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COLORADO DEPARTMENT OF PUBLIC HEALTH
AND ENVIRONMENT
HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

SAMPLE AND ANALYSIS PLAN

COLORADO SMELTER

CON000802700

PUEBLO, COLORADO

MAY 2010

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SITE INSPECTION SAMPLING AND ANALYSIS PLAN
COLORADO SMELTER CON000802700
PUEBLO, COLORADO

1.0 INTRODUCTION

The Hazardous Materials and Waste Management Division (HMWMD) of the Colorado Department of Public Health and Environment (CDPHE), under a cooperative agreement with the U.S. Environmental Protection Agency (EPA), has prepared this Site Inspection (SI) Sampling and Analysis Plan (SAP) for the former Colorado Smelter in Pueblo, Colorado.

This document is designed to guide field work during the sampling event, and has been prepared in accordance with the EPA "Guidance for Performing Site Inspections Under CERCLA", Interim Final, September 1992, the "Region 8 Supplement to Guidance for Performing Site Inspections Under CERCLA," and the CDPHE Generic Quality Assurance Project Plan (QAPP) (CDPHE HMWMD 2000). The field work will include sampling and non-sampling data collection. Sampling procedures will adhere to those outlined in this document and to Standard Operating Procedures (SOPs) (QAPP Appendix).

CDPHE performed site reconnaissances on June 12, 2007 and again on November 27, 2007. A preliminary assessment (PA) report was prepared and approved by EPA on June 26, 2008 (CDPHE HMWMD 2008). This SAP calls for the collection of up to 10 source, 8 surface water, 8 sediment, 2 background and 50 residential soil samples. The residential properties will be located within 1-mile of the former Colorado Smelter site.

2.0 OBJECTIVES

The objectives of this SI are to:

- Collect samples of fine-grained (<2mm) slag material and soils located onsite to determine if they are a source of contamination.
- Collect soil samples from residential yards in the neighborhoods surrounding the Colorado Smelter site to determine metals concentrations and to identify areas of observed contamination associated with the site.

- Collect background soil samples for the purpose of comparing metals concentrations in background samples with residential soil samples for evaluation under the Hazard Ranking System (HRS).
- Collect surface water samples from onsite seeps and wetlands, culvert discharges, and the Arkansas River to determine any impacts to surface waters.
- Collect sediment samples from onsite seeps and wetlands, discharge culverts, and the Arkansas River.

3.0 SITE LOCATION AND SITE DESCRIPTION

The remains of the 50-acre Colorado Smelter are located within a business, industrial and residential neighborhood near the Arkansas River and the central business district of Pueblo, Colorado.

The site is located in the Southwest Quarter of the Northwest Quarter of Section 6, Township 21 South, Range 64 West. The approximate coordinates are 38° 14' 55" north latitude, 104° 36' 30" west longitude (USGS 1961).

The Colorado Smelter site is delineated by Santa Fe Avenue to the east, Agram Avenue to the south, Interstate 25 to the west, and the Arkansas River to the north. The smelter was constructed on the mesa of a large ravine. Waste slag was deposited in the ravine, which contained a significant stream of water (Fry 2000). The site location and potential area of influence is identified on Figure 1. A close-up of the Colorado Smelter and surrounding area is shown on Figure 2.

The nearest residence is approximately 200 feet from the site. Residences are located east of the site across South Santa Fe Avenue and south of the site across Agram Avenue. A park is located immediately south of the ravine.

Small businesses are located on-site. This includes Ace Enterprises, Top Notch Trailers, Domenic & Sons Paint & Body Shop, Chem Way Lawn Care, Meadow Gold Dairies, Northern Colorado Paper, and Ryder Truck Rental.

At present, there are remnants of destroyed buildings and large slag piles at the Colorado Smelter site. Site conditions during a November 27, 2007 site visit are documented in Photos 1 through 7.

4.0 SITE HISTORY

The Colorado Smelting Company smelter (also known as Colorado Smelter, Boston Smelter, Boston & Colorado Smelter, and Eilers Smelter) began operating in 1883. It was constructed in a ravine between Santa Fe Avenue and the Denver & Rio Grande railroad tracks (Fry 2000).

The owners of the Madonna Mine, located in Monarch, built the Colorado Smelter in order to smelt their extracted silver-lead ore in a cost effective manner. The smelter operated eight blast furnaces, two calcining furnaces, one fusing furnace and twenty kilns (Fry 2000).

The Colorado Smelter was merged into the American Smelting and Refining Company (ASARCO) in 1899. The facility was closed in 1908. Some of the slag was used as track ballast for the D&RG track constructed between Florence and Canon City. In 1923, bricks from the blast furnace smoke stack were used to construct the St. Mary School (Fry 2000).

5.0 SITE CHARACTERISTICS

5.1 GEOLOGY AND HYDROGEOLOGY

Artificial fill and Quaternary Piney Creek and Post Piney Creek alluvium comprise the surficial deposits. The artificial fill consists of gravel, silt, clay, concrete waste, and smelter waste and slag. The Piney Creek alluvium is 10 to 46 feet thick and consists of yellowish-gray to medium-brown silt, clay, sand and gravel. It has a hydraulic conductivity of approximately 27 feet per day (CDPHE HMWMD 1992).

The alluvium lies over sedimentary bedrock composed of chalk and shale beds of the Cretaceous Pierre Shale and the Smokey Hill Shale Member of the Niobara Formation. These strata have a total thickness of approximately 3500 feet and are relatively impermeable, acting as aquatards preventing the downward migration of groundwater.

The uppermost major aquifer is the Dakota Sandstone. It is approximately 3500 feet to the top of the aquifer in the Pueblo area (USGS 1978).

5.2 HYDROLOGY

The Colorado Smelter site is located immediately south of the Arkansas River, approximately one mile west of the confluence of Fountain Creek. A portion of the site is situated within the 500 year floodplain, although the majority of area is designated Flood Zone C by the Federal Emergency Management Agency, and are therefore outside of the 500-year flood plain (FEMA 2007).

Downtown Pueblo was constructed along the banks of the Arkansas River. On June 3, 1921, a sudden rainstorm flooded both the Arkansas River and Fountain Creek. The flood destroyed approximately one third of the downtown area. Between 1921 and 1926, cement banks and dikes were constructed to reroute the Arkansas River to its present location and protect the city from future flooding.

Stream flow in the Arkansas River varies dramatically from below 20 cubic feet per second (cfs) in December and January to over 4000 cfs in June. Average annual flow of the Arkansas River in Pueblo is 573 cfs, while average annual flow in Fountain Creek is 97 cfs (USGS 2005).

