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SAMPLING AND ANALYSIS PLAN
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE
DENVER, COLORADO
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Prepared for
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1.0 INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Superfund Amendment and Reauthorization Act of 1986 (SARA), and in response to the Region VIII U.S. Environmental Protection Agency (EPA) Technical Direction Document (TDD) #T08-9503-0501,the Ecology and Environment, Inc., Technical Assistance Team (TAT) has been tasked to perform a site inspection (SI) for the Stapleton International Airport (SIA) Runways site in Denver, Colorado.

This sampling plan has been prepared in partial fulfillment of the referenced TDD. The plan is designed to guide field operations during the SI. Field work will include both sampling and non-sampling data collection, and will address nitrate and chlorinated hydrocarbon levels present in ground water and surface water in the vicinity of SIA. The levels of contamination will be determined by collecting hydrogeological measurements and collecting ground water, surface water, and sediment samples. This Sampling and Analysis Plan (SAP) was prepared in accordance with EPA Document 540-R-92-021 entitled *Guidance for Performing Site Inspections under CERCLA*, dated September 1992.

2.0 OBJECTIVES

The objectives of the SI are to:

- determine whether ground water nitrate levels within the SIA property boundaries are significantly elevated in relation to ambient urban concentrations;
- determine the migration pattern of contamination in ground water originating from areas east and south of the SIA property;
- determine if a release of hazardous substances known to exist in nearby water supply wells has occurred at SIA;

- determine if a release of hazardous substances to surface water bodies has occurred at SIA; and

- obtain non-sampling data needed to screen the site using the Hazard Ranking System.

Pending receipt of Army data, this investigation can concentrate on the area west of the N/S runways and South of Havana +49th. PGS

3.0 BACKGROUND INFORMATION

3.1 Site Description

The SIA site, as it is currently known, includes one or more ground water plumes with elevated concentrations of chlorinated hydrocarbons and measured concentrations of nitrates. It is possible that these elevated concentrations are the result of contributions of chlorinated hydrocarbons and nitrates from the SIA runways areas. Alternatively, these substances may be flowing beneath the runways along undocumented pathways from sources beyond and unrelated to SIA.

SIA has been in operation since 1929 and currently occupies approximately 4,679 acres on the northeast side of the City and County of Denver. The airport was developed into an important business center and supported airline and rental car operations, maintenance facilities, and other airport-related service industries. The airport property is bordered by various commercial and industrial operations, residential communities, and military facilities. The new Denver International Airport is complete and has replaced SIA as the Denver area's primary air transportation facility.

3.2 Project History

In October 1993, the South Adams County Water and Sanitation District (SACWSD) approached the EPA and U.S. Army with concerns about elevated nitrate levels found in samples obtained from their shallow alluvial water supply wells. SACWSD operates the Klein Water Treatment Facility, located approximately 1.5 miles northwest of the SIA property. The U.S. Army manages the Rocky Mountain Arsenal, which consists of a 27-square mile parcel of land situated along the northern border of SIA, between SIA and the drinking water supply wells operated by SACWSD.

SACWSD draws its drinking water from a series of production wells to the west and northwest of the SIA property. The concentration of nitrate in ground water samples collected from individual water supply wells was approaching the maximum contaminant level (MCL) of 10 parts per million (ppm) and the district began blending water from their wells in 1993 to dilute nitrate concentrations to below the MCL. Ground water in this area has been interpreted as flowing northwest across SIA property under the Rocky Mountain Arsenal and, subsequently, toward the Klein water treatment facility. Contamination does not appear to follow the regional ground water flow direction.

In 1993, the City and County of Denver conducted an environmental assessment at SIA to evaluate environmental conditions on the SIA property. The report indicated that urea pellets were used to deice the runways at SIA. Urea is known to degrade into nitrate and is highly mobile in ground water. The report identified several additional potential nitrate sources, including a pre-airport dairy farm, four landfills in the area, and general urban influence. Results of ground water sampling conducted at SIA indicating that elevated levels of nitrates were present at locations east and west of the north/south runways were included in the report.

The SIA environmental assessment indicates that a volatile chlorinated hydrocarbon plume originates near the 49th and Havana Street area east of SIA, and migrates across the northern part of the airport beneath the runways, and exits the airport property to the north near the commuter runways (Camp, Dresser and McKee, Inc. [CDM] 1993a). However, the configuration of the inferred plume is based on a fairly limited data set, including sample locations nearly 1 mile apart to the east and west of the north-south runways. Additional sample points are required to further delineate ground water contamination in this area. The report identified several potential sources of the contamination and documented ongoing remedial actions, which included the removal of leaking underground storage tanks and the installation of a ground water recovery well system. Sampling and analysis conducted in 1992 indicated that volatile chlorinated hydrocarbon contamination in ground water still existed, although concentrations were apparently decreasing (CDM 1993a).

3.3 Site Geology

The SIA Runways site is located within the Colorado Piedmont section of the Great Plains physiographic province. The area consists of stream-valley lowlands separated by gently rolling uplands that have minimal topographic relief, generally less than 500 feet (Smith et al. 1964). The Front Range of the Southern Rocky Mountains is located approximately 20 miles west of the site and defines the edge of the Great Plains physiographic region.

SIA is situated over the west-central portion of the Denver Basin, a major north-south trending structural depression containing sediments ranging in age from late Pennsylvanian through Quaternary. The Denver Basin is asymmetric in shape. Sediments display high-angle dips along the tectonically altered western edge and gently dipping beds to the east.

Surficial deposits at the site consist of Quaternary-aged unconsolidated sediments composed of stream and wind-blown material (i.e., alluvium, eolian sand, and loess) as well as artificial fill. These deposits range in thickness from approximately 25 feet in the southern portions of the site to 70 feet farther north. The near-surface bedrock formation underlying the site includes units of the late Cretaceous and Tertiary-aged Denver formation. The Denver formation is approximately 700 feet thick beneath the SIA property and is composed of interbedded shale, claystone, siltstone, and sandstone (Robson 1983).

3.4 Site Hydrogeology

The post-Pierre shale sedimentary rocks within the Denver Basin consist of the units that comprise the Denver Ground Water Basin. The Pierre shale is considered to be the base of the major bedrock aquifer system due its great thickness and minimal permeability (Robson and Romero 1981). The four principal bedrock aquifers in the Denver Ground Water Basin, in ascending order, are 1) the Laramie-Fox Hills aquifer, 2) the Arapahoe aquifer, 3) the Denver aquifer, and 4) the Dawson aquifer. Locally, recent unconsolidated stream- and wind-deposited sediments provide significant quantities of ground water as part of the overlying alluvial aquifer system.

The uppermost bedrock aquifer underlying the SIA property is the Denver aquifer, which is formed by the saturated part of the Denver formation. The primary water-bearing zones

of the Denver formation are moderately consolidated sandstone and siltstone layers ranging in thickness from a few inches to 50 feet. These sandstone and siltstone layers are commonly lens-shaped beds irregularly dispersed within relatively thick sequences of claystone and shale (Robson and Romero 1981). Wells completed in the Denver aquifer generally yield 0.05 to 1.0 gallons per minute per foot of drawdown and supply water for domestic and stock watering purposes (Robson and Romero 1981). Lab analyses of hydraulic conductivities of clays present in the Denver formation range from 2.0×10^{-7} to 8.6×10^{-8} centimeters per second (cm/sec) (CDM 1993a).

Unconsolidated sediments have been deposited on the eroded bedrock surface of the Denver formation. Limited data indicate the presence of a north-south trending paleochannel near the northwest boundary of the SIA property. The inferred location of this bedrock feature trends across the northeast quarter of Section 16 through the center of Section 9 and connects to another paleochannel near the southwest quarter of Section 4, Township 3 south, Range 67 west (Jacobs Engineering 1994). The laboratory-measured hydraulic conductivity for a buried sand channel located on the SIA property was 3.4×10^{-3} cm/sec (CDM 1993a).

3.5 Site Hydrology

Sand Creek and Westerly Creek are the two main drainages within the SIA property boundary (Figure 1). Sand Creek enters the site from the east, essentially bisects the SIA property, flows under the southern portion of the north-south runways, and exits the site to the west. The confluence of Sand Creek and the South Platte River is approximately 5.5 miles downstream from the point where the north-south runways cross Sand Creek. Westerly Creek, a tributary of Sand Creek, enters the SIA property from the south. It flows through the southern portion of SIA, under the central portion of the east-west runways toward its confluence with Sand Creek farther north.

