RECORD OF DECISION
OROVILLE LANDFILL
OKANOGAN COUNTY, WASHINGTON

Prepared for

U.S. Bureau of Land Management
Spokane District Office
1103 N. Fancher Road
Spokane, Washington 99212-1275

September 1995

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WESTON Work Order No. 6733-01-04-0002

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

SECTION 1

DECLARATION

1.1 SITE NAME AND LOCATION

The Oroville Landfill is located approximately three miles northwest of the city of Oroville, Washington, in Okanogan county in north central Washington. The landfill is located on the southside of the Oroville-Nighthawk Highway.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the final remedial action for the Oroville Landfill in Okanogan County, Washington, which was chosen in accordance with the Washington State Model Toxics Control Act (MTCA)(WAC 173-340). This cleanup is being performed as an independent remedial action under MTCA.

1.3 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 result in endangerment to the public health, welfare, or the environment.

1.4 DESCRIPTION OF THE REMEDY

The remedial action described in this ROD represents the final remedy to address the site's actual or potential risks attributed to contamination at the site. This action addresses the principal threat associated with contaminated soil by containment of the contamination, thereby isolating it from human and environmental receptors.

The major components of the selected remedy include:

- Consolidation of the ethion soil pile over the pesticide debris trench.
- Capping the pesticide debris trench with 24 inches of clay and 24 inches of topsoil.
- Installation of drain ditches on the uphill side of the landfill and expansion of the existing surface water diversion system to control run-on.
- Long-term monitoring and annual site inspections.

1.5 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 practical for this site. This remedy does not satisfy the statutory preference for treatment as a principal element of the final remedy. Treatment as a remedial alternative technology to address the threat was found to have a high potential for short-term risks and is not cost-effective. Therefore, treatment is not part of the remedial action.

Because this remedy will result in hazardous substances remaining on the site above risk based goals, a review of the site will be conducted within 5 years after commencement of the remedial action to ensure the remedy continues to provide protection to human health and the environment.

Approval:

Joseph M Buesing | SEP 19 1995

Spokane District Manager | Date
U.S. Dept of Interior Bureau of Land Management

Charles S. Wassinger | 9-20-95

Oregon/Washington State Director | Date
U.S. Dept of Interior Bureau of Land Management

SECTION 2

DECISION SUMMARY

2.1 INTRODUCTION

The Oroville Landfill was evaluated in 1987 under the U.S. Environmental Protection Agency (EPA) Hazard Ranking System (HRS). It was assigned a score of 13.55, which is under the score of 28.5 required for inclusion on the National Priorities List (NPL). However, the Oroville Landfill is considered a Washington State Hazardous Waste Site under the Washington State Model Toxics Control Act (MTCA)(Chapter 173-340 of the Washington Administrative Code [WAC]).

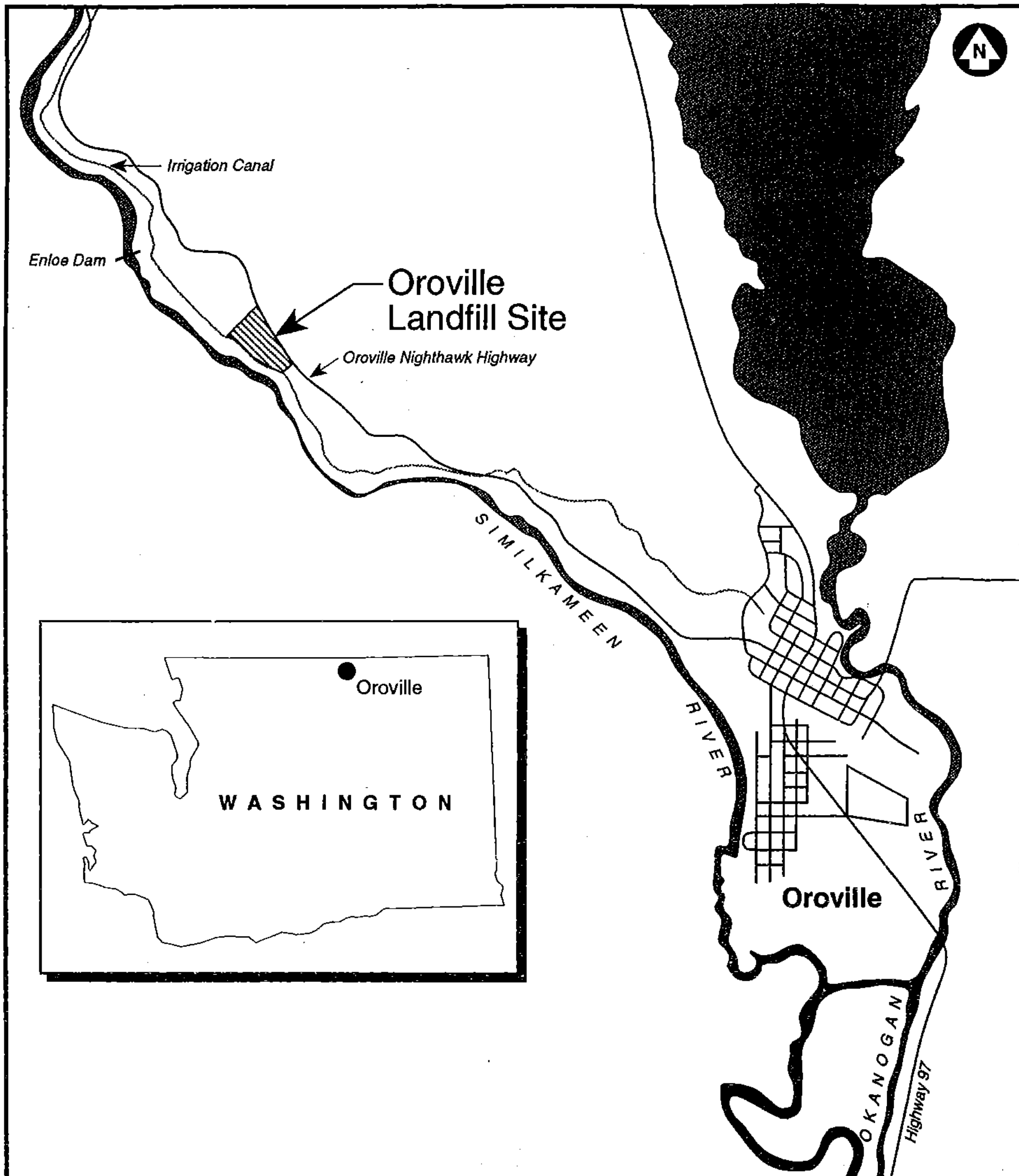
The U.S. Department of Interior Bureau of Land Management (BLM) performed a Remedial Investigation/Feasibility Study (RI/FS) in 1992 and 1993. The Remedial Investigation (RI) characterized contamination in soil, surface water, and groundwater at the facility. A baseline risk assessment, completed as part of the RI, evaluated potential effects of the contamination on human health and the environment. Risks exceeding guidelines were found. The Feasibility Study (FS) evaluated alternatives for remediating contamination.

This Record of Decision selects the final remedy for the Oroville Landfill. The site is being cleaned up as an independent remedial action under MTCA. The selection of the remedy complies with the requirements of Chapter 173-340-360 WAC and Chapter 73-340-510(5) WAC.

2.2 SITE NAME, LOCATION, AND DESCRIPTION

The Oroville Landfill is located approximately three miles northwest of the city of Oroville, Washington, in Okanogan County, north-central Washington (Figure 1). The 16-acre landfill is bordered by the Oroville-Nighthawk Highway along the eastern perimeter, and by undeveloped BLM rangeland on all other boundaries. The site is located on a sloping terrace above the north bank of the Similkameen River. Three natural drainages convey surface waters off the site: two drainages located in the western half of the site, and the erosional feature located in the eastern half of the site (Figure 2). The Oroville-Tonasket Irrigation District Similkameen River Canal (irrigation canal) runs along the southwestern site perimeter on the downslope side of the landfill. The three drainages lead to the river. Other minor drainages (gullies) lead to the canal.

Actual or potential site threats associated with the landfill include exposure to contaminated soil, runoff, and seeps.



Source: USGS Oroville Quad. 7.5' Series

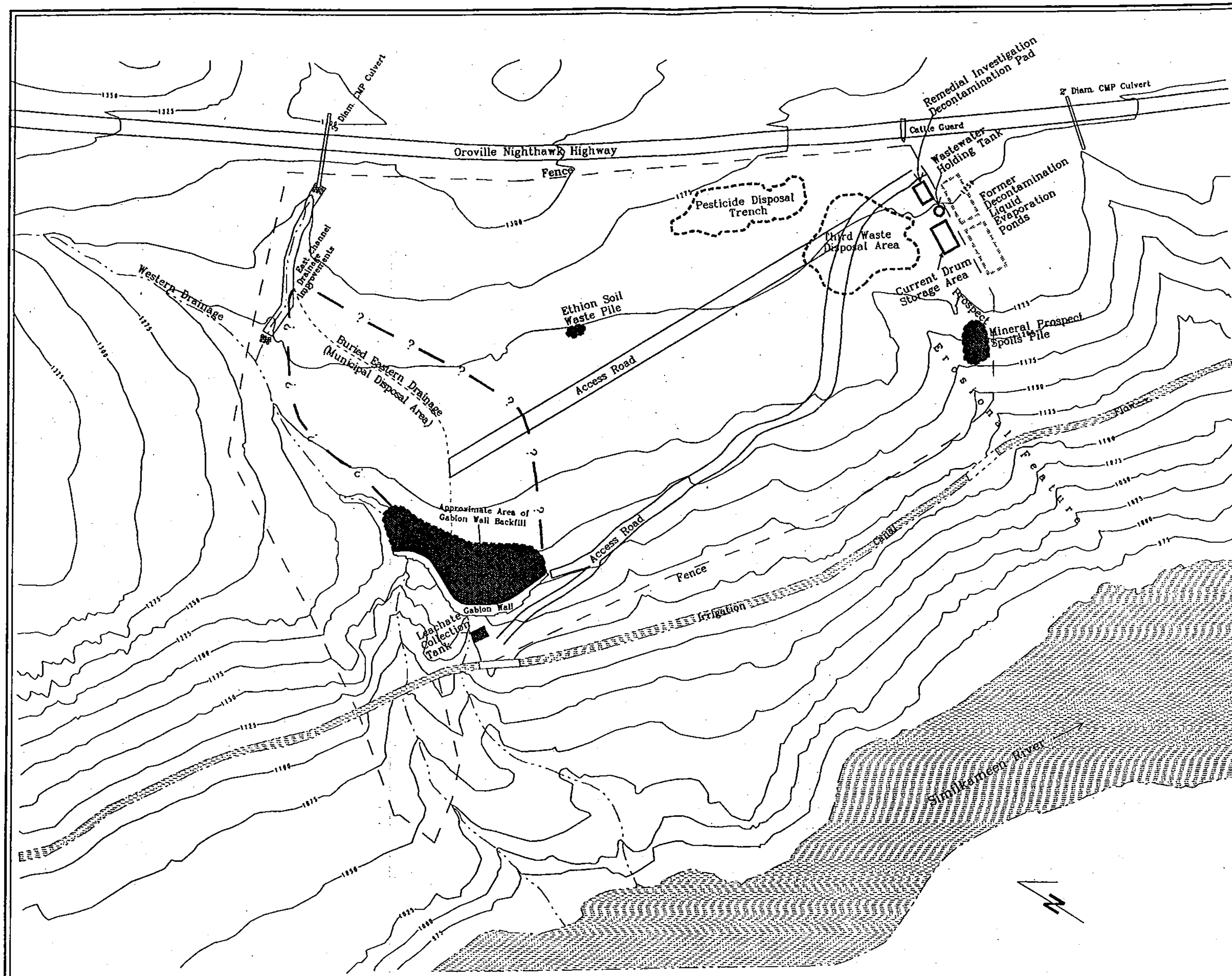
Scale in Feet
0 4000

Oroville Landfill: Site Location Map

WESTON
MANAGERS DESIGNERS/CONSULTANTS

6733-01-02-0060 August 1995

FIGURE
1



Explanation

- Approximate Boundary Line
- Established Boundary Line
- Historical Boundary Line
- Municipal Disposal Area Boundary (very approximately located)

Oroville Landfill: Site Features

Figure 2

WESTON MANAGERS DESIGNERS/CONSULTANTS

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DELIVERY ROUND: A

Meters 0 45
Feet 0 150

2-5

2.3 SITE HISTORY AND ENFORCEMENT ACTIONS

The city of Oroville operated a municipal landfill at the site from 1967 to 1976 under a Recreation and Public Purpose Lease arrangement with the BLM (the site owner). Domestic refuse, construction debris, industrial waste, and agricultural waste were disposed of at the landfill, but disposal records for these wastestreams are not available. Upon completion of landfill operations, a native soil cover was placed over the landfill.

In 1969, the landfill accepted debris generated during a pesticide warehouse fire that occurred at the Chamberlain Agricultural Company in Oroville, Washington. The debris was placed in the pesticide debris trench located in the northeastern portion of the site.

In 1987, the gabion wall and associated buttress fill/leachate system were constructed at the far western side of the landfill area approximately 600 feet from the pesticide debris trench. Other site drainage improvements in the eastern and western drainages and along the Oroville-Nighthawk Highway were also constructed, and a perimeter cyclone fence was installed.

Additionally, in 1987 the Oroville Landfill was evaluated under EPA's Hazard Ranking System (HRS). It was assigned a score of 13.55, well under the score of 28.5 required for inclusion on the NPL. Subsequently, the site was ranked by the Washington State Ranking Method (WARM) as a level "5" site, the lowest hazard ranking.

In 1989, an expanded site investigation (ESI) was conducted by WESTON/Dames & Moore to further delineate pesticide contamination in surface and subsurface soil, to investigate the site's hydrogeology, and to identify other buried disposal areas on the site.

No enforcement actions have been imposed. The site is being cleaned up as an independent remedial action under MTCA.

2.4 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Proposed Plan for the Oroville Landfill was made available for public comment from 1 August 1995 through 31 August 1995. During the public comment period, BLM mailed fact sheets and solicited public comments. The comments and questions received were responded to in a responsiveness summary, that is included as Section 3 of this ROD.