5.3 CLIMATE

Pueblo temperatures fluctuate seasonally, with an average of 160 days of below freezing lows and 64 days of above 90°F highs. Annual precipitation averages 11.2 inches, of which over half falls as rain between the months of May and August. Relative humidity is fairly low, typically 45 to 60 percent (ClimateZone). The 2-year 24-hour rainfall event is 2.0 inches (CDOT 2005).

Average wind speed is 7.7 miles per hour and predominately flows from the west-northwest, although occasional upslope conditions cause a reversal in wind direction (WebMET 1990).

6.0 PRELIMINARY PATHWAY ANALYSIS

6.1 SOURCE CHARACTERIZATION

The waste piles located at the former Colorado Smelter sites contains slag ranging in size from very coarse gravelly materials to silt. The Colorado Smelter slag pile forms a thirty-foot high escarpment visible from Santa Fe Avenue, and covers approximately 25 acres, for a total estimated volume of 50,000 cubic yards. The slag appears to have been deposited in a low area. The Denver & Rio

Grande railroad tracks, and possibly portions of Interstate 25, appear to have been constructed on the slag dump.

Emissions from smelting operations often contain inorganic constituents such as lead and arsenic. Soils contaminated with cadmium, arsenic, lead and zinc may be found in residential areas surrounding smelter plant sites. Ingestion of soil and inhalation of wind blown soil are potential human exposure pathways of concern and may occur due to the extent of off-site contamination in surface soils near the site (ATSDR 2006).

Between 1992 and 1995, several investigations were conducted by CDPHE, EPA and their contractors. The results of the investigations are discussed in detail in the Colorado Smelter Preliminary Assessment (CDPHE HMWMD 2008).

A systematic sampling effort of the source material was conducted by Ecology and Environment on August 16, 1995. The results are documented in an October 1995 report. The Colorado Smelter property was split into five sampling areas, designated A through E, based on the natural topography of the site. A total of 88 samples were collected and brought to Denver for analysis of arsenic, cadmium and lead using an X-ray fluorescence spectrometer (XRF). Seventeen samples were sent to a laboratory for confirmatory analysis. Very poor correlation was observed between the XRF analysis and laboratory analysis for both arsenic and cadmium, therefore the XRF generated data for arsenic and cadmium is of little value. However, the XRF lead analysis correlated well with the laboratory lead analysis (E&E 1995b).

The observed concentration of lead in the slag pile ranged from an estimated 56 milligrams per kilogram (mg/kg) to a high of 9300 mg/kg. A total of 59 of the 88 samples collected exceeded 400 mg/kg lead. The highest concentrations were found in the samples analyzed in sampling area C, averaging 3323 mg/kg. Samples located at the northern end of the pile (Section A) generally contained lower concentrations of lead.

6.2 AIR PATHWAY

During smelter operations, heavy metal contaminants were likely exhausted through the smoke stacks and dispersed through the air pathway to surficial soils. The blast furnace smokestack was 132 feet high. The stack from the fusing and calcining furnaces was 95 feet high. The desulphuring kilns were vented from a stack 65 feet high (Fry 1990).

Inhalation of windblown soils historically contaminated with lead and arsenic may still pose a risk to human health. The resident population within the target distance limit of 4 miles is estimated at 93,174 (EJ 2007). An estimated 3,500 acres of wetlands are located within four miles of the site (FWS 1974). Runyon/Fountain Lake is a designated State Wildlife Area, and is located between one quarter and one-mile east-northeast of the site (CDOW 2007). The Arkansas River valley, referred to as the Central Arkansas Playas, is located east of the site, approximately 2 miles away, and has been classified as a potential conservation area due to its high biodiversity. The Central Arkansas Playas area is identified on Figure 1. According to the Colorado Natural Heritage Program, several threatened or endangered species have been identified in Pueblo County (CNHP 2007).

Fine-grained source and soil particulates contaminated with heavy metals may pose an ongoing risk to human health via inhalation. Evaluation of the air pathway is being deferred until after the collection and evaluation of residential soils. If the results of analysis of residential soils indicate unacceptable concentrations of heavy metals, the air pathway may be investigated.

6.3 GROUND WATER PATHWAY

Sources are uncontained with regard to the groundwater pathway. However, it is unlikely shallow groundwater is used as a drinking water source since the area is serviced with a municipal water supply. Four municipal groundwater wells are located between 2 and 3 miles east-southeast of the site. The wells appear to be in a different hydro-geologic zone and are likely not impacted by the Colorado Smelter site. Contamination of the Dakota aquifer is unlikely given the low permeability of the overlying Pierre Shale as well as the depth to the Dakota aquifer. It is probable there are no targets for the groundwater pathway.

The seep observed on the slagheap during previous site visits may indicate a hydraulic connection between groundwater and surface water. Both the seep and the Santa Fe Avenue Bridge Culvert may serve as conveyances of shallow groundwater to the surface water of the Arkansas River. Therefore, they will be evaluated under the surface water pathway.

6.4 SURFACE WATER PATHWAY

The slag pile is uncontained and may be a contributor of heavy metals to surface water. Portions of the slag pile are in contact with surface water. Erosion channels on the sides of the slag pile indicate contaminant transport to the Arkansas River caused by unrestrained runoff.

The buildings of the Colorado Smelter were located on a bluff adjacent to a ravine that carried a significant flow of water. Slag from the smelter process was deposited into the ravine (Fry 2000). Water flowing through the ravine was not observed during the November 27, 2007 site visit. It is probable that flow increases during the spring due to snow melt and during summer rains. A wetland was observed along the base of the ravine. Channels are present along the banks of the slagheap.

The Arkansas River is channeled by dikes through the stretch that is adjacent to the site of the former Colorado Smelter. Flow is from northwest to southeast. Gullies on the slag bluffs south of the river serve as conduits for intermittent overland flow. It is possible this intermittent overland flow may be impacted by contact with the waste slag pile present in this area.

In 1989, a citizen contacted the Pueblo City-County Health Department regarding a colored discharge flowing from a pipe into the Arkansas River. The 18-inch culvert extended from the concrete levee wall along the south side of the river, directly under the Santa Fe Street Bridge. Reddish-orange stains were visible where the liquid flowed overland, suggesting the presence of elevated iron concentrations. Pueblo County collected a grab sample of the discharge on September 26, 1989. Analysis of the sample showed elevated concentrations of several metals, including iron. Based on this result, the Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment was notified (CDPHE HMWMD 1995).