Bluff Lake and associated wetland areas are located near the southeast corner of the SIA property, between the east-west runways and Sand Creek drainage.

3.6 Site Meteorology

The climate of the Denver area is classified as semiarid, receiving a mean annual precipitation of approximately 15.3 inches. The mean annual temperature is 52° F, and prevailing winds are from the south and average 8.8 miles per hour (CDM 1993a).

4.0 PATHWAY ANALYSIS

Field activities conducted under this SI will focus on impacts to the shallow ground water and on gaining additional data on the ground water flow pattern beneath the site. A large drinking water population is served by SACWSD wells, which obtain ground water from the shallow alluvial aquifer. In addition, samples will be collected to determine if on-site surface water bodies have been affected.

4.1 Waste Characterization

The SIA facility consists of a complex industrial operation involving the storage, transfer, and use of a variety of hazardous materials. Jet fuel is the material handled most frequently and in the largest amounts at SIA. Fuel oil, diesel fuel, lubricating oils, hydraulic fluids, gasoline, aviation gasoline, solvents, and waste oil are used by tenants working at the airport facilities. A series of environmental assessments prepared by CDM summarizes known environmental incidents, investigations, and areas of concern with respect to contaminated media (CDM 1993a; 1993b). The majority of environmental incidents have occurred away from the runways in the most industrialized zones of the airport and areas of contamination are associated with petroleum product releases (CDM 1993b). Fuel spills at the airport cannot be pursued under this SI because fuel is exempt from the definition of a hazardous substance under CERCLA Section 101(14).

The SIA northern zone environmental assessment report prepared by CDM indicates that urea pellets, which rapidly degrade to nitrate, have been used to de-ice runways at SIA (CDM 1993a). Additional potential sources of nitrates include a pre-airport dairy farm, four nearby landfills, and general urban influence.

Several off-site facilities and operations that pose potential environmental concern in the SIA area include the ARDCO Corporation, Lowry Air Force Base, Stanley Aviation Corporation, the I-270 and Quebec Street area, Bulk Mail Center, and Denver Engineering and Operations Center (CDM 1993a; 1993b).

The 49th and Havana Street area has been identified in numerous reports as having contributed chlorinated hydrocarbons to the environment. Information indicates that Scott's Liquid Gold, located at 4880 Havana Street just east of SIA, and an unknown source located farther east, were responsible for soil and ground water contamination, which included the following pollutants: TCA, TCE, DCE, DCA, BETX, Naptha, and Corvus oil (CDM 1993a).

4.2 Ground Water Pathway

Elevated levels of fuel-related compounds, chlorinated hydrocarbons (solvents), and nitrates are known to exist in the ground water beneath the SIA complex. Total petroleum hydrocarbons at concentrations above 1 mg/L and benzene at concentrations above 5 μg/L have been detected in ground water samples taken from the South Corporate area, the rental car agencies, the main terminal building, the fuel farms, and in the aircraft hangar area (CDM 1993a). Benzene was detected at 5μg/L in one Scott's Liquid Gold well; however, this result was qualified due to problems related to contamination in the quality assurance blank sample. Toluene was detected above ground water standard of 1,000 μg/L in the rental car and aircraft hangar areas. Wells located within and adjacent to the SIA property exhibited ground water concentrations of ethylbenzene below the drinking water standard of 680 μg/L.

Chlorinated hydrocarbon compounds, including TCE, PCE, TCA and DCE, have been detected at concentrations above the MCLs in ground water samples collected in the vicinity of SIA. TCE has been detected above 5 μg/L in the South Corporate area, the SIA fuel farm, the 49th and Havana Street area, and in wells located east and west of the north-south runways. TCE and PCE have also been detected above the MCL in an area northwest of SIA (north of I-70 and west of Quebec Street). PCE has also been detected at concentrations above the MCL in the SIA fuel farm area.

TCA concentrations above 200 μg/L were detected in a single well located east of the north-south runways. DCE was detected at levels above the MCL in ground water samples collected near the 49th and Havana Street area and in wells east and west of the north-south runways.

A subsurface investigation is currently being conducted at Lowry Air Force Base approximately 1.25 miles south of the SIA property. Results of ground water field screening analyses indicate that a plume containing measurable quantities of TCE and other chlorinated compounds flows off the base's northern boundary toward SIA's southern boundary (Moritz 1994).

Evidence suggests contributions of nitrates to the shallow alluvial aquifer may have occurred at the SIA site. Urea pellets were used to de-ice runways at SIA. There are no known liners, covers, or containment features in place to prevent migration of the degradation products, including nitrate, into the shallow aquifer. The water table aquifer is estimated to be between 20 and 45 feet below ground surface (bgs). Nitrates have been detected at levels above the MCL in ground water samples taken from areas located east and west of the north-south runways, and in samples taken from areas northwest of SIA property.

SACWSD municipal wells serve a total population of approximately 30,000. Wells screened in the Arapahoe aquifer provide 15% of the district's water. Shallow alluvial wells account for 85% of the influent. The pro-rated population served by shallow ground water is approximately 25,290. All nine shallow alluvial wells serving the SACWSD system are within ground water plume zones identified by the Chemical Sales and Rocky Mountain Arsenal National Priority List site work (Jones 1994). Influent from these wells is currently being treated for chlorinated hydrocarbons at the Klein Water Treatment Facility located at 7400 Quebec Street, Commerce City, Colorado.

4.3 Surface Water Pathway

Sand Creek flows in a northwesterly direction through the SIA property from its source in Arapahoe County to its confluence with the South Platte River. Westerly Creek enters SIA

from the south and flows northward toward its confluence with Sand Creek. Both Sand Creek and Westerly Creek have stream segments that flow under the SIA runways.

Sand Creek receives both point and non-point source contributions. Within the SIA property boundary, Sand Creek can receive point source storm water run-off from three outfalls: outfall 009C is the furthest upstream discharge; outfalls 009B and 009A are located in immediate succession to outfall 009C (Figure 1). These three outfalls receive run-off primarily from the airport proper, including aircraft de-icing areas near the terminals and in the runways. Downstream of the 009 outfalls and the SIA water treatment facility is outfall 008A (Figure 1), which discharges water accumulated primarily from the car rental lots (ENSR 1993). Discharge from 008A enters Sand Creek outside SIA property. Slope wash during precipitation is the principal non-point source contributor to Sand Creek and Westerly Creek; however, ground water seepage that may contain elevated levels of contaminants also occurs.

Surface water, sediment, and shoreline soil samples were collected during a survey of the Sand Creek fishery to determine toxicity impact of SIA discharges. Analytical results indicated some metal concentrations (mercury and silver) in the water samples, and nearly all metals analyzed in the shoreline sample were greater than EPA chronic criteria. However, TCLP analyses indicate it is unlikely that any metals would be mobilized at toxic levels from sediments (ENSR 1993). Almost all organic compounds detected in surface water and sediment samples were below the laboratory practical quantitation limit. One compound, 1,2-dichloroethane, was detected at 7μg/Kg in a single sediment sample location.

There are no known surface water intakes within 15 downstream miles of the site. There are no stocked fisheries within 15 downstream miles of the site; however, recreational fishing does occur. The Division of Wildlife has estimated fish populations at 36 pounds per acre in Sand Creek and 130 pounds per acre in the South Platte River (Colorado Department of Health 1992). Fish species in Sand Creek include plains killfish, flathead minnow, white sucker, creek chub, sand shiner, gambusia, common carp, and green sunfish. Fish species identified in Westerly Creek include plains killfish, flathead minnow, white sucker, creek chub, largemouth bass, and black bullhead (ENSR 1993). The South Platte River supports a fish population that includes bass, chub, walleye, bluegill, and

common carp. Riparian habitats are found along Sand Creek and its associated wetlands. Table 1 contains a list and current status of threatened and endangered species known to inhabit portions of Denver and Adams Counties, Colorado.