2.5 SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

The selected remedy is the final action to be conducted at the Oroville Landfill. Earlier actions consisted of placement of a native soil cover over the landfill at the completion of landfill operations, construction of a gabion wall and leachate collection system to stabilize the municipal disposal area of the landfill, construction of drainage improvements in the eastern and western drainages and along the Oroville-Nighthawk highway, and installation of a perimeter fence. The principal site threats consist of exposure of humans and wildlife to contaminated soil. The primary exposure pathways consist of ingestion and inhalation of soil contaminated with arsenic and chlorinated pesticides. The site investigations found that the greatest concentrations of contaminants were associated with site surface soil, with lesser concentrations existing in subsurface soil. Groundwater, river water, and river sediments were not determined to present significant risk or exceed regulatory criteria.

The goal of this response action is to prevent exposure of humans and wildlife to soil contaminants. Since the primary exposure pathways are associated with exposure to surface soil, this response action will contain and isolate the contaminants such that they are no longer available for ingestion, inhalation, or dermal contact. The site has already been fenced to prevent trespassers. This remedy is consistent with no-future-use plan for the site. Periodic monitoring and 5-year reviews will be performed to ensure the protectiveness of the remedy.

2.6 SUMMARY OF SITE CHARACTERISTICS

2.6.1 General Site Description

The Oroville Landfill is located approximately three miles northwest of the city of Oroville, Washington, and is approximately 16 acres in size. The site is located on a flat to gently sloping terrace approximately 300 feet above the north bank of the Similkameen River. From the terrace edge, the surface slopes southward to the river at an average slope of 35 degrees. The landfill is bordered by the Oroville-Nighthawk Highway along the eastern perimeter and by undeveloped BLM rangeland on the other perimeters. Three natural drainage systems convey surface waters off-site: two drainages, located in the western half of the site, and the erosional feature, located in the eastern half of the site (Figure 2). The Oroville-Tonasket Irrigation District Similkameen River Canal (irrigation canal) runs along the southwestern site perimeter, on the downslope side of the landfill. The canal is used to irrigate local apple orchards.

Three discrete disposal areas are located on the site (Figure 2). The first is the municipal disposal area, which filled the ravine (eastern-most drainage) located in the western half of the site. The second area is a buried trench that contains debris from a pesticide warehouse fire (pesticide debris trench). This trench is located in the southeastern quadrant of the site and covers approximately 9,000 square feet. A third disposal area, discovered during geophysical surveys of the area in 1988, is located south of the pesticide debris trench near the landfill entrance and covers approximately 11,600 square feet.

Physical structures are limited to a gabion wall and site fencing. A gabion wall was constructed on the western toe of the landfill and is used to prevent movement of a failed slope down the ravine. A 6-foot-high cyclone fence with three strands of barbed wire along the top exists around the landfill perimeter to secure the site and restrict access by the public, livestock, and wildlife.

Two decontamination wash-water evaporation ponds were constructed in 1987 just outside of the site perimeter fence, near the landfill entrance to evaporate wash-water from the decontamination of gabion wall construction equipment. The ponds were removed, the area was regraded, and a new lined decontamination pad was constructed just inside the landfill entrance gate.

A waste soil pile (approximately 8 cubic yards) is located in the central portion of the landfill. The waste soil was generated during excavations for the installation of the gabion wall when a drum containing ethion-bearing liquid was ruptured and contaminated the soil.

A mineral prospect spoils pile is located on the southeast slope of the landfill. The spoils pile was generated from mineral explorations in the area.

The Oroville-Tonasket Irrigation District Similkameen River Canal runs along the lower southwest side of the site. The 10-foot-wide by 4-foot-deep canal is elevated within an aqueduct over the western drainage. The canal runs aboveground, butted against a steep bank, except where it tunnels under protruding bedrock north of the erosional feature and south of the eastern drainage. An old, wooden drainage viaduct carries runoff from the erosional feature over the canal. The canal carries irrigation water to local apple orchards and discharges to Lake Osoyoos.

Downslope of the canal, the Similkameen River, originating in British Columbia, flows southeast to the city of Oroville where it joins the Okanogan River. Northeast and upriver approximately 1 mile, Enloe Dam impounds water to the north, and releases swift-moving water past the landfill. The river gradient past the site is approximately 27 feet per mile (Mann, 1987). Copper Mountain (1,800 feet) and its lower plateaus rise northeast of the landfill (1,300 feet). Across the river, steep slopes climb to 3,000-foot uplands that parallel the southeast trend of the river.

2.6.2 Site Geology

The Oroville Landfill is situated on a glacial terrace 300 feet above the Similkameen River at an elevation of 1,250 feet. The flat to gently sloping terrace is composed of silty glacial lake deposits and sandy and gravelly stream sediment deposited during the recessional phase of the latest glaciation. Since original deposition, these deposits have been overlain by wind-blown silt and sand (loess) and modified by erosion and landfilling activities. Depth to bedrock at the landfill varies from 0 to 30 feet below ground surface and averages about 15 feet across the central portion of the landfill.

Surface soils covering the Oroville Landfill are glacially derived silts, sands, and gravels with a minor component of clay. The soil is broadly classified as Tonasket silt loam. A loam contains roughly equal proportions of silt, sand, and clay with organic matter. Grain size analysis of three surface soil samples shows that the surface soil is comprised of silt (or clay) plus or minus sand (Unified Soil Classification System [USCS] group symbol ML).

A soil cap, largely composed of disturbed glacial material, was excavated from nearby areas and emplaced at the close of landfill operation. The soil cap was reported to be about 2 feet thick; it was not emplaced on the area of the former failed slope. Areas in the north-central part of the site are covered with coarse gravel and cobbles, apparently excess ballast from the construction of the gabion wall. In some areas unaffected by erosion or landfill operation, an upper layer of loess is present, which averages about two feet thick.

2.6.3 Adjacent Land Use and Use of Natural Resources

The land surrounding the site is undeveloped rangeland used for cattle grazing year-round. Mineral exploration in the area was extensive in the past as evidenced by local prospects, spoils piles, and shafts. While actual mining activities are no longer conducted in the area, some mining claims were recently established near the site. Therefore, BLM is in the process of withdrawing the lands within and immediately adjacent to the Oroville Landfill from entry under the mining laws as well as from disposal under the land laws. Property transfer restrictions, such as withdrawing the land from entry and classifying it as a hazardous materials site in BLM's permanent land records (Master Title Plats and Historic Index) will limit site use and development, and will apprise any potential purchaser of the property that the site was used for waste disposal and that future uses must be restricted.

Okanogan County has a long history of prospecting and mining activities. Placer miners who were focused on the stretch of river between Oroville and Nighthawk enjoyed fairly good success, particularly at Rich Bar, located 5 miles east of Nighthawk. At one time, the countryside was riddled with numerous shafts, prospects, and adits, many of which are still recognizable. Several prospects are visible in the immediate vicinity of the Oroville Landfill. Gold, copper, lead, and silver were the principal target metals. The Okanogan Free Gold Mine was located "on the north bank of the Similkameen River, about three miles above Oroville." This, perhaps, is the same mining area, including an abandoned tunnel, that is visible looking downhill and south from the Oroville Landfill. Gold and some copper were mined from the Golden Chariot claim located 5 miles north of the city of Oroville. The majority of mining in the area was concentrated near Nighthawk, particularly near Little Chopaka Mountain. By 1967, none of the metals mines were operating. Recently, interest has been expressed in developing an open-pit mine near Chesaw, east of the Okanogan River.

Local recreational activities include hunting in the surrounding mountains and valleys, golf at the public course 0.3 mile east of the landfill, and skiing at a resort located several miles east of the site. Several privately owned apple orchards are located east of the site toward the city of Oroville.

There are approximately 1,500 residents in Oroville, with a majority employed in either agriculture (fruit orchards) or tourism. The nearest residence to the site is 0.5 mile southeast of the site. Four other residences are located between the site and the city of Oroville. These homes use private wells that access an aquifer noncontiguous with the Oroville Landfill.

2.6.4 Surface Water and Groundwater Resources

2.6.4.1 Surface Water

The Similkameen and Okanogan rivers are the main surface water bodies in the area of the Oroville Landfill. These rivers and their tributaries drain a total area of about 550 square miles. The Similkameen River and its principal tributary, Sinlahekin Creek, drain an area of about 400 square miles. More than 75 percent of the water passing through the Okanogan River basin downstream from Oroville originates in the Similkameen-Sinlahekin drainage area.

2.6.4.2 Groundwater

Most of the abundant accessible groundwater in the Sinlahekin-Similkameen area of the Okanogan River basin occurs in alluvial deposits underlying the major stream valleys or in glacial deposits and alluvium accumulated in abandoned or partially abandoned valleys. Alluvial and/or glacial deposits, and hence significant groundwater, are largely absent in the Similkameen River valley from Nighthawk to Oroville. In many places in the river stretch from Oroville to Nighthawk, particularly near the Oroville Landfill, the river essentially flows on bedrock; little water-bearing alluvial or glacial deposits have accumulated, and practically no productive groundwater is available.

There are both shallow and deep groundwater systems at the Oroville Landfill site. A small amount of shallow groundwater may occur within the glacial deposits that blanket the site. At most, only a few inches of water is anticipated to exist within the alluvium, with many areas being entirely dry. It is possible that no continuous saturated zone exists within the alluvium. Instead, the system probably consists of isolated pockets of water perched on the underlying bedrock (at depths of approximately 15 to 30 feet below ground surface) and contained within shallow bedrock features.

The deeper groundwater system is first encountered at a depth of about 200 to 300 feet below ground surface. The water-bearing strata of this system are primarily limestones, shales, cherts, and siltstones of the Spectacle Formation. The deeper system is hydraulically confined by low permeability bedrock with hydraulic heads as much as 300 feet higher than the first occurrence of groundwater.

Hydraulic heads in the deep aquifer potentially indicate a very steep groundwater gradient toward the river of approximately 30 percent. Although such large gradients are possible, especially near a discharge zone, it is also possible that a single, deep, equilibrated groundwater system is not present.

A complex hydrostratigraphy exists in the deeper aquifer. The geology is highly heterogeneous, with both mineralized and open fractures and a variety of rock types occurring within a short distance. The large variation in the excess hydrostatic head (the elevation of groundwater above first occurrence) shows no clear pattern and may indicate that at least two and possibly three flow systems are present. Ion geochemistry indicates that there may be three geochemically distinct waters and several distinct flow systems within the deeper aquifer.

2.6.5 Known or Suspected Sources of Contamination

Contamination at the Oroville Landfill primarily consists of phenoxy herbicides, organophosphate pesticides, chlorinated pesticides, polycyclic aromatic hydrocarbons (PAHs), and heavy metals.

Agriculture wastes are suspected to be the source of the herbicide and pesticide contamination. Historical information indicates that the Oroville Landfill routinely accepted industrial refuse consisting of construction debris, agricultural wastes, and domestic/household wastes. The landfill also accepted refuse and debris from a pesticide warehouse fire that occurred in Oroville. Sources of PAH contamination likely consist of open burning and used oil disposal. The heavy metals in the soil originated from mineral exploration spoils and natural background levels in the local, heavily mineralized bedrock.

2.6.6 Types of Contaminants and Affected Media

Controlled and uncontrolled waste dumping occurred at the site during its operation as a landfill from 1967 to 1976. Historical and investigative information indicates that there are five major potential areas of soil contamination at the Oroville Landfill site.

The first area is the municipal disposal area located in the eastern drainage. The second area is the pesticide debris trench. The third area is the "third" waste disposal area identified in 1989. The fourth is surface soil located throughout the site. The fifth area is the mineral prospect spoils pile which is unrelated to waste disposal activities at the landfill.

Domestic refuse, construction debris, agricultural waste, and industrial waste were disposed of at the landfill in the eastern drainage during landfill operations from 1967 through 1976, resulting in classification of this area as the municipal disposal area. The eastern drainage extends from the northern corner of the site, adjacent to the Oroville-Nighthawk Highway, to the western perimeter of the site, adjacent to the gabion wall. The municipal disposal area in the eastern drainage was covered with native soil in 1976 and was improved with a leachate collection system and run-on/runoff control in 1987. Refuse consists of glass, plastic, charred wood, large metal fragments, and concrete rubble. Approximately 15 percent of the materials in the eastern drainage consists of refuse. A metal drum containing 30 gallons of a dilute emulsion of ethion (an organophosphate pesticide) was also found in this area. Contaminants in this area predominantly consist of pesticides and arsenic. Contaminated media consist of soil and debris. The volume of material disposed of in this area has not been determined but is estimated to be much greater than the amount of material placed in other disposal areas at the landfill.

The second area of site contamination is the pesticide debris trench, located in the eastern portion of the site. The southern extension of the trench is located approximately 125 feet north of the landfill entrance gate. The pesticide debris trench can be recognized by the presence of an area of bare soil measuring approximately 400 square feet, potentially caused by elevated levels of pesticides in the surface soils. Surface soils above the pesticide debris trench contain elevated levels of base/neutral/acid extractable organic compounds (BNAs or semivolatiles) and organophosphate pesticides, and highly elevated levels of chlorinated pesticides.

The trench was excavated to accommodate the debris generated during a fire at the local agricultural supply warehouse in 1969. Bottles of parathion (an organophosphate pesticide) and paraquat (a nitrogen-based herbicide) were reputed to be among the debris buried in the trench. The dimensions of the trench are estimated to be 190 feet long (northwest-southeast) by an average of 47 feet wide, encompassing an area of approximately 9,000 square feet. The trench has an estimated debris volume of 5,000 cubic yards, assuming a maximum depth of 13 feet and 2 feet of soil cover.

The third area of site contamination is an area that was delineated by detailed geophysical surveys conducted in 1988–1989. This area is named the "third" disposal area. The subsurface soils in this area contain elevated levels of chlorinated pesticides. Ground-penetrating radar (GPR), magnetometry, and in-phase electromagnetic surveys indicated that this area is located southeast of the pesticide debris trench, near the head of the eastern erosional feature. The third disposal area's dimensions are approximately 150 feet along the north/south axis and 130 feet along the east/west axis, representing an area of approximately 11,600 square feet.

Investigations indicated that the metal (ferrous) objects buried in this area, potentially consist of metal cans or drums. Assuming an average depth of 10 feet, an approximate maximum waste volume for the third disposal area is 4,300 cubic yards.

Surface soil throughout the Oroville Landfill represents the fourth area of site contamination. Soil from at least the top 3 inches has elevated levels of chlorinated pesticides, some metals, and a few BNAs. The approximate contaminated surface soil volume is 6,500 cubic yards assuming the entire 16-acre landfill site is affected to a depth of 3 inches. The Oroville Landfill was operated as an open dump and was never supervised. As a result, refuse was disposed of throughout the site. Refuse was also reportedly burned periodically. Pesticide-laden mixed roofing, flooring, and sawdust insulation wastes generated during the pesticide warehouse fire were burned on-site to reduce the volume of wastes. Contaminants generated during this burning may have been redistributed throughout the site by wind and vehicle traffic.