A WQCD representative visited the site and noted what appeared to be a natural topographic low filled with slag located behind the levee wall. Presumably, the metal contaminated discharge observed flowing from the Santa Fe Bridge culvert resulted from surface or ground waters seeping through the slag. In January 1990, the site was entered into the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database. The site was named the Santa Fe (Bridge) Culvert and given the Environmental Protection Agency identification number (EPA ID) COD982572513. In 1991, CDPHE conducted a preliminary assessment (PA) of the Santa Fe Bridge Culvert site (CDPHE HMWMD 1991).

Three probable points of entry (PPE), located within a 500 foot stretch of the Arkansas River, were observed during the November 27, 2007 site visit. A large storm water culvert is located at the northwestern corner of the site (Photo 8). The culvert discharges into a ditch that transports water from multiple locations to the Arkansas River. At the northeastern corner of the site, a small grate collects surface water into a storm water pipe (Photo 10). The pipe travels in a northeasterly direction towards the Arkansas River, although the discharge point was not observed.

The Santa Fe Avenue Bridge culvert is located between the other two PPE locations. This culvert conveys orange-colored water directly into the Arkansas River (Photo 9). The inlet to the culvert could not be found, and it is possible it does not daylight but instead drains alluvial groundwater from beneath the slagheap.

The Arkansas River downstream of the site PPE is classified as a warm water fishery. An estimated 124 pounds of fish per acre are present in the Pueblo area. The predominant species are long nosed sucker and white sucker (CDPHE HMWMD 1995). Greenback cutthroat trout, a threatened species, have been recorded in the county of Pueblo. The Arkansas River is also classified for use as a water supply, for agriculture, and for recreation (CDPHE WQCD 2005).

A wetland area of approximately 3,400 square feet is located onsite. Wetlands also intermittently line both banks of the Arkansas River and its tributary downstream of the PPE. These wetlands are generally palustrine with scrub and shrub coverage. There are roughly 12 miles of wetland frontage within the 15-mile target distance limit (DOI 1974).

The St. Charles Mesa Water District operates two surface water intakes (from the Arkansas River and from the Bessemer Ditch). The Arkansas River surface water intake is located approximately 100 feet downstream of the probable point of entry from the Colorado Smelter, and serves an estimated 5,500 people. The Bessemer Ditch intake is located over four miles southeast of the site in Lombard Village and cannot be impacted by the site.

6.5 SOIL EXPOSURE

It is likely the emissions from the smoke stacks resulted in widespread contamination of surficial soils with heavy metals. Soils contaminated with cadmium, arsenic, lead and zinc may be found in residential areas surrounding former smelter plant sites.

The site is situated in a combined industrial and residential use setting. The resident population within the target distance limits was estimated from the Environmental Justice Geographic Assessment Tool maintained by EPA (EJ 2007). The nearest residence is located approximately 200 feet from the slagheap. Approximately 7,238 residents live within one mile of the Colorado Smelter site.

Small businesses are located on-site. This includes Ace Enterprises, Top Notch Trailers, Domenic & Sons Paint & Body Shop, Chem Way Lawn Care, Meadow Gold Dairies, Northern Colorado Paper, and Ryder Truck Rental. There are an estimated 50 workers located onsite.

During September 1994, CDPHE collected residential soil samples located throughout the Pueblo area to evaluate the overall impact on soils from historic smelter operations. Twenty-one samples were located within one mile of the Colorado Smelter. Arsenic exceeded the Superfund Chemical Data Matrix (SCDM) benchmark for cancer risk (0.43 mg/kg) and the concentrations exceeded three times background in eight of the samples. Lead exceeded 400 mg/kg, the screening level recommended in EPA's 1994 OSWER Directive 9355.4-12 and CDPHE's 1997 Residential Soil Cleanup Table Value Standard, and three times background in two of the samples.

On May 11, 1995, an EPA contractor performed in situ x-ray fluorescence (XRF) spectrophotometeric lead and arsenic analysis on eight slag and 30 soil samples at the location of the former Colorado Smelter and in nearby residential neighborhoods. None of the slag samples and only three of the soil samples contained concentrations of arsenic above the detection limit. However the detection limit for arsenic using the XRF was reported at 67 mg/kg, significantly above the SCDM benchmarks for cancer (0.43 mg/kg) and non-cancer risk (23 mg/kg), and the residential Soil Cleanup Table Value Standard established by CDPHE in 1997 (0.21 mg/kg). Two of the slag samples had reported lead concentrations greater than 400 mg/kg, the screening level recommended in EPA's 1994 OSWER Directive 9355.4-12 and CDPHE's 1997 Residential Soil Cleanup Table Value Standard, as did seven of the residential soil samples (E&E 1995a).

Sampling of surface soils in the Pueblo region was also conducted by affiliates of the Colorado State University in Pueblo. Sixty-eight soil samples were collected at 33 locations and analyzed for arsenic, cadmium, lead and mercury. The results of the sampling effort were presented in the August 2006 publication of *Environmental Geochemistry and Health*. Samples were collected every two kilometers along four parallel transects running northwest to southeast across the city limits. Eight

samples were located within one mile of the Colorado Smelter site (19A, 19B, 20A, 20B, 21A, 21B, 3A, and 3B).

All 68 samples exceeded the carcinogenic risk SCDM benchmark for arsenic, although only eight samples contained concentrations of arsenic greater than three times background levels. The background levels used for comparison ranged from 5.0 mg/kg to 6.1 mg/kg for arsenic. None of the soil samples exceeded 400 mg/kg for lead. The overall average concentration for lead and arsenic was 88 and 12.5 mg/kg respectively. The concentration of lead and arsenic for the samples collected within one mile of the Colorado Smelter site was 194 and 8.6 mg/kg. The background levels used for comparison ranged from 13.9 to 32.5 mg/kg for lead. The study concluded that a higher-density geochemical survey is needed to identify smaller and possibly higher amplitude "hotspots" within the city (Diawara 2006). A copy of the paper is included as an appendix to this report.

Due to the unsystematic nature of soil sampling during previous studies, it is possible other residences may have yard soils with elevated arsenic or lead concentrations.

7.0 DATA QUALITY OBJECTIVES PROCESS

The EPA Data Quality Objective (DQO) Process is a seven-step iterative planning approach used to prepare plans for environmental data collection activities. It provides a systematic approach for defining the criteria that a data collection design should satisfy. Soil exposure is the pathway of highest potential concern for the Colorado Smelter site.

STEP 1 – THE PROBLEM STATEMENT

The problem statement is: Is contamination from historic smelting still present onsite and has contamination migrated to residential areas and nearby surface water bodies?

STEP 2 – IDENTIFYING THE DECISION

The primary study questions for this investigation are:

(1) Do the slag piles contain concentrations of metals elevated above background?