5.0 SCHEDULE OF ACTIVITIES

All field activities at the SIA Runways site will be conducted in accordance with the *Emergency Response Branch, Region VIII, Quality Assurance Project Plan* and E & E published standard operating procedures (SOPs).

5.1 Concept of Operations

The scope and objectives of this SI are: 1) to screen for nitrate levels elevated above ambient urban levels in the ground water near the SIA runways and taxiways; 2) to determine the migration pattern of chlorinated hydrocarbon contaminants in ground water originating from off-site areas east and south of the SIA property boundary; and 3) to test for impacts on fisheries and sensitive environments. The TAT anticipates performing the following tasks to accomplish these objectives:

- conducting a subsurface field screening program to delineate the distribution of ground water contamination within the shallow alluvial aquifer. TAT personnel will perform initial surveying tasks to flag proposed station locations so that buried utility lines in the vicinity of these stations can be identified. A TAT-owned Geoprobe™ and a direct-push hydraulic rig obtained under subcontract will then be used to collect ground water samples from background and downgradient station locations in the SIA area. Ground water samples will be analyzed at an off-site TAT laboratory to identify concentrations of volatile organic compounds and nitrates. Ten percent of these ground water samples will be analyzed by Contract Laboratory Program (CLP) laboratories to provide verification of TAT laboratory results;

- subcontracting a professional, licensed surveying firm to obtain vertical and horizontal coordinate data for all sample station locations at the completion of the subsurface field screening program; and

- collecting surface water and sediment samples from various surface water bodies in the vicinity of SIA for nitrate and full hazardous substance list analysis.

5.2 Schedule of Work

The TAT anticipates that field work at the SIA Runways site will begin in early May 1995. The exact date of field activities is contingent upon weather conditions; coordination with EPA, Contract Laboratory Program (CLP), drilling and survey subcontractors, SIA personnel, and off-site property owners; and other project demands. The following chart outlines planned activities and anticipated time frames for completing specific SI activities.

Activity	Time Estimate
Subsurface field screening and sampling activities	3 work weeks
TAT laboratory analysis	3 work weeks
Professional land survey activities	1 work week
CLP analysis	5 work weeks
Data validation (EPA/ESAT)	3 work weeks
Sampling activities report	2 work weeks following completion of field work
Draft analytical results report	2 work weeks following receipt of validated data
Final analytical results report	2 work weeks following receipt of EPA comments

5.3 Project Organization and Responsibilities

EPA Site Assessment Manager (SAM) Pat Smith will provide overall direction to the Ecology and Environment, Inc., staff concerning project objectives, sampling needs, and schedules. The Ecology and Environment, Inc., Project Manager, Troy Sanders, is responsible for the development and preparation of the sampling and analysis plan, health and safety plan, project team organization, site access arrangements, and supervision of project tasks, including compilation and analysis of data, and preparing other reports and deliverables.

The Ecology and Environment, Inc., site QC coordinator, who will be determined at a later date, will be responsible for ensuring field adherence to the sampling and analysis plan and E & E SOPs. The site QC coordinator is also the primary project team contact with the regional sample control coordinator for laboratory-related information.

5.4 Subsurface Field Screening Activities

A subsurface field screening program will be performed along the western, southern, and eastern perimeters of the SIA property to define the extent of volatile organic compound contamination and determine levels of nitrates present in the ground water. Additional field screening stations will be located hydraulically downgradient of the north-south and east-west runways. The locations of field screening stations will be based on a spacing interval of approximately ~~1,000 feet~~ <800' apart along areas identified on Figure 2. The TAT will use a Geoprobe™ and a Hydropunch™ rig to obtain hydrologic measurements and ground water samples. The TAT estimates that ground water samples will be collected from 65 separate stations on the SIA property.

TAT members will perform initial surveying tasks to flag proposed sample locations for identification of buried utility locations.

The Geoprobe™ and Hydropunch™ are vehicle-mounted, hydraulically-powered equipment that use static force and percussion to advance hollow steel rods to desired sample depths. The sample interval will be approximately 2 feet to 3 feet below the top of the water table. If the Geoprobe™ cannot drive the rods to ground water, the TAT will subcontract a Hydropunch™ to reach the desired sample depth. A field screening station will be abandoned only if the Hydropunch™ cannot advance the rods to ground water.

After the hollow steel rods are advanced to the desired interval, the TAT will use an electronic water level indicator to measure water levels at each field screening location. Three water level measurements will be taken over a half-hour time period to determine if stabilization has occurred. Samples of ground water entering the rods under hydrostatic pressure will be collected by pumping or bailing methods. Polyethylene tubing will be inserted through the rods and a peristaltic pump or vacuum system will bring the ground water to the surface. The peristaltic pump can draw water from depths limited to a maximum of 25 feet below ground surface.

After pumping approximately three tubing volumes from the assembly, and monitoring pH, specific conductivity, and temperature parameters for stabilization, ground water samples will be collected into appropriate sample containers. Another sample collection method

utilizes small bailers that are lowered through the hollow rods to collect ground water. Additional sample volumes will be acquired from stations designated for quality control analyses.

Each borehole created during this phase of the investigation will be backfilled with 10 to 20 mesh silica sand or grout to approximately 5 feet below ground surface. The boreholes will then be filled to ground surface with bentonite chips and hydrated with distilled or deionized water or filled with grout. A professional land surveyor obtained under subcontract to the TAT will perform required surveying tasks to provide station location coordinates and elevation data. All field screening sampling points will be located horizontally within 0.1 foot, and vertically within 0.01 foot, as specified in U.S. EPA Region VIII *Standard Operating Procedure for Survey Control Requirements.*

Ground water samples will be analyzed for volatile organic compounds at an off-site TAT laboratory using an Hewlett-Packard (HP) gas chromatograph (GC)/mass spectrometer (MS) instrument, model numbers HP5980A Series II GC and HP5972MSD, respectively. Concentrations of nitrates will be determined with an Orion model 9307B, NO_3 ion-specific electrode. The Orion probe can detect a range of concentrations between 0.1 and 14,000 ppm at an accuracy of ± 0.5 percent. Ten percent of the ground water samples will be submitted to CLP laboratories for confirmation of TAT laboratory results.

5.5 Sampling Activities

5.5.1 Sample Locations

This SI will include the collection of up to 125 samples for TAT and CLP laboratory analyses identified below.

Samples designated for TAT laboratory analysis:

- 65 field screening ground water samples, including four triple-volume matrix spike/matrix spike duplicate samples and seven CLP confirmation ~~duplicate~~ split samples;
- 4 duplicate field screening ground water samples;

- ~~4 field blank samples;~~
- 10 trip blank samples; and
- 10 equipment rinsate blank samples.

Samples designated for CLP analysis:

- 7 confirmation field screening ground water samples (noted above);
- ~~1 field blank sample;~~
- 1 trip blank sample;
- ~~2 equipment rinsate blank samples (field screening sampling decontamination);~~
- 9 surface water samples, including one triple-volume matrix spike/matrix spike duplicate sample;
- 1 duplicate surface water sample;
- 9 sediment samples; and
- 2 equipment rinsate blank samples (sediment sampling decontamination).

All ground water samples collected from Geoprobe™ or Hydropunch™ locations, as well as their associated quality assurance blank samples, will be analyzed at the off-site TAT laboratory to determine volatile organic compound and nitrate concentrations. Ten percent of these samples will be submitted to CLP laboratories for confirmation of TAT laboratory results. All surface water samples, sediment samples, and associated quality assurance blank samples will be analyzed at CLP laboratories for analytical parameters specified in Section 5.7 of this report.

Sample locations were selected based on a review of site background information and current knowledge about migration pathways with respect to targets. As discussed in Section 4.3 of this report, both Sand Creek and Westerly Creek have stream segments that flow under the SIA runways. Bluff Lake and its associated wetland areas are situated between the east-west runways and the Sand Creek drainage. These surface water bodies receive both point and non-point source contributions from the runway areas, and possess the potential for influx of contaminated ground water discharges into the streams. All

anticipated surface water and sediment sampling locations are depicted on Figure 3 of this report. Subsurface field screening samples will be collected from zones around the SIA runways. The TAT project officer will determine exact sample locations based on all available information, including conditions encountered in the field. All actual sample locations will be recorded on a site map. Table 2 describes sample matrix types, identification numbers, sampling locations, and rationale for each sample to be submitted to the off-site TAT and CLP laboratories for analysis.

