EPA ID NUMBER:** COD087077621

**TDD:** R8-8405-04

**SITE INVESTIGATION:** April, 1983

**PRELIMINARY ASSESSMENT DATE:** April, 1983

**LOCATION:** 4990 Iris; Wheatridge, CO (Iris and 50th Avenue)

**FACILITY:** Printing Office/Chemical Storage

**CONDITIONS:** Three drums of ignitable liquid (printing machine cleaner) are stored at the site. The solvent is collected and reprocessed off-site.

**REPORT:** No potential environmental hazards have been observed with present practices. Waste quantities are small well controlled and disposed of in a proper manner.

**STATUS:**

**SITE NAME:** Colorado School of Mines Research Institute

**MAP NUMBER:** 21

**EPA ID NUMBER:** COD99130518

**TDD:**

**SITE INVESTIGATION:** August, 1980

**PRELIMINARY ASSESSMENT DATE:** April, 1982 EPA

**LOCATION:** 5290 McIntyre; Golden, CO

**FACILITY:** Chemical Disposal/Mineral Research

**CONDITIONS:** Organic and inorganic (80,000 cu. ft.) materials have been disposed of into a landfill on the 29 acre site.

**REPORT:**

**STATUS:** The site was still active in December, 1983. It was discovered in August of 1980 and yttrium, sodium cyanide, tetrachloroethylene and acetone are some of the reported hazardous materials.

SITE NAME: Coors Porcelain Co.

MAP NUMBER: 22

EPA ID NUMBER: COD980635197

TDD:

SITE INVESTIGATION:

PRELIMINARY ASSESSMENT DATE: October, 1980

LOCATION: 1/2 Mile South of Ralston Reservoir

FACILITY: Clay Mine

CONDITIONS: Unknown

REPORT:

STATUS:

**SITE NAME:** Leyden Landfill

**MAP NUMBER:** 23

**EPA ID NUMBER:**

**TDD:** R8-8406-01

**SITE INVESTIGATION:** June 8, 1984

**PRELIMINARY ASSESSMENT DATE:**

**LOCATION:** SEC 25, T2S, R70W, near 82nd and Indiana, West of Arvada, CO

**FACILITY:** 68 acre inactive sanitary landfill (non-hazardous residential, industrial and commercial)

**CONDITIONS:** The landfill contains about 700,000 tons of refuse that was placed by the area fill method. Materials were compacted and covered with soil daily.

**REPORT:** Ground water monitoring wells installed since 1981 indicate low levels of organics heavy metals, cyanide and pesticide in the shallow groundwater. The geology of the area will probably inhibit contamination migration to the Fox Hills Aquifer 500 ft. below the site. No water quality data are available on surface water on or adjacent to the landfill. Silt from landfill slope is clogging Church Ditch south of the landfill.

**STATUS:** Colorado Dept. of Health conducts periodic state compliance inspections. Ground water is sampled quarterly by Jefferson County. FIT has also sampled surface and ground water and sediments. No determination of hazards to the environment have been identified at this time.

**SITE NAME:** Rocky Flats Industrial Park

**MAP NUMBER:** 24

**EPA ID NUMBER:**

**TDD:** F8-8107-01A

**SITE INVESTIGATION:** November, 1981

**PRELIMINARY ASSESSMENT DATE:** February 9, 1982

**LOCATION:** South of Hwy. 72 between Colo. 93 and Arvada; North of Golden, CO

**FACILITY:** Great Western Inorganics (GWI) American Ecological Recycle Research Corp. (A ERR) Thoro Products Co.

**CONDITIONS:** GWI manufactures chemicals (halides, sulfides, sulfates, nitrates, phosphides, phosphates, oxides, tellurides, selenides and other metals)
A ERR stores and reclaims waste chemicals for resale.
Thoro is a chemical storage and handling facility.

**REPORT:** EPA, CDH and FIT have enforced compliance to RCRA at AERR. GWI and Thoro properties have also been sampled and reviewed for compliance. Arsenic, mercury, iron, lead and capmium are the contaminants of concern. The GWI property is the area of most concern.

**STATUS:** Unknown

SITE NAME: Rocky Flats Plant

MAP NUMBER: 25

EPA ID NUMBER: CO7890010526

TDD:

SITE INVESTIGATION:

PRELIMINARY ASSESSMENT DATE: November, 1979

LOCATION: Hwy 93; Golden, CO

FACILITY: Radioactive Debris

CONDITIONS: Radioactive waste material deposited on site in a landfill. The site began operation in 1951 as a manufacturer of nuclear weapons components. The plant has disposed of radioactive waste on the 2,560 acre site.

REPORT:

STATUS: The land burial disposal site closed in 1975 and the plant is still active. The facility was ranked by the EPA and included in the latest update of the Superfund National Priorities List (NPL).