(2) Do residential yard soils contain contamination at concentrations above health-based benchmarks that are attributable to the former smelter site?

(3) Are onsite and nearby surface waters and sediments adversely impacted by the former smelter?

STEP 3 – IDENTIFYING THE DECISION INPUTS

The information that is required to arrive at a decision includes:

- Analytical data from source samples collected from the location of the former Colorado Smelter to determine the level and extent of onsite contamination;
- Analytical data from soil samples in residential yards in nearby neighborhoods to determine if contaminants from the Colorado Smelter are present;
- Analytical data for background soil from locations outside of the area of influence of the smelter to serve as a basis for comparison with soils collected from the nearby residential neighborhoods; and
- Analytical data from surface waters and sediments to determine if contaminants from the Colorado Smelter are present.

STEP 4 – DEFINE THE STUDY BOUNDARIES

The study area consists of neighborhoods located within 1-mile of the site and surface waters within 15 miles downstream of the Probable Point of Entry (PPE) of the site. Within the 1-mile radius the study area primarily includes residences to the southeast of the site in the direction of prevailing winds. Background soil will be collected from an area not likely to be impacted by the smelters that historically operated in Pueblo.

STEP 5 – DEVELOPING DECISION RULES

In general sample results will be compared to background samples to determine if an observed release or observed contamination can be documented (generally defined at three times background for the purpose of demonstrating attribution to the site) as defined in the Hazard Ranking System (HRS). Contaminants not meeting this threshold may not be considered for scoring the site under the HRS. Additionally, sample results will be compared

to Superfund Chemical Data Matrix (SCDM) benchmarks to establish Level 1 contamination as defined by the HRS and other appropriate benchmarks such as CDPHE's residential soil cleanup table value standards (CDPHE HMWMD 1997). Results from samples collected at residential properties will be shared with property owners and house occupants and if metals concentrations exceed applicable benchmarks, then CDPHE may recommend additional action.

STEP 6 – DEFINING TOLERANCE LIMITS ON DECISION ERRORS

Judgmental sampling will be used to bias samples toward more potentially contaminated areas. For yard soil sampling, multi-increment samples will be collected to more accurately reflect the average concentration of the sampling zone. All analytical data will be reviewed, verified, and validated to ensure data are acceptable for the intended use.

STEP 7 – OPTIMIZING THE SAMPLING DESIGN

Sample locations will be selected by the project manager in the field. Further discussion regarding this is contained in the following section of this SAP.

8.0 FIELD PROCEDURES

8.1 CONCEPT OF OPERATIONS

8.1.1 Schedule

Field work is scheduled to take place during the month of June 2010. The duration of the sampling event will depend in part on the number of property owners that provide CDPHE with access but is expected to be approximately one week.

8.1.2 Safety

All field activities will be conducted in strict accordance with an approved CDPHE Site Health and Safety Plan that will be developed before the start of field activities. It is anticipated that all field work can be accomplished in Level D personal protective equipment. The CDPHE

sampling team will consist of at least two people including a project officer and a health and safety officer.

8.1.3 Site Access and Logistics

CDPHE will contact property owners prior to the sampling event to obtain access to all sample locations. Property owners will be asked to sign a standard access agreement. A fact sheet and cover letter will be sent to property owners along with the access agreement form.

8.2 SAMPLE LOCATIONS AND SAMPLING METHODS

This SAP calls for the collection of background samples, source (waste pile) samples, residential soil samples, surface water samples and sediment samples. Sample locations will be photographed and locations will be recorded with a global positioning survey (GPS) instrument.

8.2.1 Background Samples

Two background samples will be collected from a location outside the area of influence of the smelters that historically operated in Pueblo. Each sample will consist of a 5-point multi-increment grab sample to ensure the collected material is representative.

8.2.2 Waste Pile Samples

It is anticipated that up to 10 samples of possible source material will be collected. This will include samples of the slag and soils located on or near the Colorado Smelter property. Each sample will consist of a 5-point multi-increment grab sample to ensure the collected material is representative of what is present in the piles. Samples will be biased towards the collection of fine-grained (less than 2 millimeter diameter) materials. Fine-grained materials are more likely to be dispersed by wind and inhaled as a respirable particle.

All source samples will be analyzed for metals by EPA START contractor URS using x-ray fluorescence (XRF) technology. For confirmation, at least 10 percent of the soil samples will also be analyzed through the EPA Contract Laboratory Program (CLP) using Routine Analytical Services (RAS) or through a laboratory under contract to CDPHE or URS.

In lab XRF sample preparation will be performed by URS and will consist of sample drying, compositing, homogenizing, and sieving using a 60-mesh (250 micrometers) sieve. URS will adhere to established instrument-specific Standard Operating Procedures (SOPs) and other internal SOPs developed for XRF analysis.

CDPHE will coordinate with URS to select samples for confirmatory laboratory analysis based on the XRF results. Generally samples with higher concentrations based on XRF results will be selected for laboratory confirmation. Depending on laboratory sample requirements, URS or CDPHE may send the XRF sample cups for analysis, or, if more sample volume is required, a split of the sample will be provided to the lab.

Erosion channels on the sides of the slag pile indicate contaminant transport to the Arkansas River caused by unrestrained runoff. These channels will be photographed as part of the Site Inspection. Opportunity samples may be collected to determine contaminant concentrations in soils transported via the erosion channels. If water is visible in the channels, additional opportunity samples may be collected to determine contaminant concentrations of materials entering the Arkansas River.

8.2.3 Residential Soil Samples

This SAP calls for the collection of residential soils from up to 50 residences. The final number of residential soil samples will depend on the number of property owners that provide access and on the presence or absence of contamination in individual properties based on visual observations. Each yard will be divided into four quadrants including the front, back and two side yards. Judgmental, biased-high 5-point multi-increment samples will be collected from each quadrant. These will later be composited into 4 samples as depicted on Figure 3. If children's play areas are identified, these will be sampled with an additional 5-point multi-increment sample. The number of quadrants or sample areas for each house will be determined in the field. Some residences will only have one quadrant sampled while others will have up to four (or five if a play area is identified). CDPHE anticipates that on average two 5-point multi-increment samples will be collected per yard. Two samples per yard times 50 yards will yield a total of 100 samples. Since each sample is comprised of 5-point multi-increment samples the total number of individual sample aliquots will be 500.

All residential samples will be located within 200-feet of the house. Samples will be collected from 0-2" or slightly deeper depending on landscaping including grass cover. Where grass is present the sod will be peeled back to allow for sample collection and immediately replaced. The samples will be collected with decontaminated stainless steel spoons or disposable plastic scoops. Each multi-increment sample will be placed in 1-quart plastic bags. No compositing, drying, or sieving of the samples will occur in the field.

