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EPA Superfund Record of Decision:

National Zinc Corp, OU 2
Bartlesville, OK
10/2/1997

NATIONAL ZINC SITE
BARTLESVILLE, OKLAHOMA

RECORD OF DECISION
REMEDIAL ACTION AT OPERABLE
UNIT 2 (ECOLOGICAL)

Prepared by

OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SEPTEMBER 27, 19

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY
RECORD OF DECISION
FOR OPERABLE UNIT TWO OF
THE NATIONAL ZINC SITE

SITE NAME AND LOCATION

National Zinc Site
Bartlesville, Oklahoma
and portions of Washington and Osage Counties, Oklahoma

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the second operable unit of the National Zinc Site, in Bartlesville, Oklahoma, developed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the site.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This operable unit is the second of two for the site. The first operable unit addresses the portions of the site that are most likely to impact human health. The function of the first operable unit is to reduce the risks to human health associated with exposure to the contaminated materials. The ROD for Operable Unit One

was written on December 13, 1994, and is being implemented at this time. While the Operable Unit One remedy does address the principle threats at the Site, the Second Operable Unit will involve continued study and possible remediation of the portions of the site that may pose undue risks to environmental receptors. The second operable unit will also address any issues involving contamination of ground water since it poses a potential ecological threat. Ground water in the vicinity of the site is not used for public or private drinking water supply but does discharge into surface water in certain areas.

The major components of the selected remedy are as follows:

This ROD describes the remedial action selected for addressing elevated metals concentrations in surface water and sediments at Operable Unit 2 (OU2) of the National Zinc Site (the Site) in Bartlesville, Oklahoma. The selected remedy is removal of contaminated sediment and offsite disposal for the impacted streams and tributaries. Clean fill will be imported to replace the excavated material in the lower reach of the North Tributary. This remedy will allow the excavated sediment (treated as needed) to be transported to an approved offsite disposal facility. Additionally, the natural recovery option will be used for Eliza Creek. During the remedial design, additional information will be gathered to designate the actual areas to be removed. If the destruction of the stream habitat will be too great in some areas, then DEQ may choose to limit removal in sensitive portions of the lower reach of the North Tributary. DEQ's goal is to maximize removal of contaminated sediments and to minimize damage to the ecosystem as much as possible.

AGRICULTURAL

Sampling of the agricultural areas will be done during the remedial design. With this information, a site-specific agricultural remedial action workplan shall be prepared and submitted to the ODEQ.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy

does not satisfy the statutory preference for treatment as a principle element of the remedy.

Because the remedy will result in hazardous substances remaining on-site above ecologically based levels, a review will be conducted five years after the commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Mark S. Coleman

10-2-96

Mark S.Coleman, Executive Director
Oklahoma Department of Environmental Quality

DATE

HIGHLIGHTS OF THE SELECTED REMEDY

- The site is separated into operable units. This Record of Decision is for Operable Unit Two which deals with ecological concerns.

- Remediation levels are being established for two different land uses. These land uses are ecological areas and agricultural areas.

	Remediation Levels (mg/kg)	
	Ecological	Agricultural
Lead	692	5000
Cadmium	100	305
Selenium	29.2	NA
Zinc	12,000	NA
Arsenic	NA	200

- The remedy selected for the ecological areas of the impacted streams and tributaries is removal of the contaminated sediment and offsite disposal. Additionally, the natural recovery will be used for Eliza Creek. Sampling of the agricultural areas will be done during the remedial design. With this information, a site-specific agricultural remedial action workplan will be prepared and submitted to the ODEQ. More detail on these remedies will be provided in the upcoming Remedial Design.

THE DECISION SUMMARY

SITE LOCATION AND DESCRIPTION

This Record of Decision (ROD) addresses the National Zinc Site (the Site) in Bartlesville, Oklahoma, and portions of Washington and Osage Counties in Oklahoma. The National Zinc facility was located on the western edge of the City of Bartlesville. The location of the former National Zinc facility coincides with the current location of the Zinc Corporation of America (ZCA) facility (Figure 1). The Site consists of those areas that have concentrations of lead, cadmium, arsenic, selenium, and zinc in soil and/or sediment, which exceed the remediation levels established in this ROD, within approximately a 3-mile radius of the ZCA facility. The ZCA facility is not a subject of this ROD or of the subsequent remedial action; it is being addressed under the authority of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended. The term Site, as used in this ROD, includes only areas beyond the boundary of the ZCA facility. The former Somex facility location is not considered part of the ZCA facility and is, therefore, part of the Site.

The Site covers a large area and is composed of a mixture of properties used for residential, commercial, industrial, recreational, and agricultural purposes. There are also some undeveloped lands which serve as wildlife habitat. The ZCA facility is now bounded to the west, northwest, and south by industrial and commercial properties. Further to the west and south land uses are primarily rural and agricultural. Residential properties border the ZCA facility to the north, northeast, east, and southeast. The central, eastern, and northern portions of the Site are primarily urban. The main commercial district in the area is in the center of Bartlesville approximately 1.5 miles to the east of the ZCA facility. The population of Bartlesville is approximately 35,000. The City is essentially bisected from north to south by the Caney River. Portions of the site lie within the flood plain of the Caney River.

HISTORY AND ENFORCEMENT ACTIVITIES

There has been a long and complex history of metal processing operations at the location of the present ZCA facility. In approximately 1907, three horizontal retort zinc smelters commenced operation at this location. Two of the smelters appear to have ceased operations in the 1920s. In 1976, the remaining horizon-

tal retort zinc smelter was converted to an electrolytic zinc refinery, which is not currently operating. During the time the horizontal retorts were in operation, metals contained in the airborne emissions from the smelter were deposited over much of the area of Bartlesville which lies west of the Caney River.

The Site has been the subject of various prior studies and investigations. These investigations revealed elevated concentrations of metals in the soil and sediment, including associated surface waters, in portions of the area within approximately a three-mile radius surrounding the ZCA facility. The metals include lead, cadmium, arsenic, and zinc. Soil sampling showed that elevated concentrations of these metals were typically found in the uppermost few inches of soil.

Historical sources of metals at the National Zinc site included ore concentrates delivered to the facility by railcar, dust from the transport and storage of ore concentrates and solid waste materials at the facility, metals emissions from roasting and smelting processes, airborne particulates from smelting and sintering processes, and various solid waste materials (e.g., retort and sinter residues, slag, crushed retorts, and condenser sands). Current potential sources of metals at the ZCA facility are being addressed by EPA pursuant to RCRA under a Consent Order with ZCA, the current owner and operator of the facility.

On May 10, 1993, the United States Environmental Protection Agency (EPA) proposed that the Site be placed on the National Priorities List (NPL). Subsequently, a memorandum of understanding (MOU) was signed between EPA and DEQ to conduct a national pilot project to complete a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) quality investigation and remediation of the Site under state authority. EPA agreed to not make a final determination to list the Site on the NPL as long as the pilot project proceeds in a timely manner and achieves CERCLA quality results.

A remedial investigation and feasibility study (RI/FS) was conducted by PTI Environmental Services (PTI) on behalf of the potentially responsible parties (PRPs), Cyprus Amax Minerals Company, Salomon Inc, and the City of Bartlesville. The RI/FS was conducted pursuant to a Consent Agreement and Final Order for Remedial Investigation, Feasibility Study, and Remedial Design (Case No. EH 94 106) entered into with DEQ. DEQ is responsible for the oversight of the RI/FS and remedy selection for the Site, under the State Pilot Project being conducted in conjunction with the EPA.

In addition to the investigations conducted at the Site, removal actions for OU1 have been and are currently being conducted to address areas that have elevated concentrations of metals in soil. In 1992, EPA evaluated soils at 54 high access areas and the decision was made to take actions on soils at 25 of those locations. In 1993, soils in 22 residential yards were evaluated by EPA and the decision was made to remediate soils at 10 of those residences. The high-access areas include places where children congregate such as schools, day care and family care centers, and parks. In 1994, Mintech, Inc., acting on behalf of Cyprus Amax Minerals Company, Salomon Inc, and the City of Bartlesville, began a second round of removal actions for certain residential yards under a Unilateral Administrative Order from EPA. This second round of removal actions consists of removing soil from yards where at least one soil sample contains elevated concentrations of metals (i.e., greater than 1,500 mg/kg lead or 90 mg/kg cadmium) and replacing it with clean soil and sod.