The TAT will collect ground water samples in linear zones identified on Figure 2, which should result in data indicating areas of ambient and elevated concentrations. Surface water and sediment samples will be collected from Sand Creek, Westerly Creek, and Bluff Lake to test for impacts on sensitive environments and fisheries. Quality assurance samples will be collected in accordance with Region VIII site assessment quality control program guidance as outlined in Section 5.8 of this report. A description of non-sampling data collection objectives is presented in Table 3.

5.5.2 Sampling Methods

All sampling will be conducted in accordance with applicable procedures outlined in the *Emergency Response Branch, Region VIII, Quality Assurance Project Plan* dated January 1990 (QAPP) (E & E 1990).

5.5.3 Ground Water Sampling

The method used for collecting subsurface field screening samples was described in Section 5.4 of this report. All sample locations will be photographed during the sampling event and each ground water sample will be screened with an organic vapor monitor at the time of collection. Subsurface field screening locations will be clustered in zones proximate to the SIA runways (Figure 2).

5.5.4 Surface Water and Sediment Sampling

Sampling will proceed from the furthest downstream location to the furthest upstream location to prevent possible cross-contamination. Where feasible, the TAT will immerse

the sample containers directly into the stream to collect samples. The TAT will measure pH, specific conductance, and temperature for each sample collected. Sediment samples will be collected with stainless steel and disposable plastic spoons. All sample locations will be photographed during the sampling event and each surface water and sediment sample will be screened with an organic vapor monitor at the time of collection. Surface water and sediment sampling locations are shown on Figure 3, and were chosen based on a review of site background information and current knowledge about migration pathways with respect to targets. Actual sample points will be determined in the field based on ambient site conditions.

5.5.5 Sample Handling and Shipment

All sample bottles will be sealed and labeled according to following protocol: container caps will be taped to the bottle; sample tags will contain all required information, including site name and sample number, time and date of collection, analysis required, and preservative used; and bottles will be placed in individual plastic bags and shipped in large metal or plastic coolers padded with an adsorbent material such as vermiculite.

All sample documents will be affixed to the underside of each cooler lid. The lid will be sealed and affixed with custody seals on at least two sides so that signs of tampering are clearly visible. Samples will be handled in accordance with chain-of-custody protocol described in the *NEIC Procedures Manual for the Contract Evidence Audit and Litigation Support for EPA Enforcement Case Development,* EPA-330/9-98-002 (EPA 1989).

5.6 Field Quality Assurance/Quality Control (QA/QC)

All samples will be collected, handled, and preserved in accordance with applicable procedures established in the *Emergency Response Branch, Region VIII, Quality Assurance Project Plan*, and *Region VIII Supplement to Guidance for Performing Site Inspections under CERCLA*. The following samples will be provided for quality assurance:

- one rinsate blank sample collected each day that sampling equipment is decontaminated and reused in the field;
- one field blank sample per set of 20 water samples;

- one trip blank sample per volatile organic sample shipment;
- one duplicate sample per set of 20 water samples; and
- one triple-volume matrix spike/duplicate water sample per set of 20 water samples.

Calibration and operation of the pH meter, conductivity meter, water level indicator, and ion-specific electrode will follow instrument manufacturer's instruction manuals. All non-disposable sampling equipment used will be decontaminated following the collection of each sample as described in the *Emergency Response Branch, Region VIII, Quality Assurance Project Plan*. The basic decontamination procedures will consist of a soapy water wash, tap water rinse, triple organic-free deionized water rinse, air or heat drying, and wrapping equipment in plastic or aluminum foil to prevent any potential contamination.

5.7 Analytical Parameters

Table 4 presents a sample plan summary detailing all analytical parameters for each sample to be submitted to the off-site TAT and CLP laboratories. All ground water samples collected from Geoprobe™ or Hydropunch™ locations, and their associated quality assurance blank samples, will be analyzed at the off-site TAT laboratory for volatile organic compound (VOC) and nitrate concentrations. CLP laboratories will use Routine Analytical Services (RAS) for VOC, semivolatile compound (BNA), pesticides/PCBs, and total metals analyses of additional samples collected during this SI. CLP will use Unique Laboratory Sample Analysis (ULSA) for nitrate analyses. Table 5 presents preservation and bottle requirements.

5.8 Management of Investigation-Derived Waste

Investigation-derived wastes generated during this SI will be handled in accordance with EPA's guidance document, *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009 (EPA 1991). The field team will be prepared to contain any material that may be contaminated. Contained wastes will be segregated by type and source, then labeled. Disposal of investigation-derived wastes will be performed under subcontract if necessary.

5.9 Site Safety and Access

An exclusion zone and personnel decontamination station (PDS) will be established during the SI. The extent and location of the exclusion zone and PDS will be determined in the field based on site conditions and prevailing meteorological conditions. It is expected that most site-related field activities can be accomplished in Level D protection; however, personal protection levels will be upgraded to Level C if site conditions warrant such an upgrade. All field activities will be conducted in strict accordance with an approved site safety plan.

The TAT will seek permission from SIA authorities and off-site property owners for property access necessary to complete the SI work. If difficulties obtaining access arise, the TAT will notify the EPA SAM. Permission for access will be obtained prior to entering all work areas.

6.0 DELIVERABLES

The E & E project manager will maintain contact with the EPA SAM to keep her informed of the technical and financial progress of this project. This communication began when the work assignment was issued. Activities under this project will be reported in deliverables (e.g., sampling activities report) described herein. Activities will also be summarized in a format appropriate for inclusion in monthly and annual reports.

6.1 Sampling Activities Report (SAR)

An SAR will be prepared to provide a detailed account of what occurred during ~~each~~ PBS sampling mobilization. The SAR will be prepared within two weeks following completion of field activities. Information will be provided regarding time of major events, dates and personnel on site, including affiliations. Deviations from the approved sampling and analysis plan will be reported in the SAR. The SAR will be organized into four major sections: Introduction, Background, Field Activities (probing, surveying, and sampling activities), and Observations. Appropriate maps, tables, and figures will be included in the SAR.

7.0 REFERENCES

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_____, Environmental Monitoring Systems Laboratory, 1991, *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells* (EPA/600/4-89/034).

_____, 1992a, Office of Emergency and Remedial Response, *Guidance for Performing Site Inspections under CERCLA* (EPA 540-R-92-021).

_____, 1992b, *Region VIII Supplement to Guidance for Performing Site Inspections under CERCLA*.

6.2 Analytical Results Report (ARR)

A draft analytical results report (ARR) will be prepared for samples analyzed under this SAP. The ARR will include a map of nitrate detections, a map of chlorinated hydrocarbon detections, and a potentiometric surface map. It will be submitted to the EPA SAM within two weeks following receipt of validated data from the EPA.

A final ARR will be prepared and will address all comments received from the EPA SAM; the final ARR will be submitted within two weeks after receipt of EPA comments. If the schedule outlined herein for the deliverables cannot be met due to unforeseen events, the EPA SAM will be notified and an alternate schedule established.

TABLE 1 (page 1 of 1)
TERRESTRIAL/AQUATIC SENSITIVE ENVIRONMENTS SPECIES LIST
STAPLETON INTERNATIONAL AIRPORT RUNWAY SITE
DENVER, COLORADO
TDD #T08-9503-0501

Species	Federal List	State List
Animals		
American peregrine falcon	Endangered	Endangered
Bald eagle	Threatened	Threatened
Whooping crane	Endangered	Endangered
Eskimo Curlew	Endangered	
White-faced ibis	Category 2	
Mountain Plover	Category 1	Special Concern
Black Tern	Category 2	
Baird's sparrow	Category 2	
Black-footed ferret	Endangered	Endangered
Preble's meadow jumping mouse	Category 2	
Swift fox	Category 2	Undetermined
Speckled chub	Category 2	
Plains topminnow	Category 2	
Colorado River Cutthroat Trout	Category 2	
Regional fritillary butterfly	Category 2	
Plants		
Ute Lady's Tresses Orchid	Threatened	
Colorado butterfly weed	Category 1	
Dwarf Milkweed	Category 2	
Showy Prairie Gentian	Category 2	

Federal Descriptors:
Endangered: A species in danger of extinction throughout all or a significant portion of its range.
Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
Category 2: Taxa for which existing information may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

State Descriptors:
Endangered: State endangered species; any species or subspecies of native wildlife whose prospects for survival or recruitments within this state are in jeopardy as determined by the commission.
Threatened: State threatened species; any species or subspecies of wildlife which, as determined by the commission, is not in immediate jeopardy of extinction but is vulnerable because it exists in such small numbers or is so extremely restricted throughout all or a significant portion of its range that it may become endangered.
Special Concern: A native species or subspecies that has been threatened or endangered or could become threatened or endangered due to low population level.
Undetermined: A species about which too little is known to accurately determine its status in the state.