Houses located southeast of the site will be the focus of the investigation since prevailing winds are from the northwest. Additionally, the density of sampling will be higher closer to the site and less dense as the distance from the site increases.

8.2.4 Surface Water Samples

This SAP calls for the collection surface water and sediment samples from up to 8 locations. Up to 3 samples will also be collected from any possible discharge points from the site, including the Santa Fe Avenue Bridge Culvert. The collection of samples from the PPE locations will be dependent on whether there is flow or not.

Two samples will be collected from the Arkansas River, one upstream and one downstream of the three probable points of entry (PPEs). The samples will be collected as grab samples from the banks of the river. If they can be collected safely, collocated sediment samples will be collected from the lowest energy flow regime available that may contain fine-grained sediment. Samples will be collected into 8-ounce jars and excess water, rocks and organic material will be decanted from the jars to the extent practical. Surface water and sediment sampling will proceed from downstream to upstream.

The Arkansas River is conveyed via a cement dike past the site. Although there are approximately 12 miles of frontage wetlands within the 15-mile target distance limit, the first wetlands encountered downstream of the PPEs are approximately 2 miles away and after the confluence of the Arkansas River with Fountain Creek. Given the high water flows in the Arkansas River, it is probable there are no impacts to wetlands along the river. Therefore, no sampling of wetland frontage along the Arkansas River will occur.

If onsite wetlands or seeps are noted, surface water and sediment samples will also be collected from those areas. It is estimated up to 3 of these opportunity samples will be collected.

For aqueous samples, the pH, temperature and conductivity will be recorded. Two aliquots will be collected from each location, one for total and one for dissolved metals. The dissolved metal fraction will be field-filtered through a 0.45 micron filter.

Samples will be collected into 1-liter polyethylene bottles and preserved in the field with nitric acid. Sample locations will be recorded on an aerial photograph and determined with a Global Positioning System (GPS) device.

CDPHE will carry a March-McBirney flow meter but does not anticipate being able to measure flow in the Arkansas River. Rather, CDPHE will obtain flow information from nearby gauging stations to estimate flow. Flow data will be combined with concentration data to calculate metals loading.

8.3 SAMPLE LABELING

Three fields will be used to provide a unique designation for all samples.

- The first field will be the letters "CO" that identifies the site as the Colorado Smelter.
- The second field will distinguish the sample media and will be: "SO" for residential soil samples; "SW" for surface water samples; "SE" for sediment samples; "WP" for waste pile samples; or "BG" for background samples.
- The third field will be a two digit numeric field to identify the sample number as -01, -02 etc. Residential soil samples will also receive an additional decimal number to identify the sample as being from the front yard (.1), left side yard (.2), right side yard (.3) and back yard (.4). Samples collected from an area indicative of a playground will be uniquely designated (.5). Should a garden be present, those samples will be identified with (.6).

8.4 CONTROL OF CONTAMINATED MATERIALS

The sampling team will dispose of all wastes produced during the investigation in accordance with CDPHE's Standard Operating Procedure Number 8 – "Investigation Derived Waste Management"

(QAPP Appendix B, CDPHE 2000). Disposable sampling equipment, rubber gloves, and protective outerwear will be decontaminated, bagged, removed from the site and disposed of as a non-hazardous solid waste. Nitric acid waste will be neutralized in the field with calcium carbonate, removed from the site, and appropriately disposed.

8.5 SAMPLE ANALYSES

All soil (residential and roadway) samples will be analyzed for metals by EPA START contractor URS using x-ray fluorescence (XRF) technology. For confirmation, at least 10 percent of the soil samples will also be analyzed through the EPA Contract Laboratory Program (CLP) using Routine Analytical Services (RAS) or through a laboratory under contract to CDPHE or URS.

In lab XRF sample preparation will be performed by URS and will consist of sample drying, compositing, homogenizing, and sieving using a 60-mesh (250 micrometers) sieve. URS will adhere to established instrument-specific Standard Operating Procedures (SOPs) and other internal SOPs developed for XRF analysis.

CDPHE will coordinate with URS to select samples for confirmatory laboratory analysis based on the XRF results. Generally samples with higher concentrations based on XRF results will be selected for laboratory confirmation. Depending on laboratory sample requirements, URS or CDPHE may send the XRF sample cups for analysis, or, if more sample volume is required, a split of the sample will be provided to the lab.

Surface water and sediment samples will be analyzed through EPA's contract lab program (CLP) for inorganic metals analysis.

8.6 NON-SAMPLING DATA COLLECTION

The following non-sampling data collection and observations will be made:

- Sample locations will be photographed and recorded in a field notebook.
- The location of each sample will be recorded with a global positioning system (GPS) instrument.

- Stream flow will be determined for surface water sample locations based on available gauging station data or in-field measurements.

9.0 CHAIN OF CUSTODY

All samples will be handled in strict accordance with chain of custody protocol prescribed in CDPHE's SOP No. 3 – "Chain of Custody" (QAPP Appendix B, CDPHE 2000). Documentation of sample storage and shipment will be included as part of the chain-of-custody procedures.

10.0 FIELD QUALITY CONTROL/QUALITY ASSURANCE

The Quality Assurance Project Plan (CDPHE 2000) that has been submitted to EPA will be adhered to. Sample bottles will be purchased commercially, will meet EPA specifications, and will be part of the quality control program. Surface water samples will be collected into 1-liter polyethylene bottles. Sediment samples will be collected into 8-ounce glass or plastic jars. Soil samples will be collected into 1-quart Zip-loc plastic bags. The subset of soil samples that are later sent for laboratory analysis may be transferred to 8-once glass or plastic jars, depending on the laboratory requirements.

The following types of samples will be provided for Quality Assurance/Quality Control (QA/QC) purposes:

- One duplicate water sample will be collected to determine accuracy and precision in laboratory analytical procedures and sample collection procedures;

- One double volume water sample will be collected to provide the extra volume for the laboratory to run matrix spike and matrix spike duplicate (MS/MSD) quality control samples.

No equipment rinsate will be collected because the effect of improperly decontaminated sampling equipment is expected to be minimal. The duplicate sample will be submitted with separate sample ID's as blind samples. The double volume samples will be designated on the Chain-of-Custody form as being for Lab QC purposes. Soil and sediment samples will also be designated for MS/MSD at the rate of one-per-twenty on the chain of custody, however extra sample volume is not necessary.