In 1995, the third round of removal actions began under the same Unilateral Administrative Order that was in effect in 1994. On August 7, 1995, a Consent Agreement and Final Order between ODEQ and Cyprus Amax Minerals Company and the City of Bartlesville was issued with removal of contaminated soils continuing. The remedial action levels for Operable Unit One are 925 mg/kg for lead, 100 mg/kg for cadmium, and 60 mg/kg for arsenic. The removal of soils is still ongoing at this time.

COMMUNITY PARTICIPATION

The involvement of local citizens in this project has been a major goal of both DEQ and EPA. The scope and complexity of this project necessitated more intensive efforts to involve the community than is typical of most projects. In 1992, DEQ established a steering committee of local representatives which attempted to include all potentially affected stakeholders in the community of Bartlesville. The steering committee serves as a mechanism to voice local concerns directly to the regulatory agencies throughout the project. Public meetings are also held in the evening following steering committee meetings and the general public has been provided information on the project in smaller portions and in a more timely manner than is typical of most projects. DEQ and EPA have jointly participated in numerous meetings with the public throughout the project. Much of the information that is included in the remedial investigation and feasibility study reports was released and discussed with the public several months before the completion of the final documents.

The Remedial Investigation and Feasibility Study report was released in spring of 1996. The proposed plan was released to the public for review and comment on May 2, 1996. The administrative record and copies of these two documents are available at two public repositories in the City of Bartlesville, the Bartlesville Public Library and the Bartlesville Chamber of Commerce. These documents are also available for public review at the DEQ central office. The potentially responsible parties (PRPs) have also established a public information office staffed by a local representative to assist citizens in obtaining information and answering questions regarding the site. The notice of availability was published in the Bartlesville Examiner-Enterprise. A public comment period was held from May 2, 1996, to June 2, 1996. A public meeting, held on May 2, 1996, presented the proposed plan to the public and invited comment. Responses to comments received are included as part of this ROD in the Responsiveness Summary.

SCOPE AND ROLE OF OPERABLE UNIT WITHIN SITE STRATEGY

Due to the complexity of the site and the desire to expedite cleanup in residential areas, the site has been divided into two operable units. They are:

Operable Unit 1 - Residential, Commercial, and Industrial areas;
Operable Unit 2 - Ecologically Sensitive and Agricultural areas

This ROD details the remedy selected for Operable Unit 2. Operable Unit 1 was addressed in the Record of Decision dated December 13, 1996. An evaluation of the use of groundwater in the vicinity of the site did not identify any active public or private water wells. No viable groundwater resources have been identified beneath the site. Therefore, ground water issues will be evaluated and addressed as part of Operable Unit 2. Groundwater is not used as a water supply and only potentially impacts environmental receptors when it discharges to surface waters.

SUMMARY OF SITE CHARACTERISTICS

The remedial investigation revealed that sediment contamination by lead, cadmium, selenium, and zinc is present, in elevated concentrations, over a relatively widespread area. Airborne emissions from historical smelting operations and associated activities appear to be a significant mechanism of dispersal of the contaminants across the site. In addition, spillage and wind transport of ore concentrates from rail cars may have also contributed to elevated metals at the site. It is also likely that solid waste materials from the smelters were physically moved to areas within the site boundaries for use as fill or for

other purposes. Lead, cadmium, and arsenic may also have other non-smelter related sources in a typical urban and rural environment. The concentrations of metals are not uniform across the site and some areas within the site boundaries are not significantly impacted.

Soil, surface water, and sediments are considered media of potential concern for the Ecological Risk Assessment for Operable Unit 2. Shallow groundwater is also a medium of potential concern for Operable Unit 2 because metals may be transported from the ZCA facility to the surface water south of the facility. Metals concentrations measured in air have not exceeded regulatory limits. Groundwater at the Site is not used for drinking water because aquifers under the Site yield only small amounts of poor quality water due to natural geologic conditions and historical oil production activities.

TABLE 1.
REMEDIATION LEVELS FOR PROTECTION OF ECOLOGICAL AND AGRICULTURAL AREAS

	Ecological	Agricultural
Arsenic	NA	200
Cadmium	100	305
Lead	692	5000
Selenium	29.2	NA
Zinc	12,000	NA

Note: Concentration measurements in mg/kg.
NA not applicable

Areas and volumes of potential concern were estimated for soil based on preliminary remediation goals for the ecological areas. The purpose of this estimation was only to develop cost estimates and to allow comparisons among remedial alternatives. The actual areas to be remediated will be defined during the remedial design phase based on data available at that time including the screening data from the current removal action.

SUMMARY OF SITE RISKS TO HUMAN HEALTH

DESCRIPTION OF ALTERNATIVES

In the Focused Feasibility Study (FFS), several methods for remediation of the Site were described and evaluated. A summary of the remedial action alternatives is presented here. A list of

the alternatives is shown in Table 2. The FFS report contains a more detailed description of the alternatives.

Alternatives include Sd-1, no action; Sd-2, institutional controls; Sd-3, partial removal, stabilization, and offsite disposal, and partial natural recovery; Sd-4, partial removal, stabilization, and offsite disposal, and partial rechannelization; Sd-5a, removal, stabilization, and offsite disposal; and Sd-5b, removal, stabilization, and onsite disposal. Alternatives Sd-2 through Sd-5b assume that any required source control activities at the ZCA facility will be implemented in accordance with RCRA Permit No. OKD000829440 issued July 14, 1995. Any required corrective measures would commence at approximately the end of 1997. Alternatives Sd-2 through Sd-5b also assume that source control measures at adjacent industrial areas, if required, will be implemented pursuant to the Consent Agreement and Final Order (CAFO) for Remedial Action between DEQ, Cyprus Amax Minerals Company, and the City of Bartlesville entered into on or about August 7, 1995. Remediation of sediments (and surface water, if necessary) will be deferred until source control activities are implemented. Subsequent references to source control activities refer to the source control activities at the ZCA facility and adjacent industrial areas.

Alternative Sd-1: No Action

The no-action alternative is required to be considered by EPA as a baseline to which all other alternatives must be compared. No further efforts would be conducted at the Site under the no action alternative. Monitoring would not be included in this alternative. Some natural recovery could occur by sediment transport and deposition processes.

Alternative Sd-2: Institutional Controls

Institutional controls would include deed restrictions for properties where sediment with elevated chemicals of potential concern (CoPCs) is left in place, as appropriate, to restrict the future use of the property. This alternative assumes that source control activities will be implemented. In addition, ongoing monitoring of sediment and surface water would be conducted. Monitoring would be conducted in the same areas annually for 3 years and, if needed, biannually for up to 7 more years, and in other areas would be conducted biannually for 10 years. Some natural recovery could occur by sediment transport and deposition processes.

Common Components of Active Soil Remediation Alternatives

Components that are common to the active remediation alternatives (those alternatives involving removal of sediment as a component of the alternative) are discussed here as a group in order to limit redundancy in the subsequent discussion of the individual alternatives. These components are:

- Source control activities will be implemented. Remediation of sediments (and surface water, if necessary) will be deferred until source control activities are implemented.
- The construction season would be during the dry season, which is approximately from the middle of June to the middle of October.
- Work would be conducted using an appropriate level (Level D) of personal protective equipment (PPE) based on previous experience with the removal actions conducted at the Site. The level of PPE may be revised during the course of remediation based on the health and safety monitoring conducted at the Site.
- Access agreement(s) for sediment sampling and remediation would be requested from the property owner(s). Remediation of a tributary segment would begin only after all access agreement(s) have been obtained for that segment.
- Photographic records would be made prior to and upon completion of remediation activities.
- During remediation activities, fugitive dust from the work areas (e.g., haul roads) would be controlled through a water spray by a tank truck or comparable equipment.
- Equipment would be decontaminated prior to being released from the Site. It is anticipated that decontamination would consist of scraping the residual sediment off the equipment and rinsing it with clean water. Decontamination residues that are generated would be incorporated into the removed or contained sediment, where possible.
- After source control activities are implemented and sediment is removed from the upper reaches of the North Tributary, surface water and sediment would be

monitored to determine whether the RAOs are achieved. If RAOs are not achieved, additional measures would be taken, which may include source identification and construction of a passive metals treatment system most likely in the upper reaches of the North Tributary to control potential ongoing sources of dissolved metals (particularly cadmium) in surface water. The tributary channels would be widened to form flow-equalization ponds. The outlet of the ponds would be directed into channels containing adsorptive media (e.g., peat, activated carbon, and/or pea gravel coated with hydrous-ferric-oxide- (HFO-) to attenuate the concentrations of cadmium, lead, and zinc in the surface water.