TABLE 2 (page 1 of 2)
SAMPLE TYPES, LOCATIONS, AND RATIONALE
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9503-0501

Sample Matrix	Sample Number	Sample Location	Rationale
Off-Site TAT Laboratory			
Ground Water	SIA-GW-01 through 65	Field screening stations	Locate ground water contamination; includes 4 QA/QC triple volume samples and 7 duplicate samples for CLP analysis.
	SIA-GW-66 through 69	Field screening stations; duplicates	Sampling and laboratory QA/QC
	SIA-GW-70 through 73	Field screening stations; field blanks	Sampling QA/QC
	SIA-GW-74 through 83	Field screening stations; trip blanks	Sampling, shipment, and laboratory QA/QC
	SIA-GW-84 through 93	Field screening stations; equipment rinsate blanks	Decontamination QA/QC (ground water sampling)
CLP Laboratories			
Ground Water	7 duplicate samples from sample set SIA-GW-01 through 65	Field screening stations	Verification of results from TAT laboratory
	SIA-GW-94	Field screening stations/ field blank	Sampling QA/QC
	SIA-GW-95	Field screening stations; trip blank	Sampling, shipment, and laboratory QA/QC
	SIA-GW-97, 97	Field screening stations; equipment rinsate blanks	Decontamination QA/QC (ground water sampling)
Surface Water	SIA-SW-01	Upstream - Sand Creek	Provide background surface water data
	SIA-SW-02	Upstream - Westerly Creek	Provide background surface water data
	SIA-SW-03	Bluff Lake	Test for impact on sensitive environments and fisheries
	SIA-SW-04	Downstream of E/W runways; Westerly Creek	Test for impact on sensitive environments and fisheries; QA/QC triple-volume sample
	SIA-SW-05	Upstream of Sand Creek/Westerly Creek confluence	Test for impact on sensitive environments and fisheries
	SIA-SW-06	Downstream of Sand Creek/Westerly Creek confluence	Test for impact on sensitive environments and fisheries
	SIA-SW-07	downstream of N/S runways; Sand Creek	Test for impact on sensitive environments and fisheries
	SIA-SW-08	Downstream of 009A, B, C discharges	Test for impact on sensitive environments and fisheries
	SIA-SW-09	Downstream of 008A discharge	Test for impact on sensitive environments and fisheries

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TABLE 2 (page 2 of 2)
SAMPLE TYPES, LOCATIONS, AND RATIONALE
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9503-0501

Sample Matrix	Sample Number	Sample Location	Rationale
CLP Laboratories (continued)			
Surface Water (continued)	SIA-SW-10	Downstream of Sand Creek/Westerly Creek confluence	Test for impact on sensitive environments and fisheries; QA/QC duplicate of SIA-SW-06
	SIA-SW-11	Equipment rinsate blank	Decontamination QA/QC (sediment sampling)
	SIA-SW-12	Equipment rinsate blank	Decontamination QA/QC (sediment sampling)
Sediment	SIA-SE-01	Upstream - Sand Creek	Provide background sediment data
	SIA-SE-02	Upstream - Westerly Creek	Provide background sediment data
	SIA-SE-03	Bluff Lake	Test for impact on sensitive environments
	SIA-SE-04	Downstream of E/W runways; Westerly Creek	Test for impact on sensitive environments and fisheries
	SIA-SE-05	Upstream of Sand Creek/Westerly Creek confluence	Test for impact on sensitive environments and fisheries
	SIA-SE-06	Downstream of Sand Creek/Westerly Creek confluence	Test for impact on sensitive environments and fisheries
	SIA-SE-07	Downstream of N/S runways; Sand Creek	Test for impact on sensitive environments and fisheries
	SIA-SE-08	Downstream of 009 A, B, C discharges	Test for impact on sensitive environments and fisheries
	SIA-SE-09	Downstream of 008A discharge	Test for impact on sensitive environments and fisheries

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TABLE 3 (page 1 of 1)
NON-SAMPLING DATA COLLECTION OBJECTIVES
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9303-0501

Waste Characterization

- Obtain estimated measurements of waste source areas.

Ground Water Migration Pathway

- Note depth to ground water.
- Note depth if probe advancement refusal, if applicable.
- Survey in probe locations for horizontal and vertical coordinates.

Surface Water and Sediment Pathways

- Locate and document the nearest fished areas within the 15-mile downstream target distance limit.
- Locate and document any threatened or endangered species that inhabit the area.
- Quantify and delineate wetlands.

TABLE 4 (page 1 of 2)
SAMPLE PLAN SUMMARY
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9503-0501

Sample Number	Sample Matrix	Field Parameters			Analytical Parameters							
					TAT		CLP					QA/QC
		Temperature	pH	Specific Conductivity	VOC	Nitrate	VOC	BNA	Pest/ PCB	Total Metals	Nitrate	Triple Vol.
SIA-GW-01 to 65	Ground water	✓	✓	✓	✓	✓	✓ (7)				✓ (7)	✓ (4)
SIA-GW-66 to 69	Ground water duplicates	✓	✓	✓	✓	✓						
SIA-GW-70 to 73	Ground water field blank				✓	✓						
SIA-GW-74 to 83	Ground water trip blank				✓							
SIA-GW-84 to 93	Ground water rinsate blank				✓	✓						
SIA-GW-94	Ground water field blank						✓				✓	
SIA-GW-95	Ground water trip blank						✓					
SIA-GW-96, 97	Ground water rinsate blank						✓				✓	
SIA-SW-01	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-02	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-03	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-04	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	✓
SIA-SW-05	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-06	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-07	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	

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TABLE 4 (page 2 of 2)
SAMPLE PLAN SUMMARY
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9503-0501

		Field Parameters			Analytical Parameters							
					TAT		CLP					QA/QC
Sample Number	Sample Matrix	Temperature	pH	Specific Conductivity	VOC	Nitrate	VOC	BNA	Pest/ PCB	Total Metals	Nitrate	Triple Vol.
SIA-SW-08	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-09	Surface water	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-10	Surface water duplicate	✓	✓	✓			✓	✓	✓	✓	✓	
SIA-SW-11	Sediment rinsate blank						✓	✓	✓	✓	✓	
SIA-SW-12	Sediment rinsate blank						✓	✓	✓	✓	✓	
SIA-SE-01	Sediment						✓	✓	✓	✓	✓	
SIA-SE-02	Sediment						✓	✓	✓	✓	✓	
SIA-SE-03	Sediment						✓	✓	✓	✓	✓	
SIA-SE-04	Sediment						✓	✓	✓	✓	✓	
SIA-SE-05	Sediment						✓	✓	✓	✓	✓	
SIA-SE-06	Sediment						✓	✓	✓	✓	✓	
SIA-SE-07	Sediment						✓	✓	✓	✓	✓	
SIA-SE-08	Sediment						✓	✓	✓	✓	✓	
SIA-SE-09	Sediment						✓	✓	✓	✓	✓	

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TABLE 5 (page 1 of 1)
SAMPLE PRESERVATION AND BOTTLE REQUIREMENTS
STAPLETON INTERNATIONAL AIRPORT RUNWAYS SITE, DENVER, COLORADO
TDD #T08-9503-0501