11.0 ANALYTICAL RESULTS REPORTING

CDPHE will prepare a draft Analytical Results Report (ARR) within 2 months after the receipt of the validated analytical data. The ARR will conform to the "Guidance for Performing Site Inspections Under CERCLA", Interim Final, September 1992 and the "Region VIII Supplement to Guidance for Performing Site Inspections under CERCLA" (EPA 1992; EPA 1993). In addition, property owners and residents will be provided with a copy of the results from their respective property.

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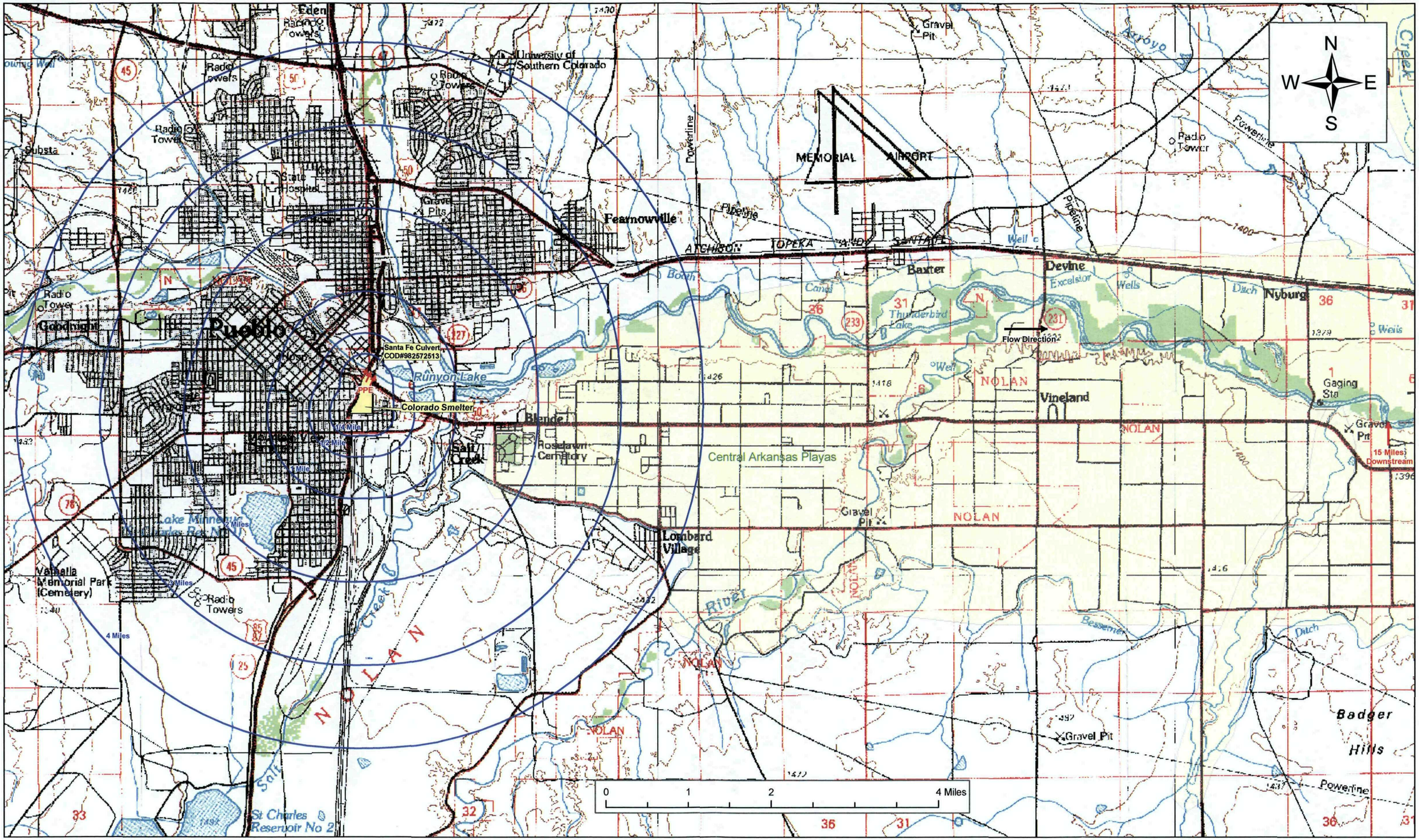


Base map from USGS 1to24 topographic quadrangle (1977)

Colorado Smelter
Sampling and Analysis Plan
May 24, 2010

Site Location and Area of Influence

Figure 1

Aerial photograph from USDA NAIP (2005)