In addition, the following components are common to Alternatives Sd-4, Sd-5a, and Sd-5b.

- Restoration would be conducted in the lower reach of the North Tributary in disturbed areas following sediment removal; it would not be conducted in the upper reaches of the North Tributary. Restoration would include supplying and placing an equivalent volume of large woody debris as in the original channel. The toes of near-vertical banks would be armored, as required, to provide protection against erosion during floods. Banks that are steeper than 2:1 (2 horizontal:1 vertical) may require erosion control such as blankets or mulch to allow establishment of vegetation. Restored floodplain areas would be revegetated with an appropriate native grass/forb seed mixture. Noxious or invasive weed species in the floodplain upstream of the restored section may need to be eradicated for the revegetation effort to be successful. Willow sprigs may be planted on the stream banks, if appropriate.
- Restoration design would include mapping and surveying the existing stream channel (the lower reach) to determine characteristics and dimensions of the restored stream, mimicking the existing channel.

Alternative Sd-3: Partial Removal, Stabilization, and Partial Natural Recovery

This alternative would include a combination of technologies to take into account the site-specific conditions of the different

segments of the North Tributary. The sediment in the upper reaches of the North Tributary would be removed, stabilized to pass the Toxicity Characteristic Leaching Procedure (TCLP) test as needed, and disposed of offsite as in OU1 or at the ZCA facility, subject to ZCA and any required regulatory approval. After this sediment is removed, the lower reach would recover with the transport and deposition of clean sediment. Figure 2 shows the locations of the areas considered for sediment removal or natural recovery as defined under the Feasibility Study Report. Actual areas for remediation and other areas will be further refined during remedial design.

Prior to sediment removal, the stream flow would be diverted as required and the sediments would then be excavated. It may be necessary to further evaluate potential stream dewatering and flow diversion options during remedial design. The sediment would be removed using a Bobcat® loader, backhoe, or mechanical dredge. The backhoe or mechanical dredge would also be able to remove debris, as necessary, in order to gain access to the sediments. Sediment resuspension would be controlled by diverting the stream flow (if any) around the area being excavated. In addition, silt curtains may be used further downstream to reduce the transport of residual suspended solids, if any.

Mechanical excavation would remove the sediment at near in situ densities (U.S. EPA 1993). The sediments would be hauled in end-dump trucks equipped with watertight tailgate seals and tarps to the OU1 temporary storage area. For this evaluation, it was assumed that sediment dewatering and particle size reduction would not be conducted. Enhanced dewatering techniques would not be required. The sediments would be stabilized using lime, cement, fly ash, or other stabilization agents to pass the TCLP (as necessary), or mixed with dry soil. The pore water in the sediments would be incorporated into the stabilization process or the dry soil. The specific stabilization agent, application rate, and curing time would be determined by treatability studies during remedial design. For the purposes of the FFS, it is assumed that stabilization would be needed for 20 percent of the sediments in the upper reaches of the North Tributary.

The sediment would be transported to an appropriate non-hazardous waste disposal site which would include either the ZCA facility, subject to ZCA and any required regulatory approval, or the OU1 non-hazardous waste landfill. If disposed of at the ZCA facility, the sediment would be disposed of in a manner that is compatible with closure activities at the facility. The sediment would be transported in trucks using appropriate preventive measures. The trucks would be covered with tarps.

With removal of contaminated sediment from the upper reaches of the North Tributary (an erosional segment of the stream), sediment deposited in the future in the lower reach (the depositional segment of the stream) will have reduced concentrations of metals. This clean sediment will, in time, provide a natural cover of the contaminated sediment now present in the lower reach. This will limit exposure of benthic organisms in the lower reach to site metals without disrupting the favorable habitat that already exists in the lower reach. Studies of site-specific partioning coefficient or Kds have indicated that site sediments have a high adsorption capacity. Because the contaminated sediment in the upper reaches will be removed, it is expected that dissolved site metals will not be present at concentrations high enough to result in significant adsorption to sediments in the stream. If dissolved site metals are still present at elevated concentrations, then additional measures would be taken, which may include construction of a passive metals treatment system in the upper reaches of the North Tributary. There will likely be a slow net reduction in metals concentrations in the sediments currently present in the lower reaches due to a slow desorption of metals from these sediments.

Ongoing monitoring of the sediment and surface water would be conducted after completion of remediation to demonstrate that the RAOs and final remediation levels have been met. (Monitoring would be conducted in the same areas annually for three years and, if needed, biannually for up to seven years, and in other areas would be conducted biannually for 10 years.) Monitoring would evaluate channel stability and reduction of metals concentrations in surficial sediment (the biologically active zone) and surface water.

Alternative Sd-4: Partial removal, Stabilization, and Offsite disposal and Partial tributary rechannelization, and Capping the existing channel with soil

Like the previous alternative, this alternative would also include a combination of technologies to take into account the site-specific conditions of the different segments of the North Tributary. The sediment in the upper reaches of the North Tributary would be removed, stabilized to pass the TCLP test as needed, and disposed of offsite or at the ZCA facility, subject to ZCA and any required regulatory approval. Remediation of the lower reach of the North Tributary would involve creating a new tributary channel and using the excavated soil to fill the existing tributary channel. The new channel would be constructed adjacent to the existing channel as shown in Figure 3.

Removal of the sediment in the upper reaches of the North Tributary would be conducted in the same manner as discussed in the preceding alternative. After removal of the sediment, the lower reach would be rechannelized. Prior to excavation for rechannelization, the stream flow would be temporarily diverted as required to allow the remediation activities to be conducted. One stream bank would be excavated down to the hard bottom using conventional excavation equipment to create a new tributary channel (small equipment such as a Bobcat® loader may be necessary in limited-access areas). Alternate stream banks may be excavated, as appropriate, to avoid excavating around trees. The excavated material would be used to cap the existing channel sediments and floodplain soils as shown in Figure 3. A 3-in. cap of topsoil would be placed over the capped area and restoration activities would be conducted. The cap would be armored as required to provide protection against erosion. Turbidity controls and long-term monitoring would be the same as in the preceding alternative.

Alternative Sd-5a: Removal, Stabilization, and Offsite Disposal

This alternative would include the same removal and disposal components as Alternative Sd-3 (Partial Removal and Partial Natural Recovery), except that removal would occur throughout the entire tributary segments targeted for remediation (i.e., the upper reaches and the lower reach of the North Tributary). A cross section of the lower reach of the North Tributary for sediment removal is shown in Figure 4. Clean fill would be imported to replace the excavated material in the lower reach of the North Tributary. The imported fill would be similar to the excavated sediment. For the purposes of the FFS, it is assumed that 20 percent of the fill would be topsoil to reconstruct the floodplain areas. The remaining portion of the fill would be sand. After placement of the fill, the stream restoration activities would be conducted in the lower reaches of the tributaries.

Alternative Sd-5b: Removal, Stabilization, and Onsite Disposal

This alternative would be the same as Alternative Sd-5a (Removal and Offsite Disposal) except that the excavated sediment (treated as needed) would be transported to the ZCA facility for disposal, subject to ZCA and any required regulatory approval. The sediment would be disposed of in a manner that is compatible with closure activities at the facility.

DEQ's Preferred Alternative

Data collected during FFS field sampling and during previous investigations at the Site indicate that sediments in two main areas of the North Tributary have metals concentrations that exceed PRGs: the two upper reaches located near the ZCA facility, which are erosional areas not considered to be important habitat areas, and the mainstream of the North Tributary from sampling station RD5 to the confluence with Eliza Creek (the "lower reach"), which is a depositional area with generally favorable habitat. The middle section of the North Tributary, from the junction of the upper reaches down to KD4, is not a depositional area and metals concentrations in this section do not exceed PRGs. Elevated metals concentrations in surface water have been observed coincident with elevated metals levels in sediment.