The mineral prospect spoils pile is the fifth contamination area and is a potential source of arsenic contamination unrelated to the pesticide disposal activities at the landfill. The pile of soil and rock exists within the site fence on the steep slope below the landfill crest immediately east of the erosional feature. The pile appears to have been generated during past mineral prospecting activities. The mineral prospect spoils pile is estimated to contain approximately 100 cubic yards of soil and rock. A soil sample collected from the pile indicates that the material contains elevated concentrations of arsenic (440 mg/kg) relative to the local colluvial (bedrock-derived) soil reference level. The mineral prospect excavation from which the spoils pile was derived measures approximately 20 feet long by 10 feet wide by 10 feet deep and has copper- and iron-mineral-stained marble and phyllite exposed in its walls.

Apart from the pesticide debris trench, the amount of agricultural pesticide waste disposed at other areas of the landfill is unknown but is anticipated to be minimal in comparison to the trench. The discovery in 1987 of a drum of pesticide (ethion) liquid in the municipal disposal area supports the historical reports that some agricultural wastes were disposed outside of the pesticide debris trench.

Chlorinated pesticides, polychlorinated biphenyls (PCBs), and several metals were detected in samples from the two groundwater seeps in the western and eastern drainages below the landfill. Endosulfan, Aroclor-1254, arsenic, and lead were detected at very low concentrations.

Pesticides were not detected in the Similkameen River surface water. Low concentrations of DDT were detected in one sediment sample collected from the Similkameen River downgradient of the landfill.

Low concentrations of chlorinated pesticides (DDT, and its breakdown products, DDD and DDE) were detected in sediment samples taken from the irrigation canal located downgradient from the landfill however, higher concentrations were detected in canal sediments upgradient of the site. Several PAHs were detected in moderate concentrations in the downgradient canal sediment samples. Low to moderate arsenic concentrations were found in canal sediments.

2.6.7 Routes of Migration

The fate of contaminants originating from the Oroville Landfill depends on site-specific migration pathways and on the chemical and physical properties of each contaminant. This section focuses on the contaminants of concern and identifies their probable routes of migration in soil, surface water, sediment, and groundwater.

2.6.7.1 Surface Soil

The principal transport mechanism of the site contaminants is as soil-bound particles suspended in surface water runoff. Contaminated soil in suspended surface water runoff is expected to travel downhill from the landfill and potentially to the irrigation canal and the Similkameen River. Windblown fugitive dust is also considered a potential mechanism of transport.

2.6.7.2 Subsurface Soil

The probable transport mechanisms of the contaminants in subsurface soil are vertical transport of free liquid by gravity and vertical transport of contaminants by percolation of rainfall. The contaminants, which may be weakly sorbed in the interstices of soil grains, could be mobilized by gravity, rainfall, or groundwater without undergoing significant degradation. Low annual rainfall (12 inches per year) and high evapotranspiration rates result in low groundwater recharge rates and vertical migration.

2.6.7.3 Surface Water

Transport of contaminants via surface water occurs by the movement of suspended soil particles in surface water runoff, resulting from rainfall or snowmelt.

2.6.7.4 Seeps

Transport of contaminants occurs as site infiltration (shallow groundwater) carries contaminants to the surface in seep water.

2.6.7.5 Sediment

Sediment containing low levels of contaminants was found in the irrigation canal and Similkameen River. Bed load transport may be the major form of transport of contaminated sediment.

Sediment bed load transport in the river and canal is possible because of seasonal high flows. This sediment may ultimately settle in areas of low flow (river bends, pools, areas of channel widening).

2.6.8 Contaminant Concentrations

Minimum, maximum, and median concentrations of contaminants for surface soil, subsurface soil, seep water, and canal sediment are shown in Tables 2-1, 2-2, 2-3, 2-4, and 2-5, respectively.

Table 2-1—Concentrations of Organic Contaminants in Surface Soil

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Chlorinated Pesticides (µg/kg)			
alpha-BHC	0.36	40	1.0
beta-BHC	1.7U	67	1.0
Dieldrin	0.360	55	1.9
4,4′-DDT	0.750	45,000	35
4,4′-DDD	1.5	11,000	4.2
4,4′-DDE	1.1	4,000	21
Endosulfan I	0.34	26,000	2.2
Endosulfan II	0.72	18,000	3.5
Endrin	0.72	900	2.0
Endrin ketone	0.36	210	2.0
Chlordane	0.36	78	1.0
Aroclor-1254	34U	4000U	--
Organophosphate Pesticides (µg/kg)			
Azinphos methyl	83U	740	47.2
Disulfoton	21U	49U	--
Ethion	41U	49,000	23.2
Ethyl parathion	41U	49U	--
Methyl parathion	21U	49	11.7
Phenoxy Herbicides (µg/kg)			
2,4-D	21U	61	11.7
2,4-DB	21U	180	11.7
2,4,5-T	4.1U	190	2.3
2,4,5-TP	4.1U	160	2.3
Dicamba	4.1U	5.6	2.3
Other Organics (µg/kg)			
Acenapthene	340U	490U	--
Benzo(a)anthracene	340U	490U	--
Benzo(b)fluoranthene	340U	490U	--
Benzo(k)fluoranthene	340U	490U	--
Benzo(a)pyrene	340U	490U	--
Benzo(g,h,i)perylene	340U	490U	--

Table 2-1—Concentrations of Organic Contaminants in Surface Soil

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Di-n-butylphthalate	38U	72	22.5
Butylbenzyl phthalate	340U	500	192.5
bis(2-Ethylhexyl)phthalate	340U	380	192.5
Chrysene	340U	490U	--
Dibenz(a,h)anthracene	340U	490U	--
Fluoranthene	98	490U	187.5
Indeno(1,2,3-cd)pyrene	340U	490U	--
N-Nitroso-di-n-propylamine	41	490U	187.5
Pyrene	41	490U	187.5
4-Chloro-3-methylphenol	100	490U	187.5

U The material was analyzed for but not detected. The associated value is an estimated sample quantitation limit.
-- Not Analyzed/Not Applicable.
[a] Value represents minimum detected concentration or minimum sample quantitation limit, whichever is lower.
[b] Value represents maximum detected concentration, or if the constituent was not detected in any sample, the value represents the maximum sample quantitation limit.
[c] Nondetects weighted at one-half the sample quantitation limit for statistics. Quantitation limits may exceed minimum detected concentrations listed.

Table 2-2—Concentrations of Inorganic Constituents in Site Surface Soil

Analyte	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]	Regional Background 90th Percentile[d]
Inorganics (mg/kg)				
Alluvial Soil				
Arsenic	1.8	43.9	8.6	7.61 (10.5)[e]
Barium	34.3	164.0	95.6	NA
Cadmium	0.37U	1.3	0.21	0.8
Chromium	9.3	33.1	21.9	31.9
Lead	6.1	58.8	7.8	13.1
Mercury	0.02U	0.04	0.03	0.04
Selenium	0.2	0.55	0.32	NA
Silver	0.70U	1.1	0.76	NA
Colluvial Soil				
Arsenic	33.8	440	127	7.61 (148)
Barium	54	322	126.5	NA
Cadmium	0.2	0.65	0.2	0.8
Chromium	11.9	82.3	30.35	31.9
Lead	7.8	18.0	13.0	13.1
Mercury	0.01U	0.04	0.03	0.04
Selenium	1.9	12.0	1.0	NA
Silver	0.4U	3.1	0.90	NA

U The material was analyzed for but not detected. The associated value is an estimated sample quantitation limit.
-- Not Analyzed/Not Applicable.
NA Not available.
[a] Value represents minimum detected concentration or minimum sample quantitation limit, whichever is lower.
[b] Value represents maximum detected concentration, or if the constituent was not detected in any sample, the value represents the maximum sample quantitation limit.
[c] Nondetects weighted at one-half the sample quantitation limit for statistics. Quantitation limits may exceed minimum detected concentrations listed.
[d] 90th percentile values from Group "East (All)" (eastern Washington) reported in "Natural Background Soil Metals Concentrations in Washington State," Washington State Department of Ecology, 1994. The reference did not distinguish alluvial soil from colluvial soil types.
[e] Values in parentheses represent site-specific background value determined in remedial investigation report (WESTON, 1993).

Table 2-3—Concentrations of Contaminants in Subsurface Soil

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Chlorinated Pesticides (µg/kg)			
alpha-BHC	0.35	1.5	0.85
beta-BHC	0.71	5.1	0.85
Dieldrin	0.73	3.6U	1.7
4,4'-DDT	2.3	250	135.0
4,4'-DDD	0.67	47	21.0
4,4'-DDE	0.67	73	45.5
Endosulfan I	1.4	3.3	1.6
Endosulfan II	0.72	3.6	1.7
Endrin	0.34	2.8	1.20
Endrin ketone	0.73	3.6U	1.7
Chlordane	0.34	1.1	0.85
Aroclor-1254	34U	36U	--
Organophosphate Pesticides (µg/kg)			
Azinphos methyl	55	55	42.7
Disulfoton	21U	22U	--
Ethion	41U	45U	--
Ethyl parathion	41U	45U	--
Methyl parathion	21U	22U	--
Phenoxy Herbicides (µg/kg)			
2,4-D	21U	140	10.7
2,4-DB	21U	41U	--
2,4,5-T	4.2U	8.2U	--
2,4,5-TP	4.2U	8.2U	--
Dicamba	4.2U	8.5	2.2
Other Organics (µg/kg)			
Acenapthene	--	--	--
Benzo(a)anthracene	--	--	--
Benzo(b)fluoranthene	--	--	--

Table 2-3—Concentrations of Contaminants in Subsurface Soil

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Benzo(k)fluoranthene	--	--	--
Benzo(a)pyrene	--	--	--
Benzo(g,h,i)perylene	--	--	--
Di-n-butylphthalate	--	--	--
Butylbenzylphthalate	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--
Chrysene	--	--	--
Dibenz(a,h)anthracene	--	--	--
Fluoranthene	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--
N-Nitroso-di-n-propylamine	--	--	--
Pyrene	--	--	--
4-Chloro-3-methylphenol	--	--	--
Inorganics[d] (mg/kg)			
Arsenic	18.9	233	38.5
Barium	63	97.6	85.0
Cadmium	0.185U	0.56	0.19
Chromium	0.64	34.7	17.3
Lead	6.10	90.0	11.5
Mercury	0.02	0.08	0.03
Selenium	0.19U	0.36	0.10
Silver	0.76	2.8	1.0

U The material was analyzed for but not detected. The associated value is an estimated sample quantitation limit.
-- Not Analyzed/Not Applicable.
[a] Value represents minimum detected concentration or minimum sample quantitation limit, whichever is lower.
[b] Value represents maximum detected concentration, or if the constituent was not detected in any sample, the value represents the maximum sample quantitation limit.
[c] Nondetects weighted at one-half the sample quantitation limit for statistics. Quantitation limits may exceed minimum detected concentrations listed.
[d] See Table 2-2 for regional background inorganic concentrations for comparison purposes.

Table 2-4—Concentrations of Contaminants in Seep Surface Water

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Chlorinated Pesticides (µg/L)			
alpha-BHC	0.005U	0.064U	--
beta-BHC	0.005U	0.064U	--
Dieldrin	0.01U	0.13U	--
4,4′-DDT	0.01U	0.13U	--
4,4′-DDD	0.01U	0.013	0.013
4,4′-DDE	0.01U	0.13U	--
Endosulfan I	0.005U	0.032	0.032
Endosulfan II	0.01U	0.13U	--
Endrin	0.01U	0.13U	--
Endrin Ketone	0.01U	0.13U	--
Chlordane	0.005U	0.064U	--
Aroclor-1254	0.10U	0.54	0.54
Organophosphate Pesticides (µg/L)			
Azinphos methyl	2U	5U	--
Disulfoton	0.5U	0.5U	--
Ethion	--	--	--
Ethyl Parathion	--	--	--
Methyl Parathion	0.5U	0.5U	--
Phenoxy Herbicides (µg/L)			
2,4-D	1.0U	1.0U	--
2,4-DB	1.0U	1.0U	--
2,4,5-T	0.2U	0.2U	--
2,4,5-TP	0.2U	0.2U	--
Dicamba	0.2U	0.2U	--
Other Organics (µg/L)			
Acenapthene	--	--	--
Benzo(a)anthracene	--	--	--
Benzo(b)fluoranthene	--	--	--
Benzo(k)fluoranthene	--	--	--
Benzo(a)pyrene	--	--	--
Benzo(g,h,i)perylene	--	--	--
Chrysene	--	--	--
Dibenz(a,h)anthracene	--	--	--
Fluoranthene	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--
Pyrene	--	--	--

Table 2-4—Concentrations of Contaminants in Seep Surface Water

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
4-chloro-3-methylphenol	--	--	--
Di-n-butylphthalate	--	--	--
Butylbenzylphthalate	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--
N-Nitroso-di-n-propylamine	--	--	--
Inorganics (µg/L)			
Arsenic	2.0	10.2	4.8
Barium	19.6	70	59.0
Cadmium	1.8U	2.0U	--
Chromium	1.6U	2.1	2.1
Lead	1.4	5.0U	2.0
Mercury	0.1U	0.2U	--
Selenium	0.9U	18.2	18.2
Silver	3.0U	3.4U	--

U The material was analyzed for but not detected. The associated value is an estimated sample quantitation limit.
-- Not Analyzed/Not Applicable.
[a] Value represents minimum detected concentration or minimum sample quantitation limit, whichever is lower.
[b] Value represents maximum detected concentration, or if the constituent was not detected in any sample, the value represents the maximum sample quantitation limit.
[c] Nondetects weighted at one-half the sample quantitation limit for statistics. Quantitation limits may exceed minimum detected concentrations listed.