LOW CONCENTRATION SAMPLES	
Organics	
VOC (water)	Two 40-ml glass septa vials, cooled to 4°C
VOC (solid)	Two 2-oz or 4-oz glass septa jars, cooled to 4°C
BNA (water)	One 80-oz amber glass jug, cooled to 4°C
BNA (solid)	One 8-oz glass jar, cooled to 4°C
Inorganics	
Metals (nitrates) (water)	One 250-ml polyethylene bottle, unfiltered, then sulfuric acid to pH <2
Metals (water total)	One 1-liter polyethylene bottle, unfiltered, then nitric acid to pH <2
Metals (nitrates) (solid)	One 8-oz glass jar
Metals (solid total)	One 8-oz glass jar

TABLE 6 (page 1 of 1)
TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL)[1]
VOLATILES

Volatiles		CAS Number	Quantitation Limits[2] Water µg/L	Low Soil/Sediment[3] µg/Kg
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl Chloride	75-01-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene Chloride	75-09-2	10	10
6.	Acetone	67-64-1	10	10
7.	Carbon Disulfide	75-15-0	10	10
8.	1,1-Dichloroethene	75-35-4	10	10
9.	1,1-Dichloroethane	75-34-3	10	10
10.	1,2-Dichloroethene (total)	540-59-0	10	10
11.	Chloroform	67-66-3	10	10
12.	1,2-Dichloroethane	107-06-2	10	10
13.	2-Butanone	78-93-3	10	10
14.	1,1,1-Trichloroethane	71-55-6	10	10
15.	Carbon Tetrachloride	56-23-5	10	10
16.	Bromodichloromethane	75-27-4	10	10
17.	1,2-Dichloropropane	78-87-5	10	10
18.	cis-1,3-Dichloropropene	10061-01-5	10	10
19.	Trichloroethene	79-01-6	10	10
20.	Dibromochloromethane	124-48-1	10	10
21.	1,1,2-Trichloroethane	79-00-5	10	10
22.	Benzene	71-43-2	10	10
23.	trans-1,3-Dichloropropene	10061-02-6	10	10
24.	Bromoform	75-25-2	10	10
25.	4-Methyl-2-pentanone	108-10-1	10	10
26.	2-Hezanone	591-78-6	10	10
27.	Tetrachloroethene	127-18-4	10	10
28.	Toluene	108-88-3	10	10
29.	1,1,2,2-Tetrachloroethane	79-34-5	10	10
30.	Chlorobenzene	108-90-7	10	10
31.	Ethyl benzene	100-41-4	10	10
32.	Styrene	100-42-5	10	10
33.	Xylenes (total)	1330-20-7	10	10

[1] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[2] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[3] Medium Soil/Sediment Quantitation Limits (QL) for Volatile, Semivolatile, and Pesticides/PCB TCL Compounds are 125, 60, and 15 times the individual Low Soil/Sediment QL, respectively.

Source: Ecology and Environment, Inc., based on Contract Laboratory Program Statement of Work, OLM01.6 (6/91).

TABLE 7 (page 1 of 3)
TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL)[1]
SEMIVOLATILES

Semivolatiles	CAS Number	Quantitation Limits[2] Water µg/L	Quantitation Limits[2] Low Soil/Sediment[3] µg/Kg
34. Phenol	108-95-2	10	330
35. bis(2-Chloroethyl)ether	111-44-4	10	330
36. 2-Chlorophenol	95-57-8	10	330
37. 1,3-Dichlorobenzene	541-73-1	10	330
38. 1,4-Dichlorobenzene	106-46-7	10	330
39. 1,2-Dichlorobenzene	95-50-1	10	330
40. 2-Methylphenol	95-48-7	10	330
41. 2,2-oxybis (1-chloropropane)	108-60-1	10	330
42. 4-Methylphenol	106-44-5	10	330
43. N-Nitroso-di-n-propylamine	621-64-7	10	330
44. Hexachloroethane	67-72-1	10	330
45. Nitrobenzene	98-95-3	10	330
46. Isophorone	78-59-1	10	330
47. 2-Nitrophenol	88-75-5	10	330
48. 2,4-Dimethylphenol	105-67-9	10	330
49. bis(2-Chloroethoxyl) methane	111-91-1	10	330
50. 1,4-Dichlorophenol	120-83-2	10	330
51. 1,2,4-Trichlorobenzene	120-82-1	10	330
52. Naphthalene	91-20-3	10	330
53. 4-Chloroaniline	106-47-8	10	330
54. Hexachlorobutadiene	87-68-3	10	330
55. 4-Chloro-e-methylphenol	59-50-7	10	330
56. 2-Methylnaphthalene	91-57-6	10	330
57. Hexachlorocyclopentadiene	77-47-4	10	330
58. 1,4,6-Trichlorophenol	88-06-2	10	330
59. 1,4,5-Trichlorophenol	95-95-4	25	800
60. 2-Chloronaphthalene	91-58-7	10	330
61. 2-Nitroaniline	88-74-4	25	800
62. Dimethylphthalate	131-11-3	10	330

[1] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[2] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[3] Medium Soil/Sediment Quantitation Limits (QL) for Volatile, Semivolatile, and Pesticides/PCB TCL Compounds are 125, 60, and 15 times the individual Low Soil/Sediment QL, respectively.

Source: Ecology and Environment, Inc., based on Contract Laboratory Program Statement of Work, OLM01.6 (6/91).

TABLE 7 (page 2 of 3)
TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL)[1]
SEMIVOLATILES

Semivolatiles	CAS Number	Quantitation Limits[2] Water µg/L	Quantitation Limits[2] Low Soil/Sediment[3] µg/Kg
63. Acenaphthylene	208-96-8	10	330
64. 2,6-Dinitrotoluene	606-20-2	10	330
65. 3-Nitroaniline	99-09-2	25	800
66. Acenaphthene	83-32-9	10	330
67. 2,4-Dinitrophenol	51-28-5	25	800
68. 4-Nitrophenol	100-02-7	25	800
69. Dibenzofuran	132-64-9	10	330
70. 2,4-Dinitrotoluene	121-14-2	10	330
71. Diethylphthalate	84-66-2	10	330
72. 4-Chlorophenyl-phenylether	7005-72-3	10	330
73. Fluorene	86-73-7	10	330
74. 4-Nitroaniline	100-01-6	25	800
75. 4,6-Dinitro-2-methylphenol	634-52-1	25	800
76. N-nitrosodiphenylamine	86-30-6	10	330
77. 4-Bromophenyl-phenylether	101-55-3	10	330
78. Hezachlorobenzene	118-74-1	10	330
79. Pentachlorophenol	87-86-5	25	800
80. Phenanthrene	85-01-8	10	330
81. Anthracene	120-12-7	10	330
82. Carbazole	86-74-8	10	330
83. Di-n-butylphthalate	84-74-2	10	330
84. Fluoranthene	206-44-0	10	330
85. Pyrene	129-00-0	10	330
86. Butylbenzylphthalate	86-68-7	10	330
87. 3,3-Dichlorobenzidine	91-94-1	20	660
88. Benzo(a)anthracene	56-55-3	10	330
89. Chrysene	218-01-9	10	330
90. bis(2-Ethylhexyl)phthalate	117-81-7	10	330
91. Di-n-octylphthalate	117-84-0	10	330
92. Benzo(b)fluoranthene	205-99-2	10	330
93. Benzo(k)fluoranthene	207-08-9	10	330

[1] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[2] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[3] Medium Soil/Sediment Quantitation Limits (QL) for Volatile, Semivolatile, and Pesticides/PCB TCL Compounds are 125, 60, and 15 times the individual Low Soil/Sediment QL, respectively.

Source: Ecology and Environment, Inc., based on Contract Laboratory Program Statement of Work, OLM01.6 (6/91).

TABLE 7 (page 3 of 3)
TARGET COMPOUND LIST (TCL) AND
QUANTITATION LIMITS (QL)[1]
SEMIVOLATILES

Semivolatiles	CAS Number	Quantitation Limits[2] Water µg/L	Quantitation Limits[2] Low Soil/Sediment[3] µg/Kg
94. Benzo(a)pyrene	50-32-8	10	330
95. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
96. Dibenz(a,h)anthracene	53-70-3	10	330
97. Benzo(g,h,i)perylene	191-24-2	10	330

[1] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.
[2] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.
[3] Medium Soil/Sediment Quantitation Limits (QL) for Volatile, Semivolatile, and Pesticides/PCB TCL Compounds are 125, 60, and 15 times the individual Low Soil/Sediment QL, respectively.
Source: Ecology and Environment, Inc., based on Contract Laboratory Program Statement of Work, OLM01.6 (6/91).