The recommended remedial alternative for the Site includes parts of Alternative Sd-3 Partial removal, Stabilization, and Offsite Disposal, and Partial Natural Recovery and Sd-5a, Removal, Stabilization, and Offsite Disposal. This alternative would include the same removal and disposal components as Alternative Sd-3 (Partial Removal and, Stabilization, and Offsite Disposal, and Partial Natural Recovery), except that removal would occur throughout the entire tributary segments targeted for remediation (i.e., the upper reaches and the lower reach of the North Tributary). The upper and lower reaches are shown in Figure 6. Clean fill would be imported to replace the excavated material in the lower reach of the North Tributary. The imported fill would be similar to the excavated sediment. For the purposes of the FFS, it is assumed that 20 percent of the fill would be topsoil to reconstruct the floodplain areas. The remaining portion of the fill would be sand. After placement of the fill, the stream restoration activities would be conducted in the lower reaches of the tributaries. This alternative would allow the excavated sediment (treated as needed) to be transported to an approved offsite disposal facility. Additionally, the natural recovery option will be used for Eliza Creek. During the remedial design, additional information will be gathered to designate the actual areas to be removed. If the destruction of the stream habitat will be too great in some areas, then DEQ may choose to limit removal in sensitive portions of the lower reach of the North Tributary. DEQ's goal is to maximize removal of contaminated sediments and to minimize damage to the ecosystem.

REMEDIAL ACTION OBJECTIVES AND RISK-BASED CONCENTRATIONS FOR AGRICULTURAL AREAS

For agricultural areas, media of concern for protection of humans is the soil. Remedial Action Objectives (RAOs) and Preliminary Remediation Goals (PRGs) for soil were established using information from the land application of sludge. RAOs are chemical- and medium-specific goals for protecting human health and the environment, and typically specify the exposure routes, receptors, and risk levels of concern. RAOs provide the basis for deriving risk-based concentrations (RBCs), which are specific contaminant concentrations that are protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs).

The RAOs for agricultural soils are:

- Prevent plants grown for direct human consumption from uptaking elevated concentrations of CoPCs that may be present in the soils
- Prevent human ingestion of animals that have eaten plants grown in the soil which may uptake elevated concentrations of CoPCs that may be present in the soils
- Prevent the equipment operator from being exposed to dust from soils with elevated concentrations of CoPCs while working the ground

PRGs for soil were based upon risk-based concentrations for metals in soil. These values were taken from the technical support document for land application of sewage sludge prepared by the Eastern Research Group for the U.S. Environmental Protection Agency (November 1992). The PRG values are:

- Cadmium– 305 mg/kg dry weight
- Lead– 5,000 mg/kg dry weight
- Arsenic– 200 mg/kg dry weight.

Sampling of the agricultural areas by the potentially responsible parties (PRPs) shall be conducted during the remedial design. With this information, a site-specific agricultural remedial action workplan shall be prepared and submitted by the PRPs to the ODEQ.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives in the feasibility study were evaluated based on the criteria described in Table 3. The following is a summary of the evaluation.

Overall Protection of Human Health and the Environment

Alternatives Sd-3, Sd-5a, and Sd-5b would all achieve approximately the same level of overall long-term protection of the environment, but would differ significantly regarding their short-term effects during remediation. Alternative Sd-3 would rank the highest because it would be protective in the long term and have minimal short-term effects on human health and the environment because only the upper reaches of the North Tributary (essentially intermittent drainage ditches with little or no aquatic habitat value) would be disturbed during remediation. Alternatives Sd-5a and Sd-5b would also provide long-term protection. However, under those alternatives, some of the habitat in the lower reach (mature trees along the riparian zone that provide important bird habitat and aesthetic values) would be destroyed during remediation and there would be a greater potential impact on Eliza Creek because of the location of the lower reach (it flows directly into Eliza Creek), and the size of the lower reach would make it more difficult to control during remediation. Alternatives Sd-5a and Sd-5b would also have greater short-term effects on the riparian area and upland fields adjacent to the North Tributary and to the construction workers and community during the removal and transport of the large volume of sediment. Alternative Sd-4 could be protective in the long term, but there is a greater degree of uncertainty associated with rechannelization; it would require a significant amount of maintenance to ensure the capped sediments are adequately contained. Alternative Sd-4 would also have the same short-term detrimental effects on the lower reach as Alternatives Sd-5a and Sd-5b. Alternatives Sd-1 and Sd-2 would not be protective of the environment.

Compliance with ARARs

The active sediment alternatives (Alternatives Sd-3 through Sd-5b) are essentially comparable for this criterion. Alternatives Sd-4, Sd-5a, and Sd-5b may have a greater chance for short-term exceedances of surface water quality standards during remediation. Institutional controls (Alternative Sd-2) may not comply with ARARs. The no-action alternative (Alternative Sd-1) would not comply with ARARs.

Cost

The estimated costs for the alternatives are presented in Table 4. Alternatives Sd-1 and Sd-2 have the lowest estimated costs. Of the active remediation alternatives (Alternatives Sd-3 through Sd-5b), Alternative Sd-3 has the lowest estimated costs. Alternatives Sd-5a and Sd-5b are essentially comparable in estimated costs. Alternative Sd-4 has the highest estimated costs.

TABLE 4. COST OF ALTERNATIVES

Alternatives	Cost($ Million)
Sd-1 No Action	0
Sd-2 Institutional Controls	0.06
Sd-3 Partial Removal and Partial Natural Recovery	2.3
Sd-4 Partial Removal and Partial Rechannelization	3.3
Sd-5a Removal and Offsite Disposal	2.8
Sd-5b Removal and Onsite Disposal	2.7
DEQ's Preferred Alternative	2.8

Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of the risk remaining at the Site after the final remediation levels have been met. Since the chemicals of potential concern are metals and they cannot be destroyed, permanence of remedial alternatives must be judged in terms of the elimination of exposure to these compounds and/or altering their bioavailability.

As discussed previously, Alternatives Sd-3, Sd-5a, and Sd-5b would provide long-term protectiveness. Alternative Sd-4 could be protective in the long term, but there is a greater degree of uncertainty associated with rechannelization; it would require a significant amount of maintenance to ensure the capped sediments are adequately contained. Alternatives Sd-1 and Sd-2 would not be protective of the environment. The DEQ's preferred alterna-

tive will eliminate exposure to significantly elevated levels of the chemicals of potential concern.

Short-Term Effectiveness

Alternative Sd-3 would have minimal impact on human health and the environment because only the upper reaches of the North Tributary would be disturbed during remediation. Under this alternative there would be minimal if any impact on the lower reach of the North Tributary and Eliza Creek, which both have established habitats that support a variety of aquatic and terrestrial organisms. The location of the upper reaches (close to access roads) would minimize impacts on the fields adjacent to the North Tributary. The small size of the channels in the upper reaches would enable remediation to be conducted in a controlled manner that would prevent the release of CoPCs to the downstream segment. Alternatives Sd-4, Sd-5a, and Sd-5b would all destroy some of the habitat in the lower reach during remediation. The habitat would eventually be restored through post-remediation restoration efforts. Under those alternatives there would also be a greater potential impact on Eliza Creek because of the location of the lower reach (it flows directly into Eliza Creek) and the size of the lower reach would make it more difficult to control during remediation (i.e., there would be a greater chance of releases of CoPCs to Eliza Creek during remediation). Alternatives Sd-4, Sd-5a, and Sd-5b would also have greater short-term effects on the riparian area and upland fields adjacent to the North Tributary during construction of access roads and use of heavy construction equipment along the banks of the North Tributary. The additional construction activities would present a greater risk to construction workers. Under Alternatives Sd-5a and Sd-5b, there would also be a greater impact on the community during the removal and transport of the large volume of sediment. Alternatives Sd-1 and Sd-2 would have short-term effects resulting from the continued exposure of aquatic organisms and transport of CoPCs in the North Tributary.

Reduction of Toxicity, Mobility, and Volume Through Treatment

All of the active alternatives (Alternatives Sd-3 through Sd-5b) would have comparable reductions in toxicity and mobility resulting from stabilization of excavated sediment and treatment of the surface water using a passive metals treatment system, if necessary. Alternatives Sd-1 and Sd-2 would not result in any reductions of toxicity, mobility, or volume through treatment.