Table 2-5—Concentrations of Contaminants in Irrigation Canal Sediment

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Chlorinated Pesticides (µg/kg)			
alpha-BHC	1.8U	2.7U	--
beta-BHC	1.8U	2.7U	--
Dieldrin	3.6U	5.3U	--
4,4′-DDT	1.4	1.6	1.4
4,4′-DDD	0.72	1.1	0.9
4,4′-DDE	1.4	3.7	1.8
Endosulfan I	1.8U	2.7U	--
Endosulfan II	3.6U	5.3U	--
Endrin	3.6U	5.3U	--
Endrin ketone	3.6U	5.3U	--
gamma-Chlordane	1.8U	2.7U	--
Aroclor-1254	36U	45U	--
Organophosphate Pesticides (µg/kg)			
Azinphos methyl	88U	120U	--
Disulfoton	22U	31U	--
Ethion	44U	62U	--
Ethyl parathion	44U	62U	--
Methyl parathion	22U	31U	--
Phenoxy Herbicides (µg/kg)			
2,4-D	22U	31U	--
2,4-DB	22U	31U	--
2,4,5-T	4.4U	6.2U	--
2,4,5-TP	4.4U	6.2U	--
Dicamba	4.4U	6.2U	--
Other Organics (µg/kg)			
Acenapthene	53	440U	180
Benzo(a)anthracene	320	320	265
Benzo(b)fluoranthene	300	300	265
Benzo(k)fluoranthene	290	290	265
Benzo(a)pyrene	360U	390	265

Table 2-5—Concentrations of Contaminants in Irrigation Canal Sediment

Contaminant	Minimum Concentration[a]	Maximum Concentration[b]	Median[c]
Benzo(g,h,i)perylene	210	210	210
Di-n-butylphthalate	40U	78U	--
Butylbenzylphthalate	360U	530U	--
bis(2-Ethylhexyl)phthalate	45	160	160
Chrysene	290	290	265
Dibenz(a,h)anthracene	46	530U	180
Fluoranthene	290	290	265
Indeno(1,2,3-cd)pyrene	270	270	265
N-Nitroso-di-n-propylamine	360U	530U	--
Pyrene	65	420	180
4-Chloro-3-methylphenol	61	440U	180
Inorganics (mg/kg)			
Arsenic	23.3	63.2	31.8
Barium	84.3	117	93.7
Cadmium	0.39U	0.56U	--
Chromium	22.9	35.6	24.5
Lead	4.8	9.8	8.8
Mercury	0.02U	0.04	0.015
Selenium	0.2U	0.28U	--
Silver	0.86	0.86	0.55

U The material was analyzed for but not detected. The associated value is an estimated sample quantitation limit.
-- Not Analyzed/Not Applicable.
[a] Value represents minimum detected concentration or minimum sample quantitation limit, whichever is lower.
[b] Value represents maximum detected concentration, or if the constituent was not detected in any sample, the value represents the maximum sample quantitation limit.
[c] Nondetects weighted at one-half the sample quantitation limit for statistics. Quantitation limits may exceed minimum detected concentrations listed.

No contaminants were found in the Similkameen River surface water or deep groundwater. Shallow groundwater samples could not be obtained. One of four sediment samples from the Similkameen River contained 1.2 µg/kg of DDT.

2.7 AFFECTED POPULATION AND ENVIRONMENT

2.7.1 Local Population

The site is located in a remote area within a relatively sparsely populated region of Washington state. The BLM owns approximately 170 acres of the square mile surrounding the landfill. North of the site approximately 640 contiguous acres are privately owned. Directly across the highway is a patented mining claim. A golf course is located southeast of the landfill. There are apple orchards 0.5 mile south of the site. The surrounding private land is designated a "Minimum Requirement District" by Okanogan County, which allows multiple uses of the land.

The city of Oroville, located approximately 3 miles southeast of the landfill, has approximately 1,500 residents, with the majority employed in either agriculture (fruit orchards) or tourism. The nearest residence to the landfill is 0.5 mile southeast near the apple orchards. Four other residences are located between the site and the city of Oroville. The wells for these homes access an aquifer off-gradient and noncontiguous with the site.

Local recreational activities include hunting in the surrounding mountains, golf at the public course 0.3 mile southeast of the site, and skiing at a resort several miles west of the site. Informal recreational activities, such as swimming and hiking, presumably occur along the river and in the mountains.

2.7.2 Environmental Habitat

The Oroville Landfill, which sits in the Okanogan Basin, is located in one of the most important wildlife areas in Washington state (Pacific Northwest River Basins Commission, 1970). A wide variety of vegetative communities in the region support many avian and animal species.

Slopes extending from the Okanogan River floodplain to the lower timberline are characterized by steppe vegetation. Steppe vegetation is comprised of two smaller zones that depend on climate and soil type. Drier and lower elevations are characterized by the big sagebrush-blue bunch wheatgrass vegetative association. A second zone, the cutleaf sagebrush-Idaho fescue zone, is found on the periphery above the sagebrush-blue bunch wheatgrass. Upland meadow, another vegetative community common to this region, is characterized by cheatgrass.

The Oroville Landfill is adjacent to the Similkameen River, which is assigned a Class A (excellent) water quality designation by the Washington State Department of Ecology in accordance with Chapter 173-201-070 WAC. Resident fish species inhabiting the Similkameen River include rainbow trout, mountain whitefish, bridgelip sucker, longnose dace, northern squawfish, black crappie, brook trout, cutthroat trout, largescale sucker, redside shiner largemouth bass, smallmouth bass and burbot. Anadromous salmonids include summer steelhead trout and summer chinook salmon. A few sockeye salmon have been observed in the lower Similkameen River. Both summer steelhead and summer chinook salmon spawn and rear in the lower reach of the Similkameen River below Enloe Falls.

A wide variety of game and nongame animal species inhabit the local area. Big game species include white-tailed deer, mule deer, cougar, and black bear. Mule deer prefer steppe habitats in winter and riparian and coniferous forest habitats year-round. White-tailed deer are generally found upstream from the Similkameen River's confluence with Palmer Lake, approximately 10 miles west of the landfill. Muskrat, beaver, mink, coyote, raccoon, bobcat, and river otter are some of the resident species found in the area. The Nuttall cottontail and white-tailed hare represent smaller game species in the area. Numerous species of resident vertebrates including smaller mammals (field mice, voles, pocket gophers), reptiles, and amphibians are also present.

Both native and introduced birds are found in the area. The mourning dove, ruffed grouse, and Columbian sharp-tailed grouse are native. California quail, chukar, ring-necked pheasant, gray partridge, and wild turkey have been introduced. Raptors are also common to this region. Common species include the American kestrel, great horned owl, short-eared owl, northern harrier, Swainson's hawk, merlin, prairie falcon, golden eagle, and burrowing owl. The most common species of raptor is the red-tailed hawk. Osprey are known to nest near Palmer Lake and forage over the Similkameen River.

The Okanogan Basin is a minor component of the Pacific flyway. Ducks and geese use the lakes for feeding and resting during migration. Migratory species include cinnamon teal, blue-winged teal, green-winged teal, wood duck, Barrow's goldeneye, hooded merganser, ruddy duck, bufflehead, redhead, ring-necked duck, American coot, American widgeon, common snipe, yellowlegs, killdeer, and western sandpiper. Mallard and Canada geese are the most common waterfowl in the area and frequently nest along the main stem of the Similkameen River.

2.8 SUMMARY OF SITE RISKS

The baseline risk assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. It serves as the baseline indicating what risks would exist if no action were taken at the site. This section of the ROD reports the results of the baseline risk assessment for the site.

2.8.1 Human Health

The baseline human health risk assessment characterizes potential human health risks from exposure to on-site contaminants, assuming the site is not remediated. The purpose of this assessment was to estimate potential incremental health risks in order to facilitate risk management decisions about the site.

No complete human health exposure pathways were found associated with groundwater, surface water, or sediments. Therefore, the human health risk assessment was developed based on exposure to soil-borne contaminants.

A screening process was used to select the contaminants of concern for use in the risk assessment. Three levels of screening were performed. Screening Level 1 eliminated inorganics with concentrations below naturally occurring background levels. Background screening was based on the EPA "tolerance interval" methodology, which was used to compare individual sample concentrations to 95 percent upper confidence limit concentrations in background soil samples. Screening Level 2 eliminated contaminants that did not contribute significantly to the overall risk at the site. In this screening step, maximum on-site concentrations were compared with listed EPA Region X risk-based soil screening concentrations. The screening concentrations are based on EPA's residential scenario soil ingestion pathway. Carcinogen concentrations resulting in a lifetime risk below one in ten million (1.0E-07) and noncarcinogen concentrations contributing to a hazard index below 0.1 were eliminated. Screening Level 3 eliminated contaminants lacking toxicity criteria. Sources for toxicity criteria included EPA's Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST).

Soil contaminants of concern included in the human health risk assessment are shown in Table 2-6.

Previous uses of this site have been for industrial purposes. Currently, there is no ongoing active use of the site and no active use is planned for the future.

An exposure assessment was completed to determine worst-case exposure conditions to humans. Although none of the site use scenarios evaluated are planned for the landfill, the evaluated scenarios provided conservative risk estimates and yielded conservative cleanup goals.

The exposure assessment assumed that the landfill could be used for both industrial and commercial purposes in the future. Industrial uses included use as a lumber transfer station or an equipment storage yard. Such uses would result in exposures predominately to adults who work at the facility. Commercial uses included use as a daycare center, which would result in exposures to children while at daycare and to adults who work at the daycare center. A trespasser scenario was also evaluated which assumed a youth trespasses onto the site and comes into contact with contaminated soil.

Table 2-6—Human Health Contaminants of Concern and Maximum Concentrations

Contaminants	Maximum Concentration (mg/kg)
Inorganics	
Arsenic	440
Chromium	82
Semivolatile Organics	
n-Nitroso-di-n-propylamine	0.041
Organophosphate Pesticides	
Ethion	49
Methyl parathion	0.049
Chlorinated Pesticides	
alpha-BHC	0.04
beta-BHC	0.067
Endosulfan I	26
Endosulfan II	18
Dieldrin	0.055
4,4′-DDT	45
4,4′-DDD	11
4,4′-DDE	4
Phenoxy Herbicides	
2,4-D (2,4-Dichlorophenoxy acetic acid)	0.061
2,4-DB (4-[2,4-Dichlorophenoxy]butyric acid)	0.18
2,4,5-T (2,4,5-Trichlorophenoxy acetic acid)	0.19
2,4,5-TP (Silvex) (2[2,4,5-Trichlorophenoxy]propionic acid)	0.16
Dicamba	0.0056

Exposure pathways for industrial use were incidental soil ingestion and inhalation of soil particulates. These exposure pathways could occur by eating with dirty hands while working at the site or by inhalation of dust. The exposure was assumed to last for 20 to 30 years.

Exposure pathways for the commercial use were incidental soil ingestion and inhalation for the child at daycare and inhalation for the adult working at the facility. Durations of exposure for the child and adult were assumed to be 6 years and 30 years, respectively.

The trespasser scenario assumed exposure to a youth through incidental soil ingestion and inhalation. It was assumed that a youth would trespass onto the site one day a week for 6 years.

A risk characterization was completed using the above scenarios applied to two locations of the site. Two different locations were used for risk determination because they had significantly different contaminant concentrations and areal extent. The two locations used were the pesticide debris trench and the whole site minus the pesticide debris trench area (e.g., the main site).

Risk was characterized as both carcinogenic and noncarcinogenic. Carcinogenic risk is displayed as an increase in the probability of developing cancer (i.e., 1×10^{-6} means that an individual's risk of cancer is increased by 1 in 1 million over the baseline risk experienced by a non-exposed person). Noncarcinogenic risk is displayed as a hazard quotient (i.e., a value greater than 1.0 means there may be the potential for non-cancer health risks). Benchmark values for "acceptable" excess cancer risk to an individual range from 1 in 10,000 (i.e., 1×10^{-4}) to 1 in 1,000,000 (i.e., 1×10^{-6}). For the Oroville Landfill, because potential future use of the site will be minimal, a benchmark cancer risk of 1 in 100,000 (i.e., 10^{-5}) was used as the cutoff for determining "acceptable" versus "nonacceptable" risk. Total non-carcinogenic risk should not exceed a hazard index of 1.0.

The risk associated with the main site by contaminants of concern for the various scenarios and receptors is shown in Table 2-7. Similar risk information for the pesticide debris trench is shown in Table 2-8. Risk to a youth associated with trespassing onto the main site is provided in Table 2-9. The risks represent the reasonable maximum exposure, defined as the highest exposure that is reasonably expected to occur at the site.

The baseline human health risk assessment indicates that if no action were taken at the site, carcinogenic and noncarcinogenic risks in excess of accepted benchmarks could occur only for a child in a daycare center (future commercial scenario).

2.8.2 Ecological

Risks to ecological receptors were evaluated based on exposure to Similkameen River water and sediments as well as soil on and around the landfill.

Exposure to the Similkameen River water is not anticipated to result in any excess ecological risk since no contaminants were found. One river sediment sample was found to contain low concentrations of DDT. However, equilibrium partitioning coefficients indicate interstitial sediment water is most likely below ambient water quality criteria and therefore poses no significant risk.

Table 2-7—Carcinogenic and Noncarcinogenic Risk for Main Site[a]

Contaminant	Future Commercial Scenario					Future Industrial Scenario			
	Carcinogenic Risk			Noncarcinogenic Risk		Carcinogenic Risk		Noncarcinogenic Risk	
	(Child)		(Adult)	(Child)					
	Ing.	Inh.	Inh.	Ing.	Inh.	Ing.	Inh.	Ing.	Inh.
Inorganics									
Chromium	N/A	N/A	N/A	0.000006	N/A	N/A	N/A	0.000003	N/A
Organophosphate Pesticides									
Methyl parathion	N/A	N/A	N/A	0.001	N/A	N/A	N/A	0.000006	N/A
Ethion	N/A	N/A	N/A	0.006	N/A	N/A	N/A	0.0003	N/A
Phenoxy Herbicides									
2,4-D	N/A	N/A	N/A	0.00004	N/A	N/A	N/A	0.000002	N/A
2,4-DB	N/A	N/A	N/A	0.000009	N/A	N/A	N/A	0.000004	N/A
2,4,5-T	N/A	N/A	N/A	0.00001	N/A	N/A	N/A	0.000005	N/A
2,4,5-TP	N/A	N/A	N/A	0.00001	N/A	N/A	N/A	0.0000005	N/A
Dicamba	N/A	N/A	N/A	0.000001	N/A	N/A	N/A	0.00000005	N/A
Chlorinated Pesticides									
alpha-BHC	1.3E-07	2.0E-10	2.2E-10	N/A	N/A	1.9E-08	N/A	N/A	N/A
beta-BHC	3.2E-10	9.9E-11	1.1E-10	N/A	N/A	4.9E-11	N/A	N/A	N/A
Endosulfan I	N/A	N/A	N/A	0.07	N/A	N/A	N/A	0.003	N/A
Endosulfan II	N/A	N/A	N/A	0.08	N/A	N/A	N/A	0.004	N/A
Dieldrin	3.8E-08	6.9E-10	7.8E-10	0.0006	N/A	5.9E-09	7.8E-10	0.00003	N/A
4,4′-DDT	4.4E-07	2.4E-09	2.7E-09	0.03	N/A	6.6E-08	2.7E-09	0.002	N/A
4,4′-DDD	1.2E-07	1.5E-10	1.7E-10	N/A	N/A	1.8E-08	1.7E-10	N/A	N/A
4,4′-DDE	1.6E-07	8.5E-10	9.7E-10	N/A	N/A	2.4E-08	9.7E-10	N/A	N/A
Other Organics									
n-Nitroso-di-N-propylamine	1.4E-07	2.2E-10	2.6E-10	N/A	N/A	2.2E-08	2.6E-10	N/A	N/A
Total (by pathway)	1.0E-06	4.6E-09	5.3E-09	0.2	N/A	1.6E-07	4.9E-09	0.009	N/A
Total	1.0E-06		5.3E-09	0.2		1.6E-07		0.009	

[a] Scientific notation (for example, 1.0E+06 = 1,000,000; 1.0E - 02 = 0.01)
[b] Because there were no inhalation reference doses available, noncarcinogenic risk was not evaluated for an adult.
N/A = Not applicable (not a carcinogen or no criteria available).
Ing. = Ingestion.
Inn. = Inhalation.