# 8.0 APPENDIX B

## OTHER RAW DATA

ENVIRONMENTAL PROTECTION AGENCY
REGION VIII, D[illegible] COLORADO

# LABORATORY SERVICES REQUEST

PROJECT NAME HARRIMAN PARK PROJECT CODE KR-8404-0 SAMPLES COLL. BY [illegible] DATE 10-23-84

SAMPLES RECEIVED AT LABORATORY BY _____ DATE _____ DATA REVIEWED BY [illegible] 11-15-84 10-7-84

ANALYST INITIALS

| STATION CODE | | SO-WW | SO-C | SO-K | SE-BK | SO-C1 | GW-[illegible]Y | SO-[illegible]Y | DW-PDC |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE COLL. TIME | | 2:00 | 10:50 | 11:50 | 1:05 | 1:50 | 11:40 | 11:40 | 7:20 |
| STATION DESCRIPTION AND REMARKS | | 2:00 10-23-84 | 10-23-84 | 10-23-84 | 10-23-84 | 10-23-84 | 10-24-84 | 10-24-84 | 10-23-84 |
| | | ug/g | ug/g | ug/g ave. value | ug/g | ug/g | ug/l | ug/g | ug/l |
| CODE | PARAMETER | | | | | | | | |
| | HOT TASK 1 & 2 METALS | | | | | | | | |
| | Aluminum | 11,900 | 11,900. | 5880 | 4960 | 14,300. | 65 | 11,500. | 77 |
| | Antimony | <8.5 | <9.6 | <8.2 | <9.4 | <9.8 | <100 | <9.2 | <100 |
| | Arsenic | 61.9 | 63.3 | 31.2 | 27.8 | 65.6 | <50 | 57.9 | <50 |
| | Barium | 129. | 106. | 55. | 101. | 103. | 110 | 118. | 35 |
| | Beryllium | <0.9 | <1.0 | <0.8 | <0.9 | <1.0 | <10 | <0.9 | <10 |
| | Boron | 8.7 | 6.9 | 1.8 | 6.8 | 15.3 | 402 | 16.4 | 14 |
| | Cadmium | 6.4 | 6.4 | 4.5 | 3.0 | 8.1 | <5 | 6.0 | <5 |
| | Chromium | 12.5 | 13.4 | 9.9 | 6.0 | 18.0 | <5 | 11.3 | <5 |
| | Cobalt | 5.0 | 4.5 | 4.3 | 3.4 | 6.0 | <5 | 5.1 | <5 |
| | Copper | 14.4 | 13.5 | 9.2 | 8.4 | 14.9 | 8 | 15.9 | 24 |
| | Iron | 12,800. | 12,800. | 10,800 | 6580. | 16,900. | 127 | 12,300. | 47 |
| | Lead | 26.3 | 23.3 | 11.4 | 17.2 | 26.1 | <30 | 25.4 | <30 |
| | Manganese | 249. | 178. | 203. | 217. | 169. | <5 | 279. | 8 |
| | Mercury | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Nickel | 14.7 | 11.3 | 6.6 | 11.4 | 12.0 | <30 | 12.0 | <30 |

results in mg/l unless otherwise indicated, heavy metals in ug/l, pH in units, turbidity in JTU, specific conductance in µ mhos/cm, as per STORET.

☆ GPO: 1979-680-570



GW-Y and DW-PDC VOA analysis submitted on 11/05/84

REGION VIII, D( ) COLORADO

# LABORATORY SE..VICES REQUEST

PROJECT NAME WHIGHMAN PARK PROJECT CODE [illegible] SAMPLES COLL. BY FITE DATE [illegible]

VOA-H2O = 11-05-84

SAMPLES RECEIVED AT LABORATORY BY _____ DATE _____ DATA REVIEWED BY [illegible] 11-15-84

| ANALYST INITIALS | STATION CODE | | SO-WW | SO-C | SO-K | SE-BK | SO-C1 | GW Y | SO-Y | DW-PDC |
|---|---|---|---|---|---|---|---|---|---|---|
| | SAMPLE COLL. TIME | | 2:00 | 10:50 | 11:50 | 1:05 | 1:50 | 11:40 | 11:40 | 2:20 |
| | STATION DESCRIPTION AND REMARKS | | ug/g | ug/g | ave values ug/g | ug/g | ug/g | ug/l | ug/g | ug/l |
| | CODE | PARAMETER | | | | | | | | |
| | | Selenium | N/A due to Fe interference | | | | | <50 | — | <50 |
| | | Silver | <0.4 | <0.5 | <0.4 | <0.5 | <0.5 | <5 | <0.5 | <5 |
| | | Thallium | <8.5 | <9.6 | <8.2 | <9.4 | <9.8 | <100 | <9.2 | <100 |
| | | ~~Zinc~~ | | | | | | | | |
| | | Vanadium | 31.2 | 32.2 | 19.3 | 20.4 | 38.2 | <10 | 32.9 | <10 |
| | | Zinc | 42.1 | 45.3 | 21.9 | 34.9 | 42.6 | 13 | 53.2 | 14 |
| | | | | | | | | | | |
| | | VOAs | | | | | | SS | ~~SS~~ | SS |
| | | | | | | | | | | |
| | | BNA | | | | | | | | |
| | | | | | | | | | | |
| | | PESTICIDES | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

All results in mg/l unless otherwise indicated, heavy metals in ug/l, pH in units, turbidity in JTU, specific conductance in µ mhos/cm, as per STORET.

★ GPO: 1979-680-370

RSEPA-012 (Rev. 11-82)

SS = Separate sheet

REGION VIII, DENVER, COLORADO

EPA

# LABORATORY SERVICES REQUEST

PROJECT NAME Harriman Park - reanalyses for As by Hydride/ICP PROJECT CODE _____ SAMPLES COLL. BY _____ DATE 11-21

SAMPLES RECEIVED AT LABORATORY BY _____ DATE _____ DATA REVIEWED BY 11-26-84

MAX. HOLD TIME | TAG COLOR SYMBOL

| STATION CODE | | SO-Y | SO-K | SO-C1 | SO-C | SO-NW | SE-BR | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE COLL. TIME | | | | | | | | |
| STATION DESCRIPTION AND REMARKS | | | | | | | | NBS Standard from Joe Lowry NEIC |
| CODE | PARAMETER | | | | | | | |
| | T-As | 6.4 | 2.3 | 5.8 | 4.9 | 6.1 | 3.9 | 61.8/66.0=9 |

All results in mg/l unless otherwise indicated, pH in units, turbidity in JTU, specific conductance in µmhos/cm, as per STORET.

★ GPO: 1979-680-570

RBEPA-012

ug/g.
wet weight