TABLE 8 (page 1 of 1)
TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QL)[1]
PESTICIDES/PCBs

Pesticides/PCBs	CAS Number	Quantitation Limits[2] Water µg/L	Quantitation Limits[2] Low Soil/Sediment[3] µg/Kg
98. alpha-BHC	319-84-6	0.05	1.7
99. beta-BHC	319-85-7	0.05	1.7
100. delta-BHC	318-86-8	0.05	1.7
101. gamma-BHC (Lindane)	58-89-9	0.05	1.7
102. Heptaclor	76-44-8	0.05	1.7
103. Aldrin	309-00-2	0.05	1.7
104. Heptachlor epoxide	1024-57-3	0.05	1.7
105. Endosulfan I	959-98-8	0.05	1.7
106. Dieldrin	60-57-1	0.10	3.3
107. 4,4'-DDE	72-55-9	0.10	3.3
108. Endrin	72-20-8	0.10	3.3
109. Endosulfan II	33213-65-9	0.10	3.3
110. 4,4'-DDD	50-29-3	0.10	3.3
111. Endosulfan sulfate	1031-07-8	0.10	3.3
112. 4,4'-DDT	50-29-3	0.10	3.3
113. Methoxylchlor	72-43-5	0.50	17.0
114. Endrin ketone	53494-70-5	0.10	3.3
115. Endrin aldehyde	7421-36-3	0.10	3.3
116. alpha-Chlordane	5103-74-2	0.5	1.7
117. gamma-Chlordane	5103-74-2	0.5	1.7
118. Toxaphene	8001-35-2	1.0	170.0
119. Aroclor-1016	12674-11-2	0.5	33.0
120. Aroclor-1221	11104-28-2	0.5	33.0
121. Aroclor-1232	11141-16-5	0.5	67.0
122. Aroclor-1242	53469-21-9	0.4	33.0
123. Aroclor-1248	12672-29-6	0.5	33.0
124. Aroclor-1254	11097-69-1	1.0	33.0
125. Aroclor-1260	11096-82-5	1.0	33.0

[1] Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[2] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment on dry weight basis will be higher.

[3] Medium Soil/Sediment Quantitation Limits (QL) for Volatile, Semivolatile, and Pesticides/PCB TCL Compounds are 125, 60, and 15 times the individual Low Soil/Sediment QL, respectively.

Source: Ecology and Environment, Inc., based on Contract Laboratory Program Statement of Work, OLM01.6 (6/91).

TABLE 9 (page 1 of 1)
INORGANIC TARGET ANALYTE LIST (TAL)

Analyte	Detection Limit (µg/L - Water[1])
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

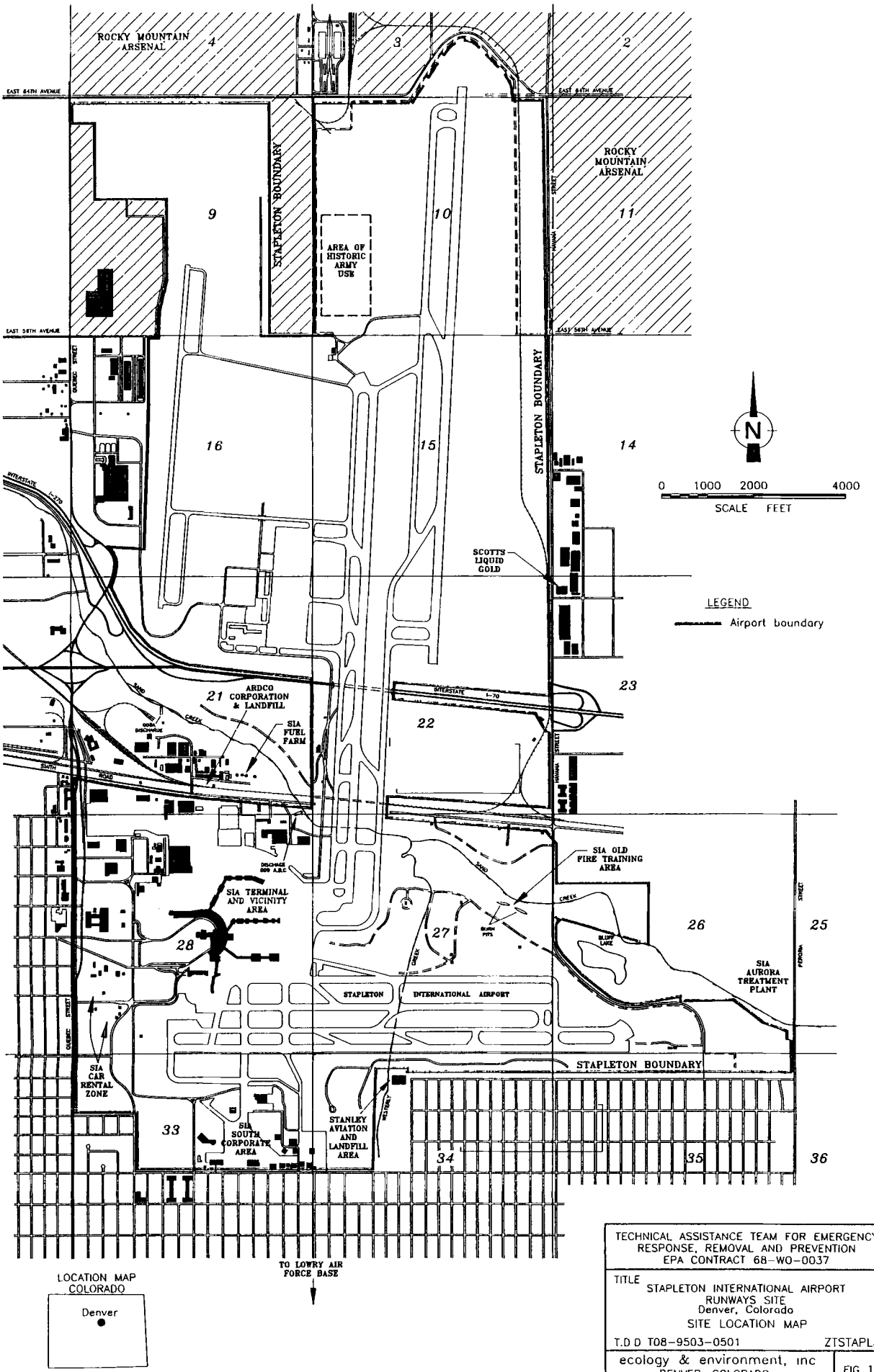
[1] Sediment detection limit 100x water (µg/Kg - soil/sediment).

Source: Ecology and Environment, Inc., based on the Contract Laboratory Program Statement of Work, ILM02.1 (9/91).

TABLE 10 (page 1 of 1)
TARGET ANALYTE LIST AND DETECTION LIMITS - NITRATES

Analyte	Detection Limit (mg/L - water)
Nitrate (NO_3 as N)	0.1

Source: U.S. EPA, Office of Solid Waste and Emergency Response, *Test Methods for Evaluating Solid Waste,* SW-846, November 1986.