Table 2-8—Carcinogenic and Noncarcinogenic Risk for the Pesticide Debris Trench Hot Spot[a]

Contaminant	Future Commercial Scenario					Future Industrial Scenario			
	Carcinogenic Risk			Noncarcinogenic Risk		Carcinogenic Risk		Noncarcinogenic Risk	
	(Child)		(Adult)	(Child)[b]					
	Ing.	Inh.	Inh.	Ing.	Inh.	Ing.	Inh.	Ing.	Inh.
Organophosphate Pesticides									
Methyl parathion	N/A	N/A	N/A	0.001	N/A	N/A	N/A	0.00006	N/A
Ethion	N/A	N/A	N/A	0.6	N/A	N/A	N/A	0.03	N/A
Phenoxy Herbicides									
2,4-D	N/A	N/A	N/A	0.00004	N/A	N/A	N/A	0.00002	N/A
2,4-DB	N/A	N/A	N/A	0.00001	N/A	N/A	N/A	0.0000006	N/A
2,4,5-T	N/A	N/A	N/A	0.00001	N/A	N/A	N/A	0.0000005	N/A
2,4,5-TP	N/A	N/A	N/A	0.0001	N/A		N/A	0.000006	N/A
Dicamba	N/A	N/A	N/A	0.000001	N/A	N/A	N/A	0.00000005	N/A
Chlorinated Pesticides									
alpha-BHC	1.3E-07	2.0E-10	2.2E-10	N/A	N/A	1.9E-08	2.2E-10	N/A	N/A
beta-BHC	6.0E-08	9.9E-11	1.1E-10	N/A	N/A	9.2E-09	1.1E-10	N/A	N/A
Endosulfan I	N/A	N/A	N/A	3.3	N/A	N/A	N/A	0.2	N/A
Endosulfan II	N/A	N/A	N/A	2.0	N/A	N/A	N/A	0.1	N/A
Dieldrin	4.4E-07	6.9E-10	7.8E-10	0.007	N/A	6.7E-08	7.8E-10	0.0003	N/A
4,4′-DDT	7.7E-06	2.4E-09	2.7E-09	0.6	N/A	1.2E-06	2.7E-09	0.03	N/A
4,4′-DDD	1.3E-06	1.5E-10	1.7E-10	N/A	N/A	2.0E-07	1.7E-10	N/A	N/A
4,4′-DDE	6.8E-07	8.5E-10	9.7E-10	N/A	N/A	1.0E-07	9.7E-10	N/A	N/A
Other Organics									
n-Nitroso-di-n-propylamine	1.4E-07	2.2E-10	2.6E-10	N/A	N/A	2.2E-08	2.6E-10	N/A	N/A
Total (by pathway)	1.0E-05	4.6E-09	5.3E-09	6.4	N/A	1.6E-06	5.3E-09	0.3	N/A
Total	1.0E-05		5.3E-09	6.4		1.6E-06		0.3	

[a] Scientific notation (for example, 1.0E+06 = 1,000,000; 1.0E-02 = 0.01).
[b] Because there were no inhalation reference doses available, noncarcinogenic risk was not evaluated for an adult.
Ing. = Ingestion
Inh. = Inhalation
N/A = Not applicable (not a carcinogen or no criteria available).

Table 2-9—Carcinogenic and Noncarcinogenic Risk for the Main Site—Trespasser Scenario[a]

Contaminant	Carcinogenic Risk		Noncarcinogenic Risk	
	Ing.	Inh.	Ing.	Inh.
Inorganics				
Arsenic	1.2E-06	2.1E-08	0.03	N/A
Chromium	N/A	N/A	0.0000005	N/A
Organophosphate Pesticides				
Methyl parathion	N/A	N/A	0.00009	N/A
Ethion	N/A	N/A	0.002	N/A
Phenoxy Herbicides				
2,4-D	N/A	N/A	0.000003	N/A
2,4-DB	N/A	N/A	0.000001	N/A
2,4,5-T	N/A	N/A	0.0000009	N/A
2,4,5-TP	N/A	N/A	0.000009	N/A
Dicamba	N/A	N/A	0.00000009	N/A
Chlorinated Pesticides				
alpha-BHC	9.6E-09	2.9E-11	N/A	N/A
beta-BHC	4.6E-09	1.5E-11	N/A	N/A
Endosulfan I	N/A	N/A	0.02	N/A
Endosulfan II	N/A	N/A	0.02	N/A
Dieldrin	3.4E-08	1.0E-10	0.0005	N/A
4,4'-DDT	5.6E-08	3.6E-10	0.004	N/A
4,4'-DDD	1.6E-08	2.2E-11	N/A	N/A
4,4'-DDE	2.4E-08	1.3E-10	N/A	N/A
Other Organics				
n-Nitroso-di-n-propylamine	1.1E-08	3.3E-11	N/A	N/A
Total (by Pathway)	1.3E-06	2.2E-08	0.07	N/A
Total	1.3E-06		0.07	

[a] Scientific Notation (for example, 1.0E+06 = 1,000,000; 1.0E-02 = 0.01)
Ing. = Ingestion.
Inh. = Inhalation.
N/A = Not Applicable.

The most significant source of ecological risk is associated with site soil. Four areas were evaluated to determine which had the highest risk to terrestrial species. The four areas were (1) the complete area within the landfill boundary fence, (2) the area within the landfill fence excluding the pesticide debris trench and prospect spoils pile, (3) the pesticide debris trench alone, and (4) the off-site area immediately downslope of the landfill.

A screening process was used to determine the landfill soil contaminants of concern to use in the ecological risk assessment. Contaminants were not included in the risk assessment if they met any of the following criteria:

- Contaminants were infrequently detected. Less than or equal to 10% frequency of detection criterion was used as a basis for exclusion.

- Contaminants had low detected concentrations. A comparison of the highest detected concentration with the lowest contract required quantitation limit (CRQL) was made for each contaminant. Those with a maximum detected concentration below the CRQL were excluded.

- Contaminants had preliminary hazard quotients of less than 0.01 for soil ingestion toxicity. A screening of potential toxicity to birds and mammals (the chukar partridge and northern pocket gopher) was made where possible by comparing published toxicity information with maximum soil concentrations.

- Inorganic compounds were below background. Inorganic contaminants were screened against background using a 95% tolerance interval.

The analytes shown in Table 2-10 were identified as soil contaminants of concern for the ecological risk assessment.

An exposure assessment was completed to identify contaminated habitats, identify species that may be potentially exposed, determine significant routes/pathways of exposure, and determine indicator species. As discussed above, four areas were determined as potentially contaminated habitats. The pesticide debris trench was considered an area because its contaminant concentrations are generally much higher than those at the rest of the landfill. The off-site area was considered a discrete area because downslope migration of contaminants has been documented and attributed to runoff. Several potentially exposed species were identified and are listed in Appendix D of the Remedial Investigation report. Indicator terrestrial species and routes of exposure used in the ecological risk assessment are provided in Table 2-11.

Table 2-10—Ecological Contaminants of Concern and Maximum Concentrations

Contaminants	Maximum Concentration (mg/kg)
Inorganics*	
Silver	3.1
Semivolatile Organics	
Di-n-butylphthalate	0.072
Butylbenzylphthalate	0.50
Bis(2-ethylhexyl) phthalate	0.38
Organophosphate Pesticides	
Azinphos methyl	0.74
Ethion	49
Methyl parathion	0.049
Chlorinated Pesticides	
Endosulfan I	26
Dieldrin	0.055
4,4′-DDE	4
Endrin	0.90
Endosulfan II	18
4,4′-DDD	11
4,4′-DDT	45
Endrin ketone	0.21
gamma-Chlordane	0.078
Phenoxy Herbicides	
2,4,5-TP (Silvex)	0.16

*Arsenic was eliminated as a contaminant of concern during the tolerance interval screening for all areas except the mineral prospect spoils pile.

Table 2-11—Indicator Species and Exposure Routes

Indicator Species	Routes of Exposure
Northern Pocket Gopher	Ingestion of plant roots Ingestion of plant shoots Incidental soil ingestion
Chukar Partridge	Ingestion of seeds Ingestion of plant shoots Incidental soil ingestion

The northern pocket gopher was chosen as an indicator species for the following reasons: it lives and breeds on the site; it will potentially live on-site its whole life, receiving maximum exposure duration; it is a burrowing animal, receiving exposure to both surface and subsurface soil, it is herbivorous, receiving contaminant intake from plant ingestion, and it plays an important role in the food chain.

The chukar partridge was chosen as another indicator species for the following reasons: the site provides prime nesting habitat for the partridge; the chukar partridge will potentially spend its whole life on the site; its potential exposure is similar to other seed-eating birds; and the partridge is a popular game species in the area.

Ecological risk is also displayed as a hazard quotient. When a hazard quotient exceeds 1.0, potential adverse effects may occur to the receptor. Chemical-specific hazard quotients for each receptor for each area of the site are provided in Section 6 of the Remedial Investigation report and are summarized on Table 2-12.

Table 2-12—Ecological Risk (Hazard Index)

	Main Site		Main Site Minus Hot Spots		Pesticide Trench		Off-Site	
Receptor	Average	RME[a]	Average	RME[a]	Average	RME[a]	Average	RME[a]
Gopher	3.7	49	0.3	4.1	440	490	.003	.08
Chukar	0.3	2.5	0.3	0.7	0.4	0.7	.0004	.01

[a] RME = Reasonable Maximum Exposure or upper 95% hazard index.

The greatest ecological risk is to the gopher and is attributable to the pesticide debris trench. This risk is predominantly due to presence of the contaminants ethion, DDT, and endosulfan. Over 80% of the risk was due to ingestion of contaminated plant roots.

As a result of the human health and ecological risk assessment, it has been determined that actual or threatened releases of substances from the site, if not addressed by implementing the response action selected in this ROD, may present a threat to public health welfare and the environment.

2.9 REMEDIAL ACTION OBJECTIVES AND CLEANUP GOALS

Site risks exceeded generally accepted levels for both humans and biota. The risk assessment determined that the most sensitive receptor to site contaminants is the gopher. Risks to the gopher exceeded human health risks. The pesticide debris trench presented the highest human health and ecological risk of all areas evaluated. Other areas of the site (excluding the pesticide trench and spoils pile) have very minimal human health risk and low ecological risk.

Therefore, soil cleanup levels were developed based on the pesticide debris trench contaminants of concern assuming a burrowing rodent as the receptor.

Remedial action objectives for the Oroville Landfill are:

- Prevent human contact with contaminated pesticide debris trench soil.
- Prevent terrestrial biota from contacting contaminated soil/vegetation in the pesticide debris trench.

Remedial actions objectives have not been developed for the other areas of the site (i.e., the main site) for the following reasons:

- The risks to human health for the main site excluding the pesticide debris trench and the prospect spoils pile are substantially below the regulatory benchmarks.
- The calculated ecological risks for the main site (based on average and RME [or upper 95th percentile] concentrations) are minimal compared to those for the pesticide debris trench.
- The reasonable maximum exposure (RME) approach used in the ecological risk assessment is very conservative and the exceedance of a hazard index of 1 only indicates the <u>potential</u> for risk at the main site.
- The main site ecological risk calculated using the average values did not exceed a hazard index of 1.
- The RME risk for the gopher was heavily influenced by one sample, and that one sample represents an area much smaller than the range area of a gopher. Therefore, it is much more likely that a gopher will be exposed to average main site concentrations rather the RME concentrations.

Remedial actions objectives have not been developed for the prospect spoils pile because the elevated arsenic concentrations and the resulting health and environmental risks did not result from the former pesticide waste disposal practices at the landfill which is BLM's primary objective for remedial action at the site. Similar prospect spoils piles are found all across the Okanogan County region due to the abundant bedrock mineralization and historic mineral prospecting activities.

Cleanup goals were derived based on meeting the remedial action objectives, ecological risk guidelines, and practical quantification limits (PQLs). The cleanup goals for the Oroville Landfill and their bases are provided on Table 2-13.

Table 2-13—Cleanup Goals[a]

Compound	Cleanup Level (mg/kg)	Cleanup Level Basis
Bis(2-ethylhexyl)phthalate	0.33	PQL
Butylbenzylphthalate	0.33	PQL
Ethion	0.05	PQL
Azinphos methyl	0.192	Protection of gopher
Endosulfan I	0.113	Protection of gopher
Endosulfan II	0.113	Protection of gopher
Endrin	0.189	Protection of gopher
DDT	0.189	Protection of gopher

[a] Based on risk results and contaminants of concern from the pesticide debris trench.
PQL = Practical Quantitation Limit for the specific pesticide analysis.

2.10 DESCRIPTION OF ALTERNATIVES

The following section discusses the remedial action alternatives that were evaluated in the feasibility study.

2.10.1 Alternative 1: No Action

Evaluation of a No-Action alternative is required in order to provide a basis for comparison of existing conditions and risks of potential conditions resulting from implementation of other remedial alternatives.

2.10.1.1 Major Components of the Remedial Alternative

Under the No-Action alternative, no additional remedial action would be taken to eliminate existing sources of contamination or to reduce the risks to humans or the effects on the environment.

2.10.1.2 Treatment Component

There is no treatment component for this alternative. Reduction in toxicity or volume would occur only through natural processes such as photodegradation or biodegradation. Toxicity, mobility, and volume of the contaminated materials would remain at their present value for an indefinite period of time.