Implementability

Of the active remediation alternatives (Alternatives Sd-3 through Sd-5b), Alternative Sd-3 would be the easiest to implement because of the location of the upper reaches (close to access roads) and the smaller channels would enable remediation to be conducted in a controlled manner. Alternatives Sd-4, Sd-5a, and Sd-5b would be more difficult to implement because the degree of difficulty is compounded by the location of the lower reach (it is farther from existing roads), the larger size of the streambed including the higher flow rate, the larger volume of sediment that would be remediated, and the greater chance that the sediment from the lower reach would need to be dewatered and the effluent treated. In addition, Alternative Sd-4 would require extensive ongoing maintenance to ensure that the sediments are adequately contained. Restoration efforts would also need to be implemented for the lower reach to re-establish the existing aquatic habitat. Alternatives Sd-1 and Sd-2 would be implementable from a technical standpoint.

Community Acceptance

The acceptance of the preferred alternative and/or other alternatives by the Bartlesville Community was evaluated through the public participation process and comments received during the formal public comment period. These comments are addressed in this ROD in the Responsiveness Summary. None of the comments received indicated a preference for another alternative over DEQ's preferred alternative.

State/Federal Acceptance

This is typically a criteria used in the Superfund process. However, because the project is being led by a state agency, federal acceptance has been evaluated in lieu of state acceptance. Federal acceptance has been evaluated based on any comments received during the formal public comment period from EPA or other federal agencies. The comments received are addressed in the Responsiveness Summary of this ROD.

THE SELECTED REMEDY

The selected remedy is DEQ's preferred alternative. DEQ's preferred alternative is a combination of two of the other alternatives discussed in the Feasibility Study. The preferred alternative includes elements of Alternatives Sd-3 (Partial Removal and Partial Natural Recovery) and Sd-5a (removal and offsite disposal).

Data collected during FFS field sampling and during previous investigations at the Site indicate that sediments in two main areas of the North Tributary have metals concentrations that exceed PRGs: the two upper reaches located near the ZCA facility, which are erosional areas not considered to be important habitat areas, and the mainstream of the North Tributary from sampling station RD5 to the confluence with Eliza Creek (the "lower reach"), which is a depositional area with generally favorable habitat. The middle section of the North Tributary, from the junction of the upper reaches down to KD4, is not a depositional area and metals concentrations in this section do not exceed PRGs. Elevated metals concentrations in surface water have been observed coincident with elevated metals levels in sediment.

The recommended remedial alternative for the Site is Alternative Sd-5a, Removal and Offsite Disposal. This alternative would include the same removal and disposal components as Alternative Sd-3 (Partial Removal and Partial Natural Recovery), except that removal would occur throughout the entire tributary segments targeted for remediation (i.e., the upper reaches and the lower reach of the North Tributary). The upper and lower reaches are shown in Figure 6. Clean fill would be imported to replace the excavated material in the lower reach of the North Tributary. The imported fill would be similar to the excavated sediment. For the purposes of the FFS, it is assumed that 20 percent of the fill would be topsoil to reconstruct the floodplain areas. The remaining portion of the fill would be sand. After placement of the fill, the stream restoration activities would be conducted in the lower reaches of the tributaries. This alternative would allow the excavated sediment (treated as needed) to be transported to an approved offsite disposal facility. Additionally, the natural recovery option will be used for Eliza Creek. During the remedial design, additional information will be gathered to designate the actual areas to be removed. If the destruction of the stream habitat will be too great in some areas, then DEQ may choose to limit removal in sensitive portions of the lower reach of the North Tributary. DEQ's goal is to maximize removal of contaminated sediments and to minimize damage to the ecosystem as much as possible.

REMEDIAL ACTION OBJECTIVES AND RISK-BASED CONCENTRATIONS FOR AGRICULTURAL AREAS

For agricultural areas, media of concern for protection of humans is the soil. Remedial Action Objectives (RAOs) and Preliminary Remediation Goals (PRGs) for soil were established using information from the land application of sludge. RAOs are chemical- and medium-specific goals for protecting human health and the environment, and typically specify the exposure routes, receptors, and risk levels of concern. RAOs provide the basis for deriving risk-based concentrations (RBCs), which are specific contaminant concentrations that are protective of human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs).

The RAOs for agricultural soils are:

- Prevent plants grown for direct human consumption from uptaking elevated concentrations of CoPCs that may be present in the soils
- Prevent human ingestion of animals that have eaten plants grown in the soil which may uptake elevated concentrations of CoPCs that may be present in the soils
- Prevent the equipment operator from being exposed to dust from soils with elevated concentrations of CoPCs while working the ground

PRGs for soil were based upon risk-based concentrations for metals in soil. These values were taken from the technical support document for land application of sewage sludge prepared by the Eastern Research Group for the U.S. Environmental Protection Agency (November 1992). The PRG values are:

- Cadmium– 305 mg/kg dry weight
- Lead– 5,000 mg/kg dry weight
- Arsenic– 200 mg/kg dry weight.

Sampling of the agricultural areas will be done during the remedial design. With this information, a site-specific agricultural remedial action workplan will be prepared and submitted to the ODEQ.

STATUTORY DETERMINATIONS

Protection of Human Health and the Environment

The selected remedy for Operable Unit Two will be effective in eliminating or reducing risks to public health. The selected remedy will achieve these goals through a combination of the removal of contaminated soils, the use of engineering controls, the use of institutional controls, and where appropriate the treatment of contaminated soils. The remediation levels that will be used are sufficiently protective of human health and fall within the range of such standards established at similar sites across the Nation.

Any potential cross-media impacts that might occur as a result of the implementation of the selected remedy can readily be controlled through standard monitoring and engineering controls. The selected remedy calls for air monitoring to be conducted throughout construction activities and dust control measures to be instituted when necessary. No unacceptable short-term risks will be caused by the implementation of the selected remedy.

Compliance with ARARs

The selected remedy will comply with the following ARARs.

CHEMICAL SPECIFIC ARARS		
Standard, Requirement, Criteria or Limitation	Citation	Application
Federal		
Solid Waste Disposal Act & Resource Conservation and Recovery Act (RCRA)	40 CFR Part 261	Applicable. Some of the soils that will be removed from the site could exhibit the characteristic of toxicity. Any soils that exhibit this characteristic will require treatment.
Clean Air Act National Ambient Air Quality Standards	40 CFR Part 50	Relevant and Appropriate during construction activities
State		
Oklahoma Hazardous Waste Management Regulations	OAC 252:200	Applicable. Same reason as above.
Oklahoma Environmental Quality Code	27A Oklahoma Statutes Section 2-1-101 et seq.	Applicable. Soil contamination is a public nuisance.
Oklahoma Air Pollution Control Regulations	OAC 252:100	Applicable if air concentrations are above the maximum allowable increase due to remedial action.

ACTION SPECIFIC ARARS		
Standard, Requirement, Criteria, or Limitation	Citation	Application
Federal		
Solid Waste Disposal Act RCRA Subtitle C	40 CFR Parts 261 264 & 265	Applicable. Portions may be relevant and appropriate to storage and treatment of waste for off-site shipment.
Occupational Safety and Health Act (OSHA) Regulations	29 CFR 1910	Applicable. It is the responsibility of employers involved in activities on the site to conform with the requirements of OSHA.
State		
Oklahoma Environmental Quality Code	27A Oklahoma Statutes Section 2-1-101 et seq.	Applicable. Soil contamination as a public nuisance.
Oklahoma Hazardous Waste Management Regulations	OAC 252:200	See criteria for 40 CFR Parts 261, 264, and 265
Oklahoma Air Pollution Control Regulations	OAC 252:100	Applicable if sufficient emissions were generated as a result of construction activities.
Oklahoma Solid Waste Management Regulations	OAC 252:500 & 510	Applicable to any offsite disposal of nonhazardous waste. Relevant and appropriate to any possible onsite disposal options.