Colorado Smelter
Sampling and Analysis Plan
May 24, 2010

Site Neighborhood

Figure 2

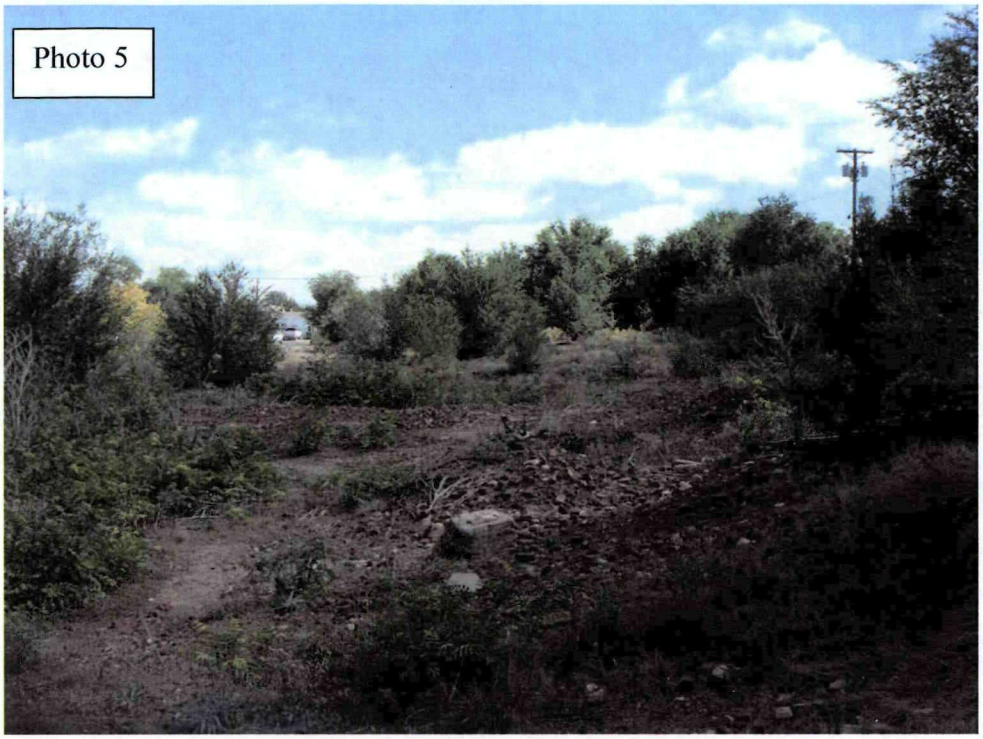
PHOTOLOG

Colorado Smelter slagheap
looking southwest from Santa Fe Ave

Colorado Smelter slag

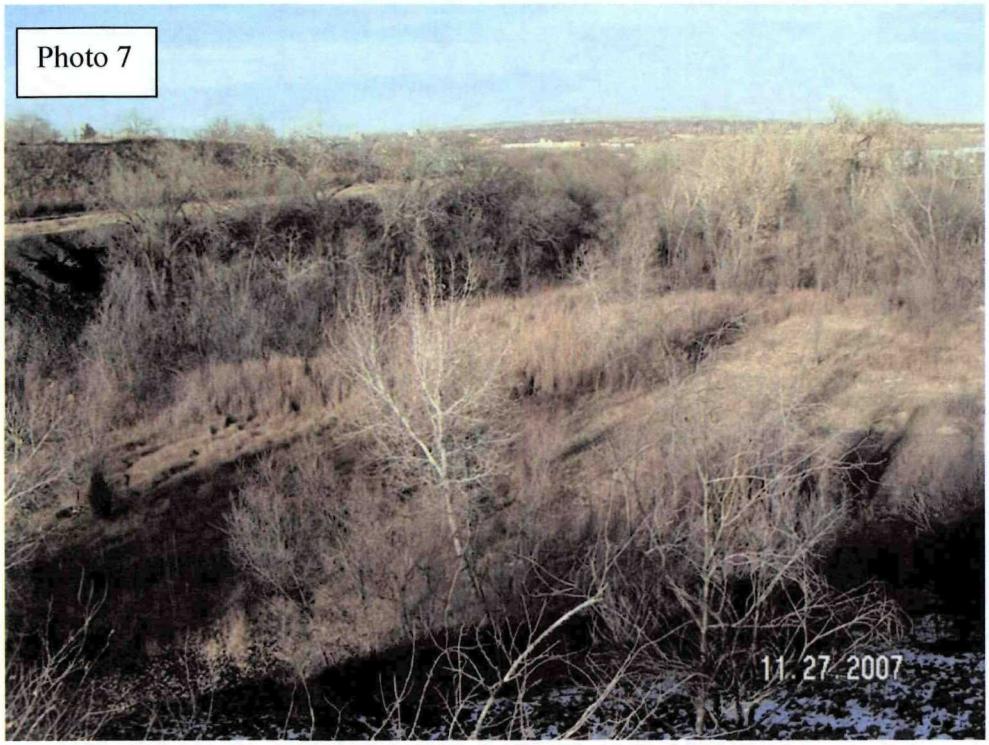
Colorado Smelter slagheap and railroad grade
looking northwest in the ravine

Fox observed on slagheap, looking west across the ravine



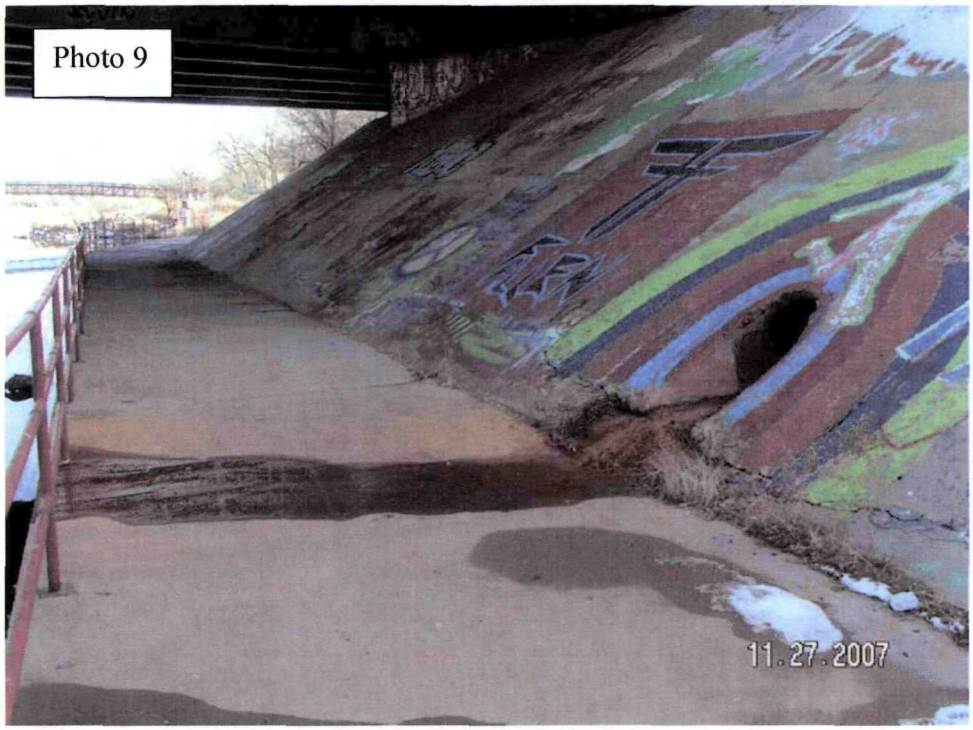
Colorado Smelter building foundation remnants
looking south in the ravine