2.10.1.3 Containment Component

Containment is not a component of the No-Action alternative.

2.10.1.4 General Component

The No-Action alternative requires no implementation.

2.10.1.5 Compliance with ARARS

The No-Action alternative does not meet Washington State cleanup goals.

2.10.1.6 Costs and Remediation Time Frame

There is no cost or time required to implement the No-Action alternative.

2.10.2 Alternative 2: Institutional Controls

2.10.2.1 Major Components of Remedial Action

In this alternative, institutional controls are employed to limit or prohibit activities that may interfere with the integrity of existing waste containment structures and to prevent human exposure to hazardous substances on the site. These measures consist of restrictions to access, property transfer and land use restrictions, and long-term monitoring.

Access restrictions prevent unauthorized entrance to the site and may include fencing and signs. Property transfer restrictions prevent transfer of the property rights to entities that may develop the land or use the land for purposes that could result in unknown exposure to site contaminants. Land use restrictions are limitations that prohibit disturbances of the site soil that may cause exposure to contaminants.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells for 30 years and annual site inspections.

2.10.2.2 Treatment Component

There is no treatment component for this alternative. Reduction in toxicity or volume would occur only through natural processes such as photodegradation or biodegradation. Toxicity, mobility, and volume of the contaminated materials would remain at their present value for an indefinite period of time.

2.10.2.3 Containment Component

This alternative has no containment component.

2.10.2.4 General Components

This alternative has no general components

2.10.2.5 Compliance with ARARS

This alternative would not comply with MTCA cleanup standards. Most of the action-specific state and federal regulations are not applicable to this site because the waste was placed before these regulations became effective.

2.10.2.6 Costs and Remediation Time Frame

Costs for this alternative are estimated at $250,000 over a 30-year period. It is estimated that 3 months would be required to implement land use restrictions and 1 week would be required to install warning signs.

2.10.3 Alternative 3: Capping

2.10.3.1 Major Components of the remedial Action

This alternative consists of installation of a low-permeability cap over the entire landfill and implementation of institutional controls along with site monitoring. The cap will serve to control the erosion and transport of contaminated soil by wind and water, control run-on and runoff, isolate contaminated soil from receptors and minimize the infiltration of surface water into the landfill.

Institutional controls such as land use restrictions, access restrictions, property transfer restrictions would be implemented. Fences and warning signs would be installed.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells. Annual inspections of the cap for degradation would be performed and needed repairs made.

2.10.3.2 Treatment Component

There is no treatment component for this alternative. Reduction in toxicity or volume would occur only through natural processes such as photodegradation or biodegradation. Toxicity, mobility, and volume of the contaminated materials would remain at their present value for an indefinite period of time.

2.10.3.3 Containment Component

This alternative uses a 4-foot low-permeability cap to contain site contaminants and prevent infiltration. The cap would consist of 2 feet of clay with a permeability of 1×10^{-6} cm/sec covered by a 2 foot thick layer of topsoil. The cap would be revegetated with native grasses to prevent erosion and provide evapotranspiration. The cap would be placed over the entire landfill area.

Although the gopher may occasionally burrow below 4 feet and the roots of shrubs may extend below 4 feet, the proportion of the burrow or root within the contaminated soil below the cap is expected to be very low compared to the proportion in the uncontaminated cap material, making prolonged exposure to contaminants at concentrations high enough to present an unacceptable risk unlikely. Additionally, the development of a grass cover over the cap will restrict the establishment of deeper rooted shrubs.

2.10.3.4 General Components

In preparation of the site for capping, steep slopes and subsiding areas would be stabilized. The surface of the landfill would be filled as needed and contoured to promote runoff to the site perimeter. The 15 drums of investigation-derived waste (IDW) would be placed over the pesticide debris trench. Protruding objects would be removed and the site graded to a slope of 2 to 10 percent.

2.10.3.5 Compliance with ARARS

This alternative complies with Washington State cleanup standards by isolation of the contaminated soil through use of a cap. Washington State Dangerous Waste Regulations are not applicable to this alternative since the wastes were deposited before the earliest effective date of the regulations. Land Disposal Restrictions (LDRs) are also met by this alternative since the waste was placed in this landfill before these regulations became effective (8 November 1986).

2.10.3.6 Costs and Remediation Time Frame

The cost of this alternative is estimated to be $3,440,000. This cost includes maintenance and long-term monitoring over a 30-year period. A 4-month period would be required to install a cap over the landfill.

2.10.4 Alternative 4: Selective Capping

2.10.4.1 Major Components of the Remedial Action

The major components of this alternative include consolidation of the ethion soil pile over the pesticide debris trench and subsequent installation of a 4-foot low-permeability cap over the debris trench area. Institutional controls and long-term monitoring would be performed.

Institutional controls such as land use restrictions, access restrictions, property transfer restrictions would be implemented. Fences and warning signs would be installed.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells for 30 years. Annual inspections of the cap for degradation would be performed and needed repairs made.

2.10.4.2 Treatment Component

There is no treatment component for this alternative. Reduction in toxicity or volume would occur only through natural processes such as photodegradation or biodegradation. Toxicity, mobility, and volume of the contaminated materials would remain at their present value for an indefinite period of time.

2.10.4.3 Containment Component

A low-impermeability cap consisting of 2 feet of clay (permeability of 1×10^{-6} cm/sec) covered by 2 feet of topsoil would be installed over the pesticide debris trench. The cap would be revegetated with native grasses. The cap would prevent infiltration of precipitation and facilitate evapotranspiration, isolate the most highly contaminated soil from human and environmental receptors as well as control erosion of the most highly contaminated site soil.

Although the gopher may occasionally burrow below 4 feet and the roots of shrubs may extend below 4 feet, the proportion of the burrow or root within the contaminated soil below the cap is expected to be very low compared to the proportion in the uncontaminated cap material, making prolonged exposure to contaminants at concentrations high enough to present an unacceptable risk unlikely. Additionally, the development of a grass cover over the cap will restrict the establishment of deeper rooted shrubs.

2.10.4.4 General Components

The pesticide debris trench would be graded to remove high spots and low areas as well as plants and shrubs. The ethion soil pile would be removed from its present locations and consolidated on top of the pesticide trench. The trench area would be graded to coincide with the approximate slope of the landfill. Protruding objects would be removed and the trench capped with a slope of 2 to 10 percent.

2.10.4.5 Compliance with ARARS

This alternative complies with Washington State human health cleanup standards by isolation of the most highly contaminated soil through use of a cap. A small area of the site (i.e., west of the pesticide debris trench) may still exceed ecological cleanup goals. This area has a Hazard Index of 4 which indicates minimal risk to the environment due to the conservative assumptions used.

Washington State Dangerous Waste Regulations are not applicable to this alternative since the wastes were deposited before the earliest effective date of the regulations. LDRs are also met by this alternative since the waste was placed in this landfill before these regulations became effective (8 November 1986).

2.10.4.6 Costs and Remediation Time Frame

The cost of this alternative is estimated to be $660,000. This cost includes maintenance and long-term monitoring over a 30 year period. A 3-month period would be required to install a cap over the pesticide trench.

2.10.5 Alternative 5: Excavation with On-site Incineration and Capping

2.10.5.1 Major Components of the Remedial Action

In this alternative, contaminated soil from the pesticide debris trench (5000 cubic yards) and ethion soil pile would be excavated and incinerated. The residual ash would be toxicity characteristic leaching procedure (TCLP) tested, stabilized as necessary and placed back into the excavation. The 15 drums of IDW would also be placed into the trench. The pesticide debris trench would be covered with an low-permeability cap.

Institutional controls such as land use restrictions, access restrictions, property transfer restrictions would be implemented. Fences and warning signs would be installed.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells for 30 years. Annual inspections of the cap for degradation would be performed and needed repairs made.

2.10.5.2 Treatment Component

A mobile incinerator would be brought to the site, set up, tested and used to incinerate the most highly contaminated site soil. The incinerator would be erected on an uncontaminated portion of the site. Ash from the incinerator may fail TCLP tests due to metals. In this case, the ash would be stabilized such that it passes the TCLP leach tests.

2.10.5.3 Containment Component

This alternative includes an low-permeability cap to isolate the materials and ash placed in the pesticide debris trench. The cap consists of 2 feet of clay and 2 feet of topsoil. The cap will be revegetated with native grasses to prevent erosion and enhance evapotranspiration. The cap will be sloped to promote runoff. The cap would be constructed with a permeability of 1×10^{-6} cm/sec.

2.10.5.4 General Component

Material in the pesticide debris trench would be excavated and staged in soil stockpiles according to its type. A mobile lab will be setup on the site to analyze material as it is excavated from the pesticide trench. Materials excavated from the trench will be screened to separate large debris from soil. Soil will be incinerated whereas the large debris may be disposed of in the trench if not contaminated or will be disposed in an off-site hazardous waste landfill if it is contaminated.

2.10.5.5 Compliance with ARARS

This alternative would achieve human health cleanup standards for the site through destruction of the contaminants. Elevated arsenic levels in the prospect pile would be eliminated as a site threat by placing this material in the bottom of the pesticide trench and covering it with a cap.

Ecological risk would still remain slightly above guidelines in the area west of the pesticide trench. Due to conservatism used in the model, this risk is anticipated to be minimal.

Washington State Dangerous Waste Regulations are applicable to this alternative since dangerous wastes will likely be "generated" during the excavation of the pesticide debris trench. All generated wastes will be managed in accordance with Washington State Dangerous Waste Regulations. In the same way, LDRs are applicable to the wastes generated during implementation of this alternative. LDRs would be met by the treatment (incineration) of the pesticide debris trench contaminants prior to on-site and off-site disposal.

2.10.5.6 Costs and Remediation Time Frame

The cost of this alternative is estimated to be $9,430,000. This cost includes incineration, maintenance and long-term monitoring over a 30-year period. An 8- to 10-month period would be required to excavate the wastes, incinerate the excavated material and install a cap over the trench.

2.10.6 Alternative 6: Excavation with Off-site Incineration/Disposal

2.10.6.1 Major Components of the Remedial Action

This alternative would excavate 5,000 cubic yards of material from the pesticide debris trench, remove the ethion soil pile and incinerate this material in an off-site incinerator or dispose of it directly in a hazardous waste landfill depending on its contaminant concentrations. The resultant incinerator ash would also be disposed in an off-site hazardous waste landfill.

The 15 drums of IDW would be placed in the excavated trench and covered with fill. The site would then be graded and revegetated.

Institutional controls such as land use restrictions, access restrictions, property transfer restrictions would be implemented. Fences and warning signs would be installed.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells for 30 years. Annual inspections of the site would be performed.

2.10.6.2 Treatment Component

This alternative employs an off site incinerator for treatment of the contaminated soil. Soil exceeding LDRs would be sent to the incinerator where it would be treated to destroy the contaminants. Ash from the incinerator may also need to be stabilized to pass TCLP tests.

2.10.6.3 Containment Component

Containment would be provided by the off-site hazardous waste landfill where soil below LDRs would be directly disposed. The off-site landfill would be equipped with multiple top and bottom liners, leachate collection systems, leak detection systems, and a low-permeability cover. No containment of wastes on the Oroville Landfill is provided by this alternative.

2.10.6.4 General Component

Material in the pesticide debris trench would be excavated and staged in soil stockpiles according to its type. A mobile lab will be setup on-site to analyze material as it is excavated from the pesticide trench to determine whether it requires incineration or can be directly land disposed. Materials excavated from the trench will be screened to separate large debris from soil. Contaminated soil will be incinerated or disposed off-site whereas the large debris may be disposed of in the trench if not contaminated. Contaminated debris above action levels will be disposed in an off-site hazardous waste landfill.

2.10.6.5 Compliance with ARARS

This alternative would achieve human health cleanup standards for the site through off-site destruction or disposal of the contaminants. Elevated arsenic levels in the prospect pile would be eliminated as a site threat by placing this material in the bottom of the pesticide trench and covering it with fill.

Ecological risk would still remain slightly above guidelines in the area west of the pesticide trench. Due to conservatism used in the model, this risk is anticipated to be minimal.

Washington State Dangerous Waste Regulations are applicable to this alternative since dangerous wastes will likely be "generated" during the excavation of the pesticide debris trench. All generated wastes will be managed in accordance with Washington State Dangerous Waste Regulations. In the same way, LDRs are applicable to the wastes generated during implementation of this alternative. LDRs would be met by the treatment (incineration) of the pesticide debris trench contaminants prior to off-site disposal.

2.10.6.6 Costs and Remediation Time Frame

The cost of this alternative is estimated to be $30,940,000. This cost includes off-site incineration and disposal, maintenance and long-term monitoring over a 30-year period. A 3- to 4-month period would be required to excavate the wastes, incinerate the excavated material and backfill the trench.

2.11 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

2.11.1 Overall Protection of Human Health and the Environment

Alternative 1 provides no protection of human health and environment because contamination is left in place, as is. Alternative 2 provides protection of human health through institutional controls and barriers but provides no protection of the environment. Alternatives 3 and 4 provide protection through isolation of the contaminants from humans and ecological receptors. Some potential ecological risk remains under Alternative 4 as a result of not capping the entire landfill. However, due to the conservatism used in the model, this risk is anticipated to be minor. Alternatives 5 and 6 provide protection because they remove and/or destroy the most highly contaminated soil. However, like Alternative 4, some potential ecological risk remains since not all contaminated soil is removed.

2.11.2 Compliance with ARARS

Alternatives 1 and 2 would not comply with cleanup standards established by Washington State. Alternatives 3 and 4 would comply with cleanup standards by isolating the contamination and providing long-term monitoring. One small area of the site would exceed cleanup standards under Alternative 4 but this is not anticipated to be significant due to its very low hazard index. Alternatives 5 and 6 would also comply with cleanup standards since the contaminated soil exceeding allowable risks is removed and/or destroyed. Similar to Alternative 4, one small area of the site would not comply with ecological risk guidelines. This area is not expected to be significant due to the low risks present. Alternatives 1, 2, 3, and 4 would meet LDRs and Washington State Dangerous Waste Regulations since the wastes were disposed before the effective date of these regulations. Alternatives 5 and 6 would meet LDRs and Washington State Dangerous Waste Regulations since the wastes would be treated prior to disposal.