Cost-Effectiveness

The selected remedy is currently estimated to cost 2.8 million dollars. The completion of the Remedial Design will provide more accurate information to determine the degree to which removal will take place. At that point a more accurate, cost estimate for the selected remedy can be incorporated into the Remedial Design.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable (MEP)

As stated previously, the Chemicals of Potential Concern are metals and they cannot be destroyed, permanence of remedial alternatives must be judged in terms of the elimination of exposure to these compounds and/or the degree of alteration of their bioavailability. Removal of contaminated sediment from streams is the most permanent solution possible in terms of the elimination of the potential for exposure. The selected remedy allows for monitoring of the streams to see if natural recovery proves effective in reducing the bioavailability of the chemicals of potential concern. Any sediments that are destined for offsite disposal will be stabilized if they fail the toxicity characteristic leaching procedure (TCLP).

Preference for Treatment as a Principle Element

At this time there is no known effective treatment technology for the chemicals of potential concern that would allow treatment to be a principle element of the selected remedy.

RESPONSIVENESS SUMMARY

The following questions were received by DEQ a the public meeting held on May 2, 1996. No written questions were submitted.

1. Citizen asked about EPA calculations for land application of sludge containing heavy metals. Is there any effect when sludge is applied time after time?

> *The Remedial Goals for agricultural land use were based on EPA's calculations for land application of heavy metal containing sludge. The EPA figures are based on maximum lifetime loading of sludge to soil. In other words, while sludge may be applied again and again, there is a limit to the total amount of metal which can end up in soil. This*

limit is considered by EPA to be a safe level in agricultural soil. That limit is the basis for the Remedial Goals for agricultural lands. Please refer to the Ecological Risk Assessment and Feasibility Study for more details.

2. A citizens was concerned about Figure eight. The SP3 selection in Figure eight had the highest overall rating and the highest threshold rating. Why was SP5a selected over SP3?

The actual selected remedy is a combination of Sd-3 and Sd-5a. The main difference is the the lower reach will be removed as well as the upper reach of the tributary. Total removal will produce a higher overall rating and threshold rating.

3. A citizen was concerned about control of airborne material when soil removal was undertaken.

During removal, the control of airborne materials will be done. The actual method will be presented in the Remedial Design but one possible method is to keep the material damp and the trucks hauling the material covered.

4. Citizen asked if was there a way to prevent any possible pollution from being washed downstream during sediment removal from creek beds.

This will be addresed in the Remedial Design but one possible method will be coffer dams.

5. Citizen asked about coordination between offsite and onsite activities. Can onsite activities be taken care of to fit into the offsite project timeline so that things do not have to be done again. What is the timeline for this project?

The offsite activities will be coordinated with the schedule of onsite activities as well as the Operable Unit One activities. There is no point in removing contamination downstream until the areas upstream are remediated. A schedule of these activities will be in the Remedial Design.

6. Citizen asked a question not directly related to the proposed plan for OU2, "Have the piles at ZCA been sprayed recently, in view of the inclement weather and reports of 100 mph winds, to make sure they are not depositing any airborne material?

Yes. The piles are sprayed on a regular basis and air monitoring at the fence line is ongoing.

WHAT'S NEXT?

The Remedial Design report will be completed by spring of 1997. The selected remedial action alternative will be implemented once the Remedial Design is completed and approved by DEQ and the remedial action for OU1 is complete along with any action necessary on the National Zinc Site.

FOR MORE INFORMATION

The RI/FS reports or any other documents contained in the updated Administrative Record file for the National Zinc Site, are available at the information repositories listed below.

Bartlesville Public Library
600 S. Johnstone
Bartlesville, Oklahoma 74005

Bartlesville Chamber of Commerce
201 S.W. Keeler
Bartlesville, Oklahoma 74004

Westside Community Center
501 S.W. Bucy
Bartlesville, Oklahoma 74004

Department of Environmental Quality
Waste Management Division
1000 NE 10th Street
Oklahoma City, Oklahoma 73117-1212

If you have any questions about this project, please call:

Ms. Monty Elder at 1-800-869-1400 or
Mr. Scott Thompson at (405)271-7213.

GLOSSARY

Apparent effects threshold (AET) Analogous to the preliminary remediation goals (PRG).

Applicable or Relevant and Appropriate Requirement (ARAR) — The federal and state laws or regulations that a cleanup must usually attain. An applicable requirement is a promulgated federal or state standard that specifically addresses a hazardous constituent, remedial action, location, or other circumstance at a site. To be applicable, the remedial actions or the circumstances at the site must be within the intended scope and authority of the requirement. A relevant and appropriate requirement is a promulgated federal or state requirement that addresses problems or situations similar to those encountered at a site, even though the requirement is not legally applicable.

Operable Unit — (OU1 or OU2) A distinct portion of a Superfund site or a distinct action at a Superfund site. An operable unit may be established based on a particular type of contamination, contaminated media (e.g., soils, water), source of contamination, or some physical boundary or restraint.

Preliminary remediation goal (PRG) — An initial specific contaminant concentration (e.g., in soil) that is protective of human health and the environment and complies with ARARs. Preliminary remediation goals are used during the evaluation of remedial action alternatives.

Remedial action alternative — A potential method for cleaning up a site. Remedial action alternatives are developed from general response actions (e.g., removal and disposal), technologies (e.g., chemical treatment), and process options (e.g., stabilization) after screening. Possible remedial action alternatives include no action, institutional controls, onsite containment with no treatment, and removal and disposal options with or without treatment.

Remediation level — The final cleanup level (i.e., specific contaminant concentration in soil) that is established upon completion of the remedial investigation, feasibility study and any other necessary additional studies.

Remedy or remedial action — Those actions consistent with the permanent remedy taken instead of, or in addition to, removal action in the event of a release of hazardous substances to the environment so that they do not cause substantial danger to present or future public health or welfare or the environment.

Removal action — The cleanup or removal of released hazardous substances from the environment to minimize or mitigate damage to the public health or welfare or to the environment.

LIST OF ACRONYMS

ARARs - applicable or relevant and appropriate requirements
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CoPCs - chemicals of potential concern
DEQ - Department of Environmental Quality
EPA - Environmental Protection Agency
FFS - Focused Feasibility Study
HFO - hydrous-ferric-oxide-
MOU - memorandum of understanding
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NPL - National Priorities List
OU1 - Operable Unit One
OU2 - Operable Unit Two
PRGs - preliminary remediation goals
PPE - personal protective equipment
PRPs - potentially responsible parties
PTI - PTI Environmental Services
RAOs - remedial action objectives
RBCs - risk-based concentrations
RCRA - Resource Conservation and Recovery Act of 1976
RI/FS - remedial investigation and feasibility study
ROD - Record of Decision
SARA - Superfund Amendments and Reauthorization Act
Site - National Zinc Site in Bartlesville, Oklahoma
TCLP - Toxicity Characteristic Leaching Procedure
ZCA - Zinc Corporation of America

TABLES

TABLE 2. SUMMARY OF REMEDIAL ACTION ALTERNATIVES FOR DETAILED ANALYSIS

Sediment Alternatives	
Sd-1	No action (including natural recovery)
Sd-2	Institutional controls[a]
Sd-3	Partial removal, stabilization, and offsite disposal[b] and partial natural recovery[a,c]
Sd-4	Partial removal, stabilization, and offsite disposal[b] and partial tributary rechannelization and capping the existing channel with soil[a,c]
Sd-5a	Removal, stabilization, and offsite disposal[a,c]
Sd-5b	Removal, stabilization, and onsite disposala,c

a Alternative assumes that source control activities at the ZCA facility and adjacent industrial properties will be implemented.

b Offsite disposal is used as a representative disposal option and does not preclude the use of onsite disposal.

c Alternative includes use of passive metal adsorption media after sediment removal to control potential ongoing sources of dissolved metals in surface water.

TABLE 3. EVALUATION CRITERIA

Threshold Criteria

1. Overall protection of human health and the environment
   - How well does the alternative protect human health and the environment, both during and after construction?
2. Compliance with federal and state environmental standards
   - Does the alternative meet all applicable or relevant and appropriate state and federal laws?

Balancing Criteria

3. Cost
   - What are the estimated costs of the alternative?
4. Long-term effectiveness and performance
   - How well does the alternative protect human health and the environment after completion of cleanup?
   - What, if any, risks remain at the Site?
5. Reduction of toxicity, mobility, or volume through treatment
   - Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substance?
6. Short-term effectiveness
   - Are there potential adverse effects to either human health or the environment during construction or implementation of the alternative?
   - How fast does the alternative reach the cleanup goals?
7. Implementability
   - Is the alternative both technically and administratively feasible?