LOCATION MAP
COLORADO

TECHNICAL ASSISTANCE TEAM FOR EMERGENCY RESPONSE, REMOVAL AND PREVENTION
EPA CONTRACT 68-WO-0037

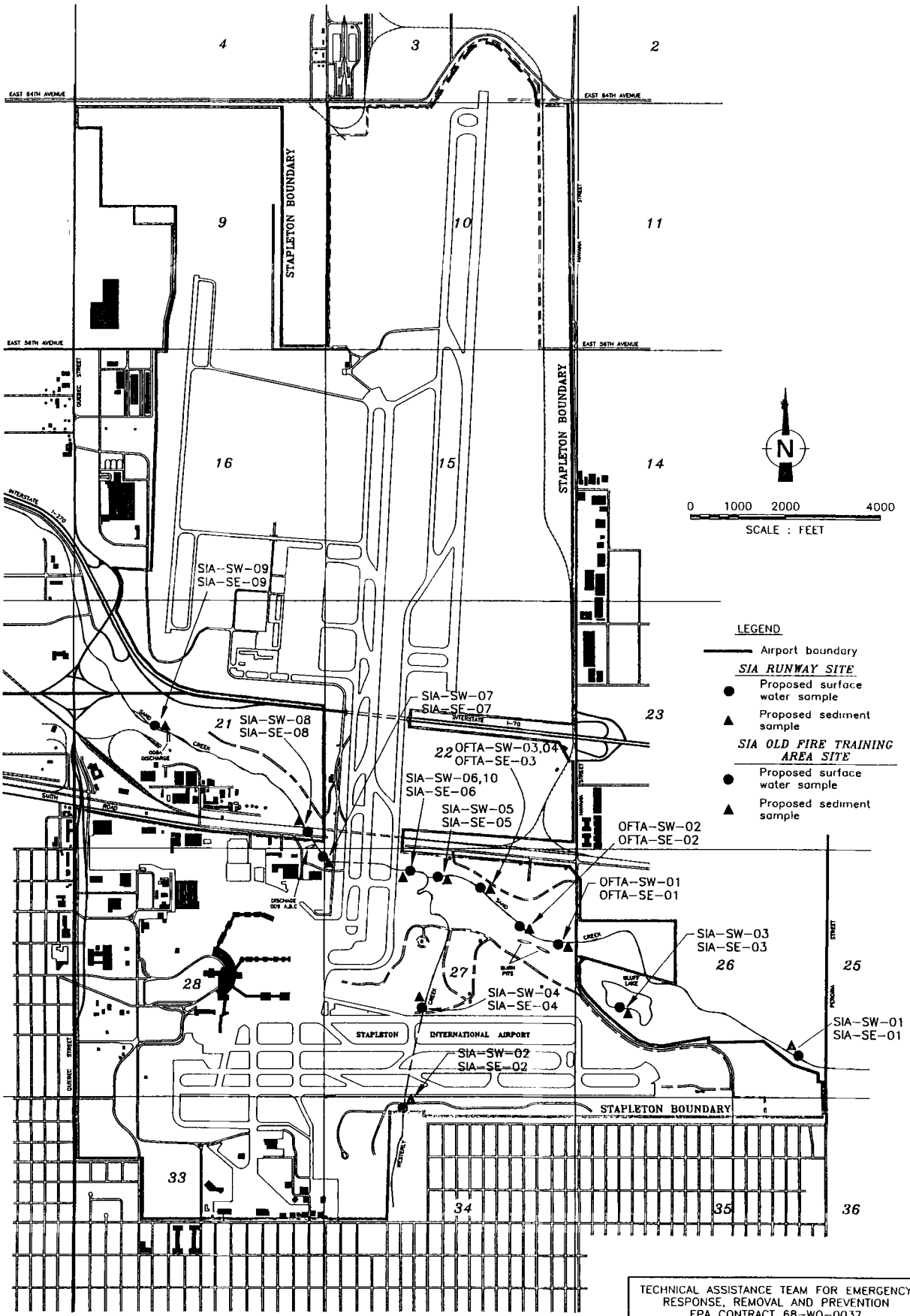
TITLE
STAPLETON INTERNATIONAL AIRPORT
RUNWAYS SITE
Denver, Colorado
SITE LOCATION MAP

T.D.D T08-9503-0501 ZTSTAPL3

ecology & environment, inc
DENVER, COLORADO

FIG 1

Date 04/10/95 Drawn by TS Scale 1" = 2000'



TECHNICAL ASSISTANCE TEAM FOR EMERGENCY RESPONSE, REMOVAL AND PREVENTION
EPA CONTRACT 68-WO-0037

TITLE: STAPLETON INTERNATIONAL AIRPORT
RUNWAYS SITE
Denver, Colorado
SURFACE WATER/SEDIMENT SAMPLE
LOCATION MAP
T.D.D T08-9503-0501

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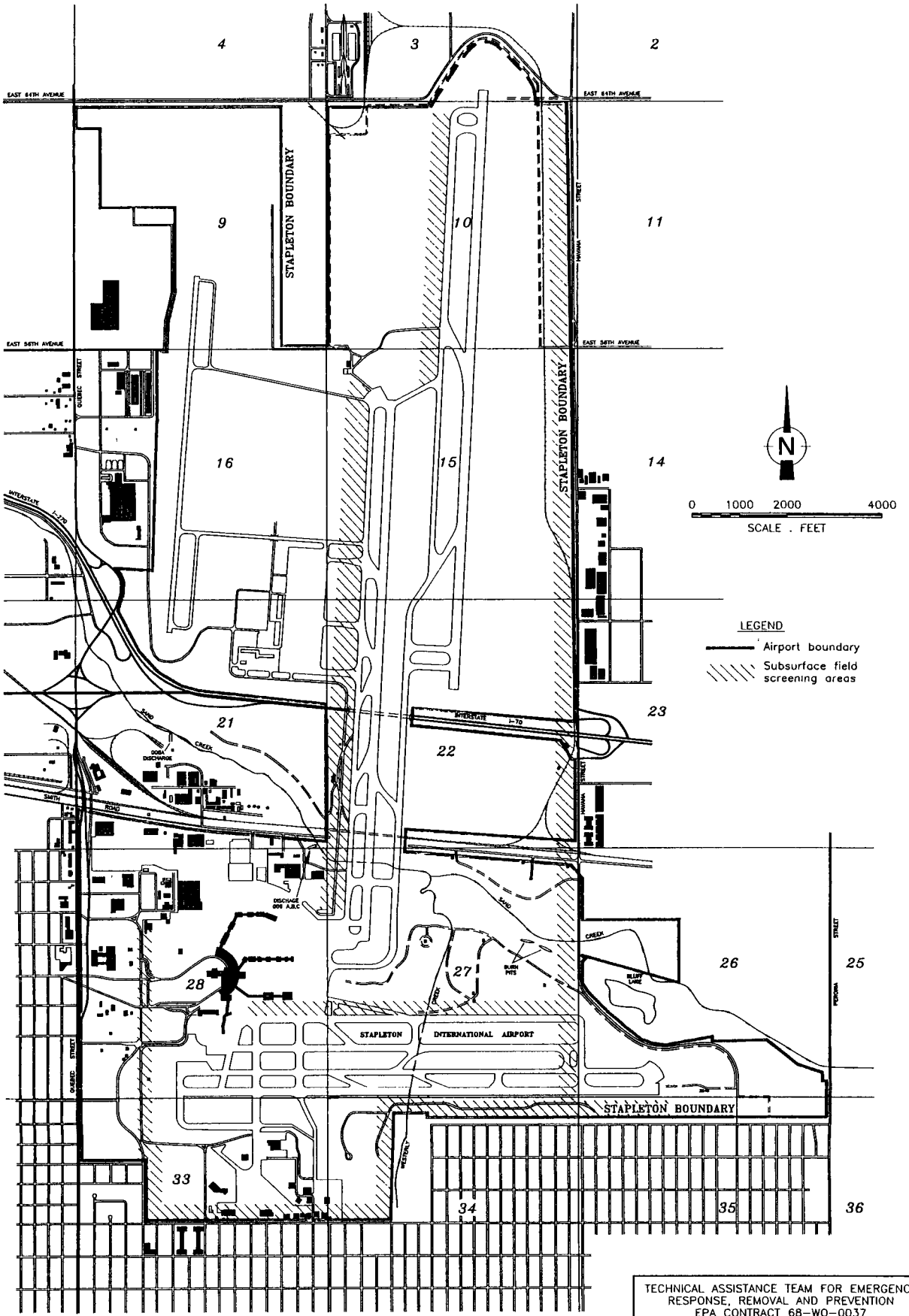
FIG 3

Date 04/10/95 Drawn by: TS Scale:



TECHNICAL ASSISTANCE TEAM FOR EMERGENCY RESPONSE, REMOVAL AND PREVENTION
EPA CONTRACT 68-WO-0037

TITLE. STAPLETON INTERNATIONAL AIRPORT
RUNWAYS SITE
Denver, Colorado
PROPOSED SUBSURFACE FIELD SCREENING AREA

T.D.D T08-9503-0501

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FIG 2

Date. 04/10/95 Drawn by. TS Scale