Colorado Smelter remnants, looking west from the ravine



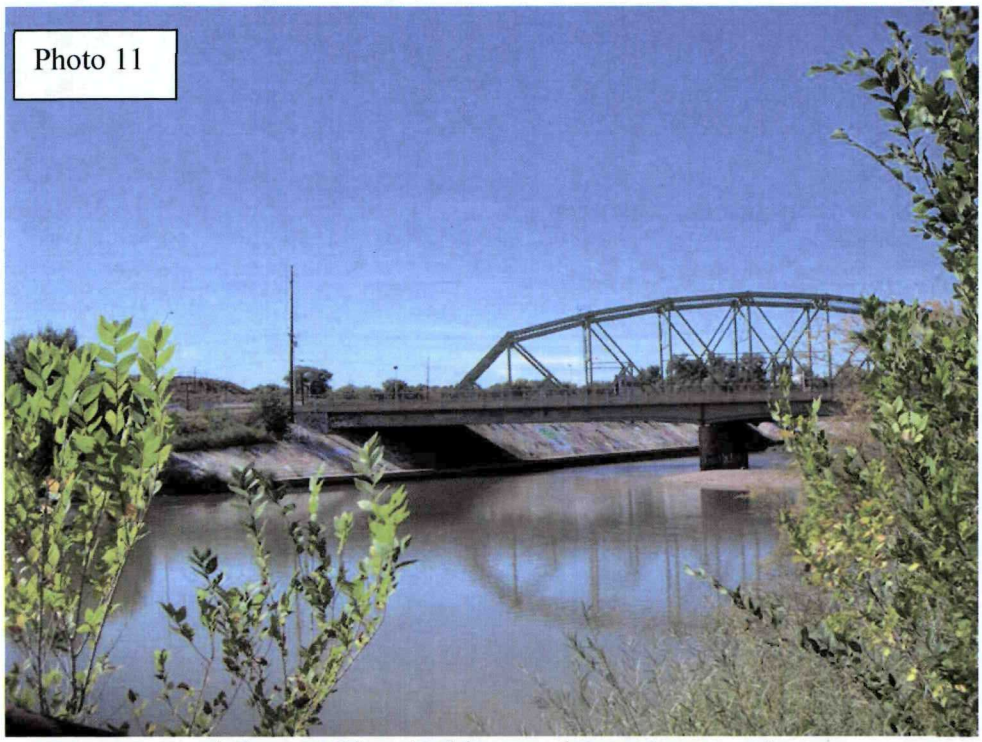
Wetland located in base of ravine, looking north

Western storm water culvert located behind the Ace Enterprises building (possible PPE)

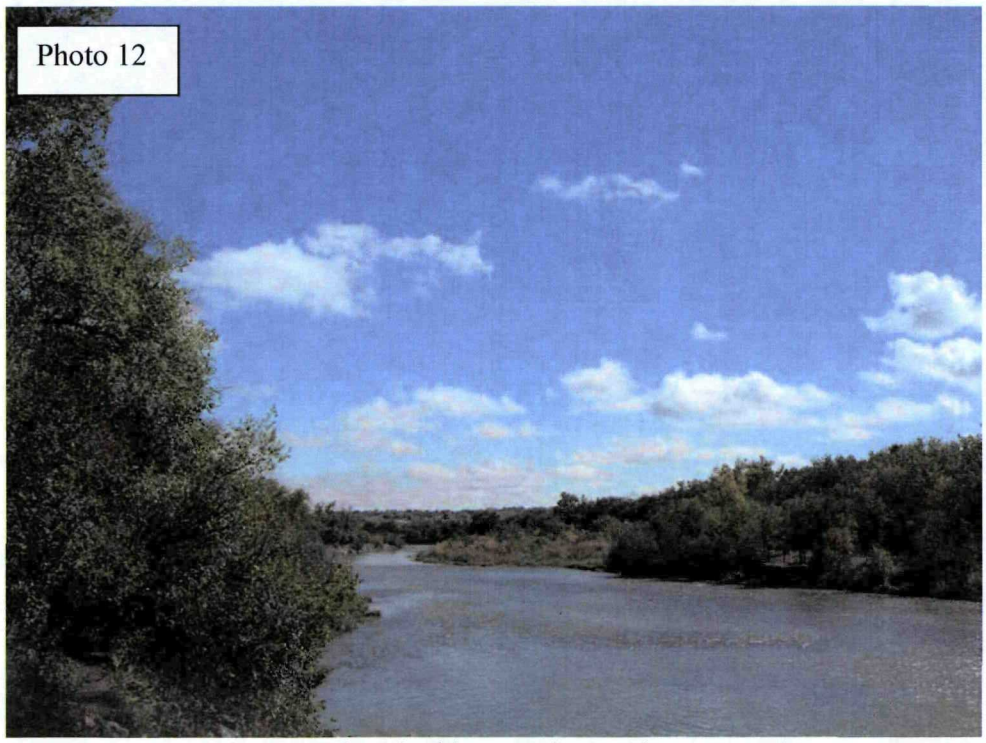


Santa Fe Avenue Bridge Culvert (main PPE)

Eastern storm water collection drain, located in front of vacant A&W / Kentucky Fried Chicken building (possible PPE)

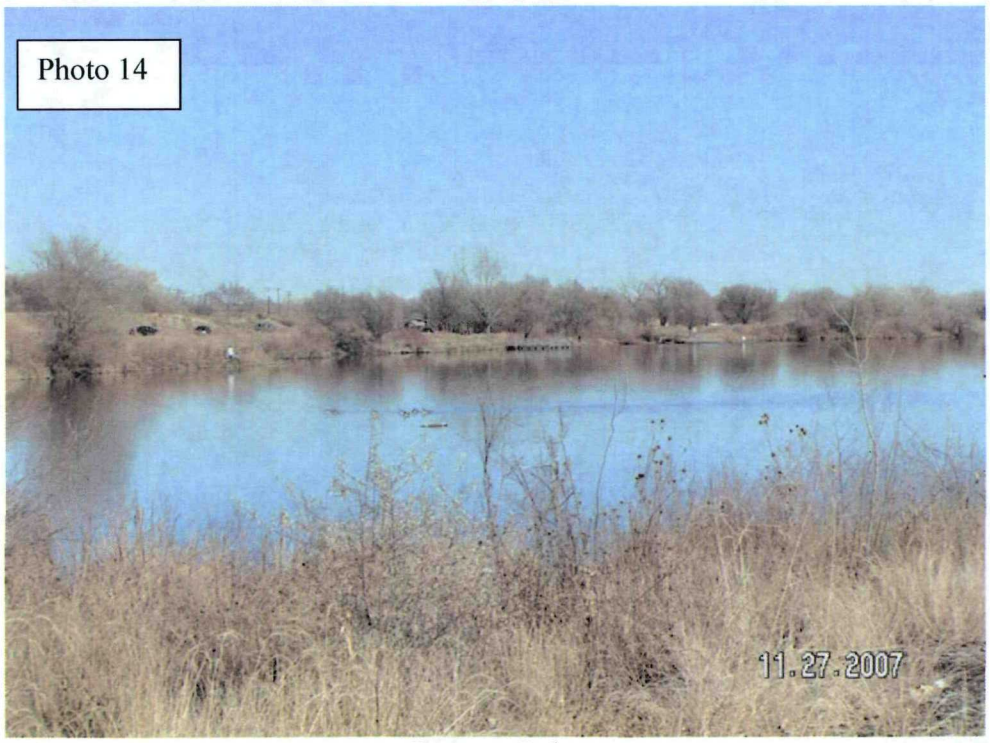


Arkansas River looking southwest (upstream)



Arkansas River looking southeast (downstream)

St. Charles Mesa Water intake location, looking south towards Santa Fe Avenue bridge



Runyon Lake