Modifying Criteria

8. State acceptance
   - Typically what are the state's comments or concerns about the alternatives considered and the preferred alternative? Federal acceptance will be considered in lieu of state acceptance.
9. Community acceptance
   - What are the community's comments or concerns about the preferred alternative?
   - Does the community generally support or oppose the preferred alternative?

Note: The Oklahoma Department of Environmental Quality (DEQ) uses nine criteria to evaluate the remedial action alternatives. With the exception of the "no action" alternative, all alternatives must meet the first two "threshold" criteria. DEQ uses the next five criteria as "balancing" criteria for comparing alternatives and selecting a preferred alternative. After public comment, DEQ may alter its preference on the basis of the last two "modifying" criteria.

FIGURES

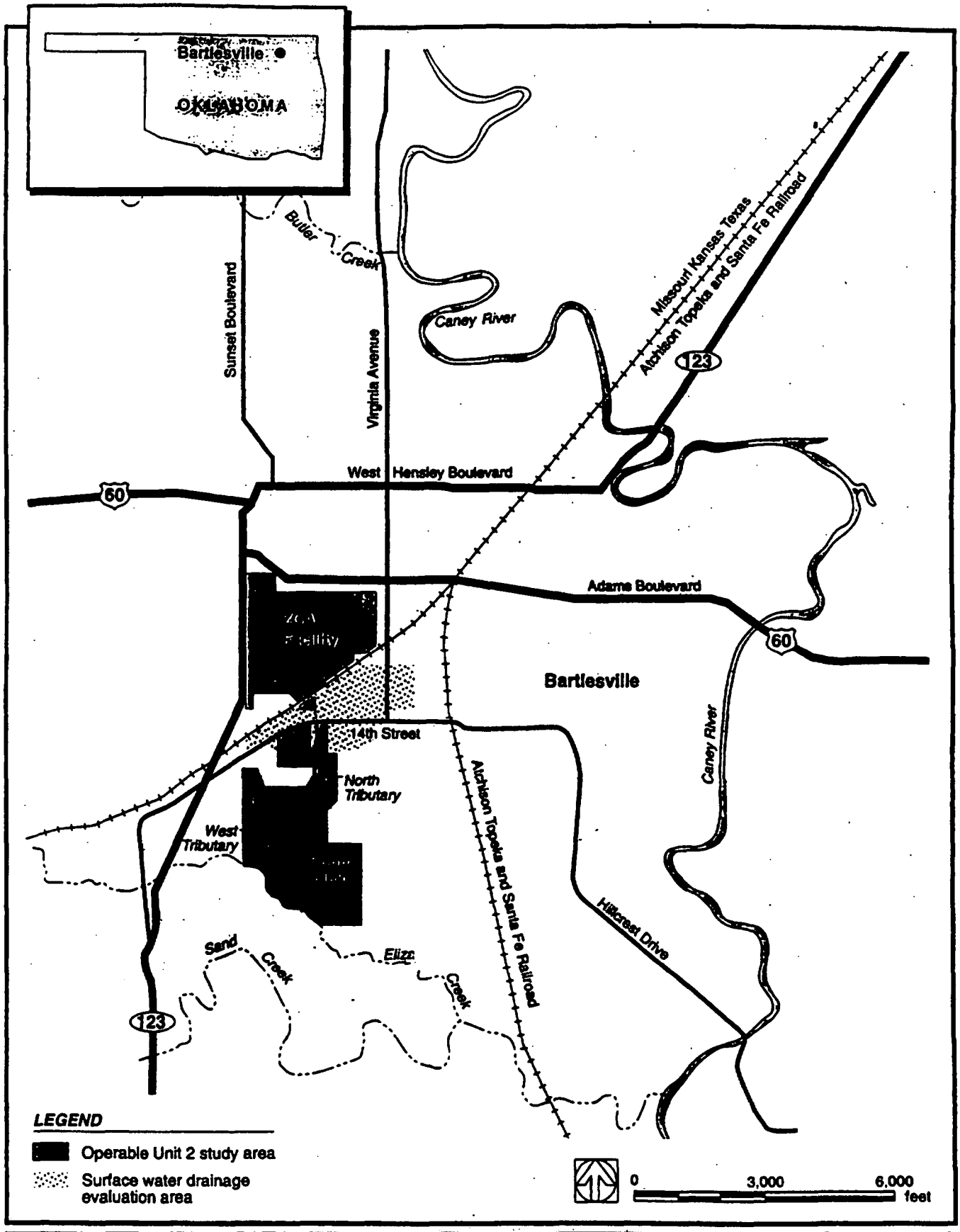

Figure 1. Operable Unit 2 study area location.

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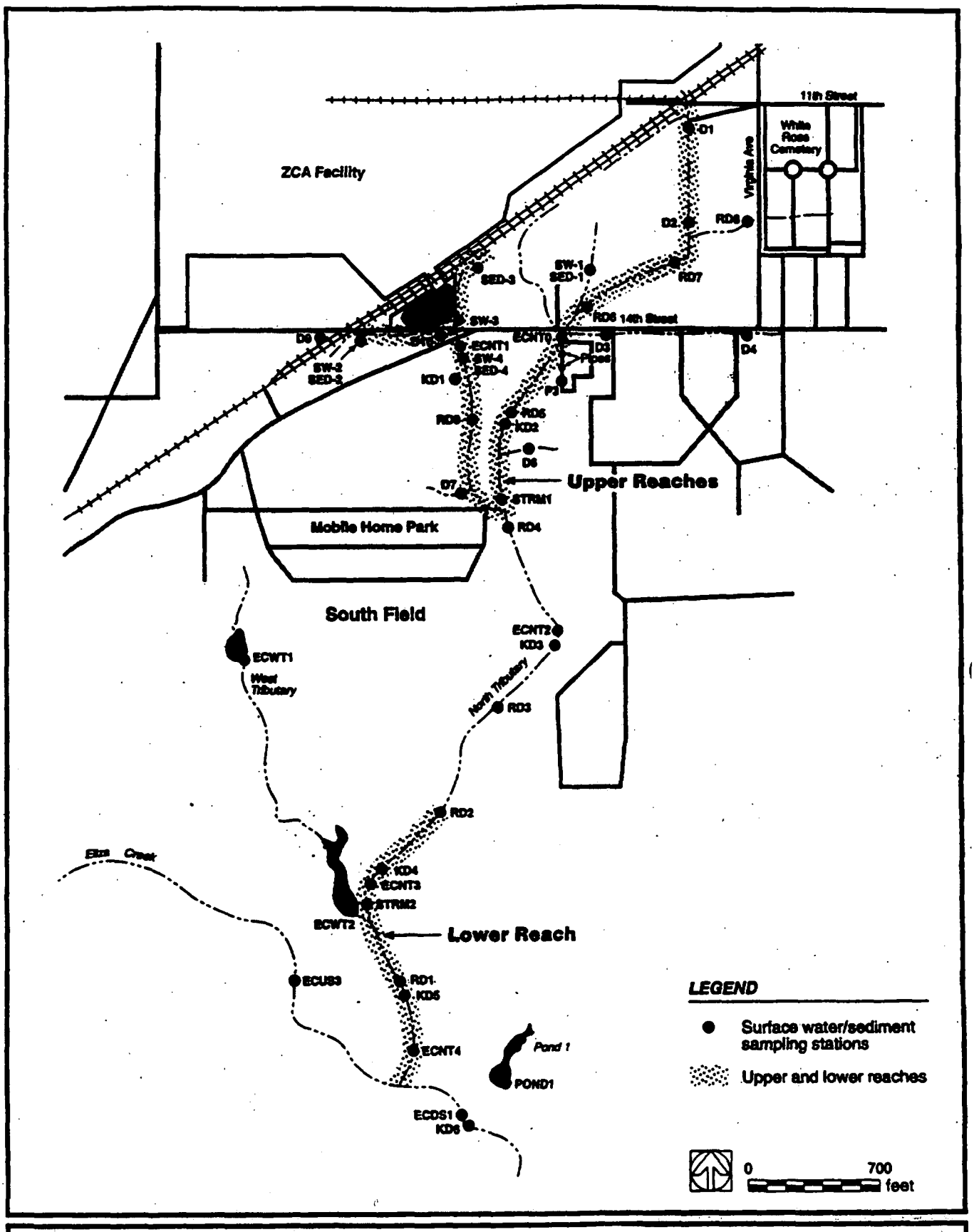

Figure 2. Areas considered for sediment removal and natural recovery.