2.11.3 Long-term Effectiveness

Alternative 1 has no long-term effectiveness since no action is taken to reduce exposure to contaminants. Alternative 2 has the second lowest long-term effectiveness since it relies on institutional controls to provide protection. Over time, signs and documentation can be damaged or lost. Alternative 3 and 4 have better long-term effectiveness than Alternative 2 because the contaminated soil is isolated from the environment and human exposure. Alternative 5 and 6 have the best long-term effectiveness because the contamination is either destroyed or disposed in a secure and constantly monitored landfill.

2.11.4 Reduction of Toxicity, Mobility and Volume through Treatment

Alternatives 1, 2, 3, and 4 provide no reduction of toxicity, mobility or volume through treatment. However, Alternatives 3 and 4 provide reduction in mobility through isolation of the contaminants. Alternatives 5 and 6 provide reduction from incineration of the contaminated soil.

2.11.5 Short-term Effectiveness

Alternative 1 and 2 present no short-term risks since no remedial work is performed. Alternatives 3 and 4 present the second lowest risks since these alternatives involve minimal intrusive activities. The most significant short-term risks would be from injury by earth moving equipment. Alternatives 5 and 6 present the highest short-term risks. These risks are due to potential injury from earth moving equipment and potential exposure to highly toxic pesticides in containers or soil during the excavation activities. Additional risk includes the release of contaminants from bottles and drums of pesticides potentially breached during excavation. Of the active alternatives, Alternative 4 would be completed in the shortest time period--3 months.

2.11.6 Implementability

Alternative 1 requires no implementation since no work is performed. Alternative 2 is the second easiest to implement since it involves installation of signs and property restrictions. Alternative 4 is the third easiest to implement since only a portion of the landfill is capped.

Alternative 3 is next easiest to implement since it mostly involves site grading and backfilling. Alternative 6 is more difficult to implement since it involves excavation, backfilling and soil transport. Alternative 5 is the hardest to implement because it requires installation and testing of an on-site incinerator, incineration of contaminated soil, soil excavation, backfilling and equipment demobilization.

2.11.7 Cost

The costs for the various alternatives are shown in Table 2-14.

Table 2-14—Comparison of Alternative Costs

Alternative	Cost ($)
Alternative 1: No Action	0
Alternative 2: Institutional Controls	250,000
Alternative 3: Capping	3,440,000
Alternative 4: Selective Capping	660,000
Alternative 5: On-site Incineration and Capping	9,430,000
Alternative 6: Off-site Incineration/Disposal	30,940,000

2.12 THE SELECTED REMEDY

Based upon consideration of MTCA requirements, the detailed analysis of alternatives using the nine criteria, and comments from the public; BLM has determined that Alternative 4: Selective Capping is the most appropriate remedy for the Oroville Landfill.

2.12.1 Remedy Description

Alternative 4 consists of installing a low-permeability cap over areas of the landfill that have risks to human health and the environment above acceptable standards. As discussed in the risk assessment, human health risks exceed 1×10^{-5} only in the pesticide debris trench. Ecological hazards exceed guidelines (Hazard Index [HI] = 1) for three areas: (1) the pesticide debris trench, (2) the mineral prospect spoils pile, and (3) a limited area represented by one sample west of the pesticide debris trench towards the center of the landfill. BLM has determined that remediation the prospect spoils pile is beyond the scope of this action because similar spoils piles are so widespread across the region.

Alternative 4 would consolidate the ethion soil pile and 15 drums of nonhazardous IDW over the pesticide debris trench and cap this area with a low-permeability cap. The area west of the pesticide debris trench would remain uncapped, since although the hazard index (HI = 4) may indicate some potential ecological risk, the anticipated risk associated with this area is minor because the hazard index was calculated using RME exposure scenarios and conservative algorithms, and the hazard index is associated with a localized area which is smaller than the home range of either of the receptors evaluated. Capping the pesticide debris trench would provide erosion control, minimize infiltration into the trench, and prevent exposure to ecological receptors.

The pesticide debris trench would be graded to remove high and low areas and any existing plants or shrubs. The drums and pile of ethion soil would be loaded onto trucks and spread evenly over the pesticide debris trench. The trench area would then be capped. The cap would consist of 24 inches of clay (maximum permeability 1×10^{-6} cm/sec) covered with 24 inches of topsoil. This cap construction was selected because the landfill is located in an arid region of the state, and high evapotranspiration rates exist that result in low groundwater recharge rates.

Topsoil would be revegetated with native grasses. The cap would extend approximately 25 feet beyond the edges of the pesticide debris trench to prevent exposure to burrowing animals. The cap would be designed with slopes of approximately 10 to 20 percent to coincide with the approximate slope of the landfill surface. Area covered by the cap would be approximately 230 feet long by 110 feet wide. The source of clay and topsoil is assumed to be available on BLM lands at a distance of less than 20 miles.

To prevent precipitation, run-on or snow melt on the uphill side of the cap from pooling at the cap/landfill interface and infiltrating under the cap, a shallow ditch lined with an impermeable membrane and filled with gravel would be constructed around the uphill perimeter. The drainage ditch would extend partly down the ends of the cap where it would discharge onto the landfill surface. A 2-inch to 3-inch layer of gravel would be placed near the trench discharge points to prevent erosion.

Institutional controls such as land use restrictions, access restrictions, property transfer restrictions would be implemented to manage the contaminants left on-site. Fences and warning signs would be installed.

Long-term monitoring would consist of sampling surface soil and sediment from the existing gullies located below the landfill at least every 5 years and annual sampling of groundwater seeps, leachate, and upgradient and downgradient deep aquifer monitoring wells for 30 years. Annual inspections of the cap for degradation would be performed and needed repairs made.

2.12.2 Cleanup Levels

The cleanup goals for the Oroville Landfill were developed from a human health/ecological risk assessment. The risk assessment determined that the pesticide trench conditions pose an excess child lifetime cancer risk of 1×10^{-5} and a hazard index of 6.4. The trench also had the highest ecological risk with an average hazard index of 440. The risk assessment determined that the most stringent cleanup goals would be those necessary to protect burrowing animals. Therefore, the cleanup goals shown in Table 13 were developed such that they do not result in excessive risk to animals burrowing in landfill soil.

2.12.3 Cost and Remediation Time Frame

The time to implement this alternative is estimated at 3 months. The costs for this alternative are $660,000 as shown in Table 2-15.

2.13 STATUTORY DETERMINATION

This section discusses how the selected remedy meets four criteria critical to determining the most optimum remedy.

2.13.1 Protection of Human Health and the Environment

Overall protection of human health and the environment is obtained through the reduction of contaminant mobility and human and biotic exposure to contaminants. Organic contaminants would be expected to naturally degrade over time. Inorganic contaminant concentrations would remain the same, except in areas where leaching would occur. Leaching would be expected to be minimal since run-on/runoff controls would be implemented and highly contaminated areas would be capped.

Capping would reduce ecological hazards and human health risks due to dermal contact, inhalation and ingestion of contaminants. The human health risk would be reduced to less than 1×10^{-5} and a hazard index less than 1.0. The ecological risk would be reduced to less than 1.0 in most places of the site. Some ecological risks would remain in the area west of the pesticide debris trench since the contaminants in this area are not treated or contained. The risk associated with this area is expected to be minimal since conservative estimates indicate a hazard index value of 4. Calculation of this hazard index assumed constant exposure to the contaminants and used conservative RME exposure scenarios.

During relocation of the ethion soil material and construction of the cap, on-site and off-site risks would be minimized through engineered controls, use of personal protective equipment and appropriate decontamination procedures.

This alternative would also have no significant short-term risks since minimal excavation is performed. It is anticipated that few injuries would occur as a result of importing soil, backfilling and grading.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

Containment through capping complies with cleanup standards, provided that it includes a compliance monitoring program that ensures the long-term integrity of the containment

Table 2-15—Selective Capping Cost Estimate

Item	Unit	Quantity	Unit Cost	Total Cost
Direct Capital Costs				
1. Construction				
Clay Layer	CY	2500	$12.00	$30,000
Topsoil Layer	CY	2500	$8.00	$20,000
Revegetation	Acre	0.6	$1,500.00	$900
Cap Installation	CY	5000	$3.00	$15,000
Cap Run-on Diversion Trench	LF	450	$3.00	$1,350
Mobilization/Demobilization	15% of Subtotal			$10,088
2. Building & Services	LS	1	$5,000.00	$5,000
Total Direct Costs:				$82,338
Indirect Capital Costs				
1. Engineering, Construction Management, Oversight	25%			$20,584
2. Contingency Allowances	30%			$24,701
3. Permits, Legal Fees, Licenses for Cap Construction	5%			$4,117
4. Sales Tax	7.8%			$6,422
Total Indirect Costs:				$55,824
Total Capital Costs:				$138,162
Operation and Maintenance Costs				
1. Sampling (beginning 1996)				
Water Sampling: Seeps, Wells, Leachate	Workdays/Year	3	$750.00	$2,250
Analytical (chlorinated pesticides)	Samples/Year	5	$620.00	$3,100
Sediment Sampling	Workdays/Year	1	$750.00	$750
Analytical (chlorinated pesticides)	Samples/Year	3	$740.00	$2,220
Surface Soil Sampling (per Alt 2)	Workdays/Year	0.2	$750.00	$150
Analytical (chlorinated pesticides)	Samples/Year	1	$740.00	$740
Report	Workhour/Year	20	$80.00	$1,600
2. Annual Seeding	Allowance/Year	1	$1,000.00	$1,000
3. Administration	Workhours/Year	25	$80.00	$2,000
4. Maintenance Reserve	Allowance/Year	1	$20,000.00	$20,000
Total Operation & Maintenance Costs:				$33,810
Present Worth Analysis:	Discount Range	5%		$519,743
TOTAL COSTS:				$657,905

system and includes long-term monitoring and institutional controls. Therefore, cleanup goals would be achieved for the majority of the site, including the pesticide debris area.

Ecological cleanup goals may be slightly exceeded for the area west of the pesticide debris trench since the materials from this area are not contained or treated. It is probable that the risks from this area will be minimal. Human health risks from the contaminants in this area do not exceed 1 x 10^{-5}. Ecological hazards are also expected to be minimal since conservative estimates indicate that the hazard index value is 4.

Alternative 4 would comply with applicable state and federal laws. In Washington, the Dangerous Waste Regulations govern the generation, handling, treatment, storage and disposal of dangerous waste, and establish permitting requirements for dangerous waste management facilities. However, all dangerous waste at the Oroville Landfill was deposited prior to the earliest effective date of the Dangerous Waste Regulation (2 February 1982). In addition, hazardous waste that is land disposed before 8 November 1986, does not have to be removed from the land disposal unit for treatment to achieve compliance with land disposal restrictions. Therefore, the provisions of the Dangerous Waste Regulations do not apply to Alternative 4.

In order to protect worker health and safety and ensure compliance with health and safety requirements, cap installation would comply with worker protection standards under 29 CFR 1910 and Chapter 296-62 WAC.

The pesticide debris trench would be capped to minimize infiltration through the contaminated soil and debris and to prevent contact with human and environmental receptors. Construction of the cap would comply with the minimal functional standards of Chapter 173-304 WAC.

2.13.3 Cost Effectiveness

The selected remedy is cost effective because it balances protection of human health and environment against short-term effectiveness, long-term effectiveness and reduction in toxicity, mobility and volume. The costs for alternatives that provide treatment or off-site disposal, and for capping the entire landfill are disproportionate when compared to the incremental benefit in long-term effectiveness gained. The selected remedy optimizes the remedial benefit gained while minimizing costs.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practical

The selected remedy provides the best balance of trade offs among the alternatives with respect to the evaluation criteria. Selective capping maximizes long-term effectiveness and permanence while minimizing short-term risk, costs and implementability difficulties. Although selective capping does not reduce toxicity, mobility and volume through treatment, it does reduce mobility by isolating the contaminants.

Although there are other alternatives that provide better long-term effectiveness (Alternatives 5 and 6), their short-term risks are much higher, they are more difficult to implement and are disproportionately expensive when compared to the incremental benefit gained.

Alternatives 1 (no action) and 2 (institutional controls) are less expensive, have fewer short-term risks and are easier to implement than the selected alternative but they provide no or minimal protection of human health and environment, provide no reduction in toxicity, mobility and volume and minimal long-term effectiveness.

Capping the entire landfill (Alternative 3) is much more expensive than selective capping but provides very little additional overall protection of human health and the environment.

2.13.5 Preference for Treatment as a Principal Element

The selected remedy does not meet the preference for treatment as a principal element since capping is the only remedial activity performed. Treatment of site contamination requires excavation of site materials. Much of the buried hazardous materials on-site is in unknown form but, based on historical information, some is believed to exist as drums and bottles of pesticides and herbicides. As a result of the extreme toxicity of this material and the likelihood of rupturing the containers during excavation, it was determined that *in situ* isolation was the best and safest remedy for this material.

2.14 RATIONALE FOR DECISION ON NEED FOR A NATURAL RESOURCES DAMAGE ASSESSMENT

Under the NCP, Natural Resource Damage Assessments (NRDAs) are often performed where an oil spill or other release of a hazardous substance causes harm to environmental resources. In the case of Oroville Landfill, BLM leased the area as a municipal dump site under the Recreation and Public Purposes Act in 1967. When the lessee needed a place to dispose of fire damaged pesticides in 1969, there were no environmental laws or guidelines in place at the time for the disposal of dangerous chemicals. Placement of the pesticide wastes in a landfill trench, considering the rather arid environment at the site, was standard practice at that time.

BLM learned of the problem at the site in 1987 and began a series of investigations and construction projects to determine the extent and seriousness of the contamination and to protect the environment. To ensure the remedy is effective, monitoring of the pathways by which contaminants move will continue for 30 years, following remediation.

Because there is no evidence of any harm to water quality, fish, wildlife, vegetation, or other natural resources, and because eliminating livestock access to a small area by fencing is a very minor impact, BLM has determined there is no need to perform an NRDA at this site.

SECTION 3

RESPONSIVENESS SUMMARY

3.1 INTRODUCTION

This summary responds to comments received on the Oroville Landfill Proposed Plan during the public review period held by the United States Department of the Interior Bureau of Land Management from August 1, 1995 to August 31, 1995. The proposed plan was developed from information in the Oroville Landfill Remedial Investigation/Feasibility Study. Copies of the Proposed Plan were available at the Oroville Public Library in Oroville, Washington, BLMs Spokane District Office in Spokane, Washington, and their Wenatchee Resource Area Office in Wenatchee, Washington. BLM issued a Fact Sheet in August 1995 summarizing the work completed to date and encouraging participants to submit comments on the Proposed Plan.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

Table 3-1 provides a chronological summary of BLM's community involvement efforts.