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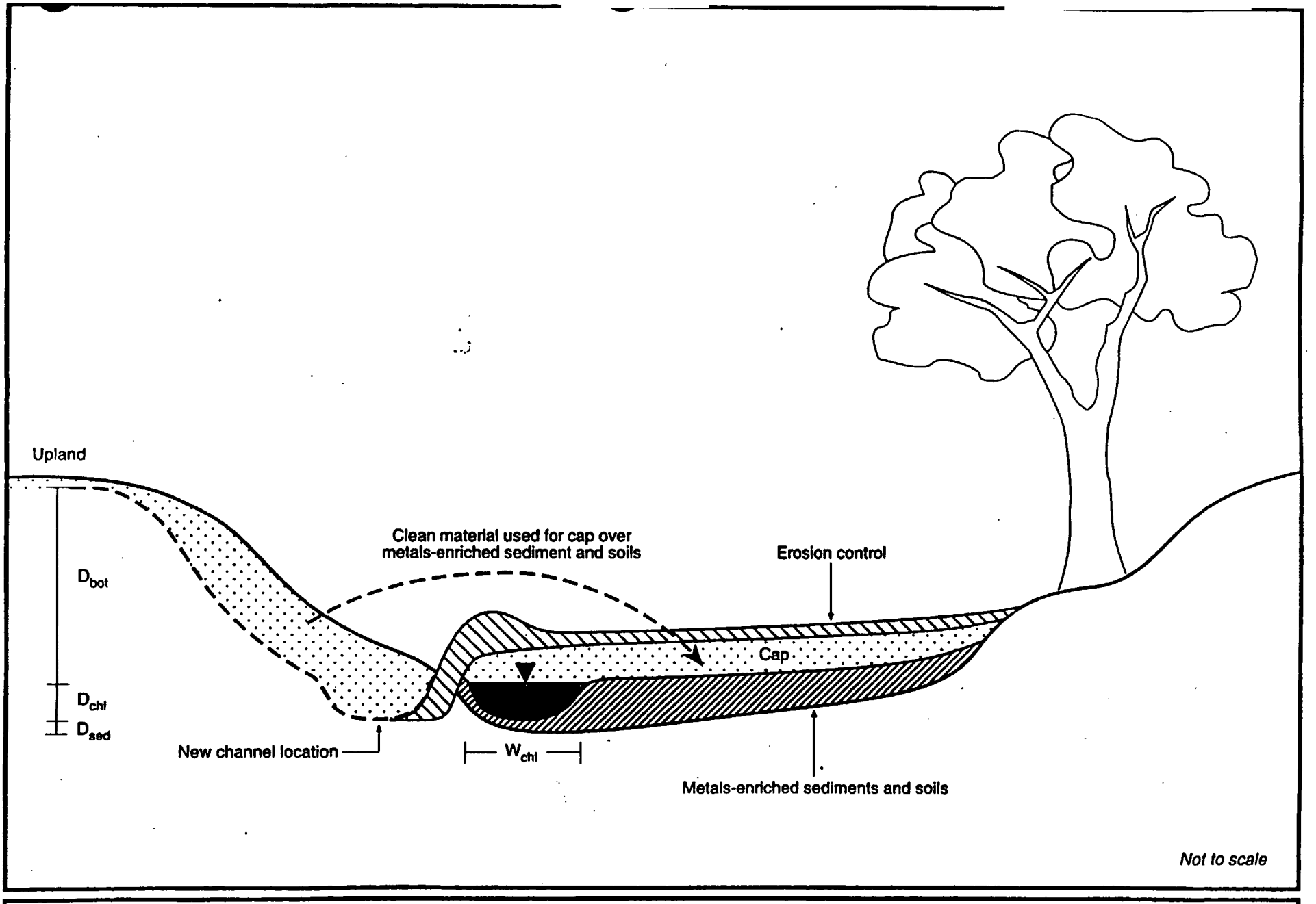

Figure 3. Cross section of lower reach of the North Tributary for rechannelization.

C626-12-10 01/17/96

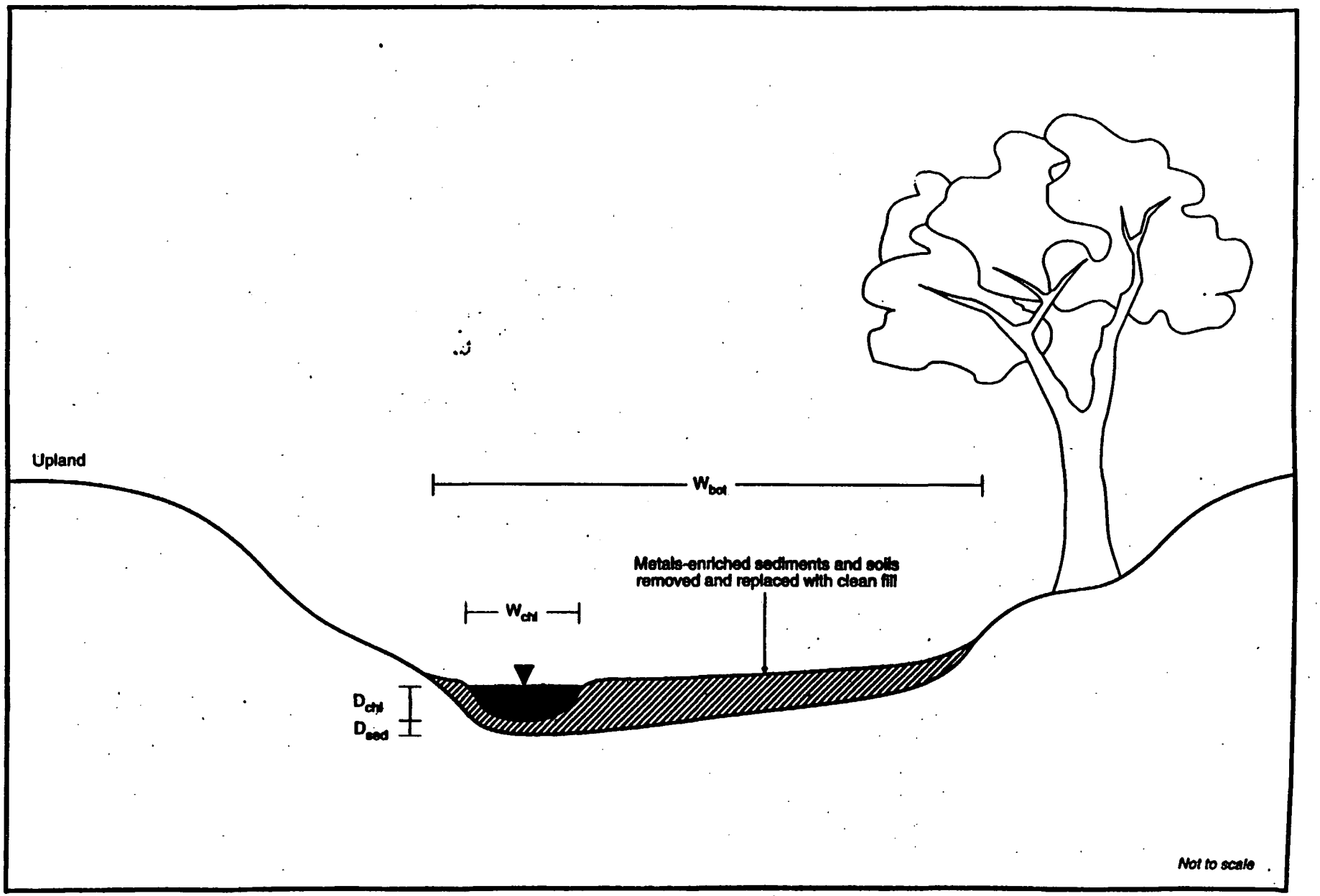

Figure 4. Cross section of lower reach of the North Tributary for sediment removal.

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