3.3 SUMMARY OF PUBLIC COMMENTS AND BLM RESPONSES

Table 3-1—Summary of Community Involvement Efforts

Mailing	Date	Number Sent
Fact Sheet on RI/FS		
- Oroville Library	24 February 1992	15
- Public	26 February 1992	103
- Media	26 February 1992	13
RI/FS		
- Oroville Library	3 July 1995	1
- Department of Ecology (Yakima, WA)	15 June 1995	1
State Environmental Policy Act Checklist		
- Department of Ecology (Yakima, WA)	15 June 1995	1
Environmental Assessment		
- Public	30 June 1995	25
- Media	30 June 1995	12
- Oroville Library	3 July 1995	1
- Newspapers (legal notices)	3 July 1995	6
- Newspapers (news releases	28 June 1995	22
- Letter to public announcing availability of EA	5 July 1995	92
Proposed Plan/Draft Cleanup Action Plan		
- Oroville Library	1 August 1995	2
- Public	1 August 1995	14
- Department of Ecology (Yakima, WA)	1 August 1995	1
- Media	1 August 1995	5
Fact Sheet on Proposed Plan/Draft Cleanup Action Plan		
- Oroville Library	1 August 1995	10
- Public	1 August 1995	24
- Media	1 August 1995	10

3.3 SUMMARY OF PUBLIC COMMENTS AND BLM RESPONSES

3.3.1 Overview

The selected remedial action response is to construct a four foot thick, low-permeability cap over the pesticide disposal trench, as described in Section 2.12.1.

This remedy differs from that described in the Proposed Plan in one way. BLM has determined the mineral prospect spoils pile need not be removed and placed over the trench area prior to construction of the cap. There are many similar spoils piles in the general area, and elsewhere in Northern Washington, left from previous mineral exploration. None of these are planned for treatment. In addition, the spoils are situated over 100 feet down a very steep slope making retrieval of the material nearly impossible. Also, the landfill was ranked and placed on the Washington Site Register based on its pesticide contamination, not for naturally occurring arsenic levels.

BLM is currently investigating other low-cost options for in-place treatment of the spoils, such as liming, to neutralize or bind-up the arsenic and make it unavailable to plants and animals.

No new alternatives have been presented by the public; in fact community interest in the site has been quite low and no preference for one alternative over another has been expressed.

3.3.2 Background on Community Involvement

Over 100 fact sheets were distributed to the public and media in February 1992. The sheets included a form for commenting and requesting additional information. Fifteen of the forms were returned but none listed concerns or other comments.

The Environmental Assessment (EA) and Proposed Plan/Draft Cleanup Action Plan (PP/DCAP) were made available to the public and media as shown in Table 3-1. The formal comment period on the EA ran from June 30, 1995 to August 1, 1995. For the Proposed Plan, it ran from August 2, 1995 to August 31, 1995. One written comment was received on each of the two documents. No modifications or other changes in the proposal were indicated based on these comments. Due to lack of interest, no public meeting was held.

3.3.3 Summary of Comments Received and Agency Responses

Comments and questions raised during the public comment periods on the EA and PP/DCAP for the Oroville Landfill remedial action are presented and discussed in detail in this section. The two comment letters received are provided in the Appendix. There were no verbal comments and no written comments were received after the end of the formal comment period.

3.3.3.1 Comments on the Environmental Assessment

The single comment on the EA was from the Columbia River Inter-Tribal Fish Commission (see Appendix). Each comment is numbered in this text and in the letter and is presented in a "comment" and "response" format.

1) Comment: "Actions affecting the site have the potential to adversely affect federally reserved treaty resources of our member tribes. For this reason, and substantial deficiencies in the EA, we request that the Bureau prepare a full environmental impact statement to allow the action to be fully examined and evaluated."

Response: The Remedial Investigation/Feasibility Study (RI/FS) completed in July, 1993 is considered functionally equivalent to an EIS by the US Department of Justice and the Environmental Protection Agency. Therefore, an EIS will not be prepared.

2) Comment: "While the EA presented a good general overview of some of the problems, the EA failed to fully address cultural resource, water quality and fishery issues."

Response: The preferred alternative in the EA proposes minimal disturbance of a site extensively disturbed in the past when it was a municipal landfill so damage to cultural resources is highly unlikely. Since the RI/FS found no contamination in water samples from the Similkameen River and very low concentrations in only one sample of river sediment, impacts to water quality and fisheries are not expected. The proposed action would encapsulate contaminated soils and greatly reduce the chance of future off-site impacts.

3) Comment: "To our knowledge, none of our tribes, in particular the Yakama Indian Nation, was consulted by the Bureau in the development of this EA."

Response: Several officials of the tribe nearest the site, the Colville Confederated Tribes, were sent both of the fact sheets, copies of the EA and PP/DCAP, and letters announcing the availability of the EA. There were no requests for a copy of the EA and no comments were submitted.

The Yakama Indian Nation Tribal Council Chair was sent a copy of the PP/DCAP and a fact sheet on August 29, 1995 requesting a review for Traditional Cultural Properties or sacred areas that might be affected by the proposed actions.

4) Comment: "We found that the EA failed to consider the full potential of the hazardous waste site to hinder or prevent recovery of treaty reserved salmon and steelhead resources of the Similkameen River."

Response: See response to #2) above.

5) Comment: "Additionally, the EA has not addressed any synergistic or cumulative effects of the proposed action. It is possible that all anadromous salmonid stocks in the Similkameen could become transboundary stocks. The EA has not addressed this issue."

Response: Since there are no impacts to water quality and fish, there are no cumulative impacts and no impacts to transboundary stocks. Transboundary stocks have never been an issue at the site.

6) Comment: "Also, given the strong likelihood that Enloe Dam will be removed, it is essential that the Oroville landfill remediation prevent leakage of toxic wastes into the Similkameen River. Because they both reside close to each other on Bureau land, CRITFC considers the Enloe Dam project and the landfill site as very closely linked."

Response: The proposed cap is designed to prevent migration of pesticide contaminated soil by wind and water erosion and leaching into ground water by infiltration of surface water, thus protecting the river and fish. Enloe Dam has no relationship to the landfill as it is 3/4 mile to the west and 200 feet below the landfill in elevation.

7) Comment: In our opinion, it is not acceptable to make final decisions, without thorough analysis, on actions which may hamper or prevent salmon enhancement in the Similkameen watershed."

Response: Since a problem at the landfill was recognized in 1987, the Bureau has conducted a number of studies, including a slope stability study, Site Investigation, Expanded Site Investigation, and RI/FS. The slope stability study resulted in emergency appropriations to construct a gabion wall to prevent a massive slide of unconsolidated landfill debris that would have ruptured the irrigation canal and, very possibly, have entered the river. During gabion construction, measures were also taken to control and divert surface runoff away from known contaminated areas.

As stated previously, the RI/FS is equivalent to an EIS. The RI characterized the hydrology, geology, contaminants, and site migration pathways, among other things. It also developed conclusions, supported by RI data, regarding the source of contamination, potential for off-site release, and extent of contamination, both from a concentration and a real standpoint. A baseline assessment of risk to human health and the environment was also performed.

In the FS portion, all potential remedial alternatives were developed that are applicable to the site. Remedial alternatives were screened by considering their effectiveness, ease of implementation, cost, and environmental impacts. A detailed analysis of alternatives was completed and the selection of the preferred alternative presented.

All steps in the process to select an appropriate remedy for the site were documented and, along with the studies, made available to the public and interested parties at local and regional centers (Oroville Library, Dept. of Ecology in Yakima, and BLM's Wenatchee and Spokane Offices).

Therefore, analysis was thorough. Again, there is no indication of impacts from the proposed action that might affect salmon enhancement.

8) Comment: "CRITFC is particularly concerned that the Bureau's preferred EA alternative, simply capping the existing site, does not meet cleanup standards under the Model Toxics Control Act and thus increases the long term risks to human health and to the environment."

Response: CRITFC has not identified which criteria the preferred alternative fails to meet. MTCA cleanup standards are presented in Table 5 and discussed in considerable detail on pages 8 to 11 of the PP/DCAP. The planned remedy meets all four of the threshold criteria, all five of the balancing criteria, and the one modifying criteria.

The discussion is summarized on page 11 as follows. "...the preferred alternative provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. It provides good protection of human health and the environment, meets state and federal laws, and complies with state cleanup standards. It provides good long- and short-term effectiveness, is easily implementable, and has a moderate cost."

9) Comment: We do not believe that these risks, which are accepted in the preferred alternative, can be adequately addressed by a monitoring program."

Response: The monitoring program, which will continue at least 30 years, is designed to detect contaminant movement or migration through the surface water and ground water pathways. Further investigation and remedial action will be required in the future should monitoring detect appreciable contaminant movement from the site.

3.3.3.2 Comments on the Proposed Plan/Draft Cleanup Action Plan

The only written comment on the PP/DCAP was from Mr. Jay A. Johnson of the law offices of Davis, Arneil, Dorsey, Kight, & Parlette of Wenatchee, representing Chamberlin Distributing Company, the source of fire damaged pesticides disposed at the landfill.

1) Comment: "It is our further understanding that a majority of the materials in the pesticide trench did not come from the warehouse fire, but from a historic use of that trench by local orchardist for the deposit of spray materials and hazardous waste."

Response: A 1991 confidential report commissioned by the BLM investigated potentially responsible parties in the disposal of pesticides at the landfill. The report identifies five separate witnesses as stating that:

1) a special trench was constructed after the Chamberlain Warehouse fire;
2) damaged pesticides from the fire were disposed of in that trench;
3) no other pesticides from any other source were disposed there; and
4) the trench was covered with soil within a week after the fire.

APPENDIX

C 2: 1703 ORZA

COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION
729 N.E. Oregon, Suite 200, Portland, Oregon 97232
Telephone (503) 238-0667
Fax (503) 235-4228

RECEIVED
AUG - 4 1995
BUREAU OF LAND MANAGEMENT
SPOKANE, WA

August 1, 1995

Via facsimile, 3:00 p.m.

Joseph K. Buesing
Spokane District Manager
Bureau of Land Management
Spokane District Office
1103 N. Fancher
Spokane, Washington 99212

RE: Oroville Landfill Site Remediation (1703 ORZA)

Dear Mr. Buesing:

The Columbia River Inter-Tribal Fish Commission (CRITFC), a technical service organization for the Confederated Tribes of the Warm Springs Reservation of Oregon, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, and the Yakama Indian Nation, appreciates the opportunity to comment on the Environmental Assessment entitled, "Oroville Landfill Site Remediation." 1 Actions affecting the site have the potential to adversely affect federally reserved treaty resources of our member tribes. For this reason, and substantial deficiencies in the EA, we request that the Bureau prepare a full environmental impact statement to allow the action to be fully examined and evaluated.

2 While the EA presented a good general overview of some of the problems, the EA failed to fully address cultural resource, water quality and fishery issues. 3 To our knowledge, none of our tribes, in particular the Yakama Indian Nation, was consulted by the Bureau in the development of this EA.

4 We found that the EA failed to consider the full potential of the hazardous waste site to hinder or prevent recovery of treaty reserved salmon and steelhead resources of the Similkameen River. For example, the reach of the river adjacent to the site is critical habitat for a particular stock of summer chinook which displays a unique subyearling life history. Although low in numbers, this stock has had the ability to persist above nine mainstem dams. The adjacent site also provides important holding habitat for adult salmonids. Further, just a few miles downstream, a salmon rearing pond built to mitigate the impacts of Rock Island Dam could be impacted by the proposed alternatives.

Additionally, the EA has not addressed any synergistic or cumulative effects of the proposed
5 action. It is possible that all anadromous salmonid stocks in the Similkameen could become
transboundary stocks. The EA has not addressed this issue. Also, given the strong
likelihood that Enloe Dam will be removed, it is essential that the Oroville landfill
6 remediation prevent leakage of toxic wastes into the Similkameen River. Because they both
reside close to each other on Bureau land, CRITFC considers the Enloe Dam project and the
landfill site as very closely linked. In our opinion, it is not acceptable to make final
7 decisions, without thorough analysis, on actions which may hamper or prevent salmon
enhancement in the Similkameen watershed.

CRITFC is particularly concerned that the Bureau's preferred EA alternative, simply capping
8 the existing site, does not meet cleanup standards under the Model Toxics Control Act and
thus increases the long term risks to human health and to the environment. We do not
9 believe that these risks, which are accepted in the preferred alternative, can be adequately
addressed by a monitoring program.

In conclusion, consistent with the Bureau's trust responsibility to our member tribes, we recommend that the Bureau begin scoping for an environmental impact assessment (EIS) that can address among other things, the issues presented above. We anticipate that a thorough EIS will allow correction and resolution of deficiencies in the EA. Should you have questions regarding these comments please contact Robert Heinith at (503) 731-1289.

Sincerely,

Ted Strong
Executive Director

ts:rh

cc: Fisheries program managers
Bambrick, YIN
Oshie, YIN
Hamilton, YIN
Llewelyn, WA Ecology
Scott-Brier, DOI
Burnham, BIA/Portland

DAVID J. DORSEY
MILBURN D. KIGHT
ROBERT L. PARLETTE
ROBERT L. WHITE*
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THOMAS F. O'CONNELL
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August 25, 1995

RECEIVED
AUG 28 1995
BUREAU OF LAND MANAGEMENT
SPOKANE, WA

Jake Jakabosky .
Bureau of Land Management
Spokane District Office
1103 North Fancher Road
Spokane WA 99212-1275

Re: Oroville Landfill Proposed Plan/Draft Cleanup Action Plan

Dear Jake:

This is a follow up to our phone conversation on August 24, 1995 concerning the Draft Cleanup Action Plan for the Oroville Landfill Site. As I explained to you, Our firm represents Chamberlin Distributing Company. The proposed Plan/Draft Cleanup Action Plan would appear to infer/indicate that the majority of the debris in the pesticide debris trench located in the northeast corner of the landfill site is attributable to debris removed from a fire at Chamberlin's warehouse in Oroville, Washington. Although I believe some of the material in the pesticide trench may have been from the foregoing fire, it was delivered to that site at the direction of the Okanogan County Health Department and at the direction of the City of Oroville. It is our further understanding that a majority of the materials in the pesticide trench did not come from the warehouse fire, but from a historic use of that trench by local orchardist for the deposit of spray materials and other hazardous waste.

1

I would request that you put our firm on your mailing list concerning any proposed actions relating to the above referenced matter. Your courtesies on this matter are appreciated.

Very truly yours,

Jay A. Johnson

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F:\JAJ\C-E\CHMBB.L05
August 25, 1995