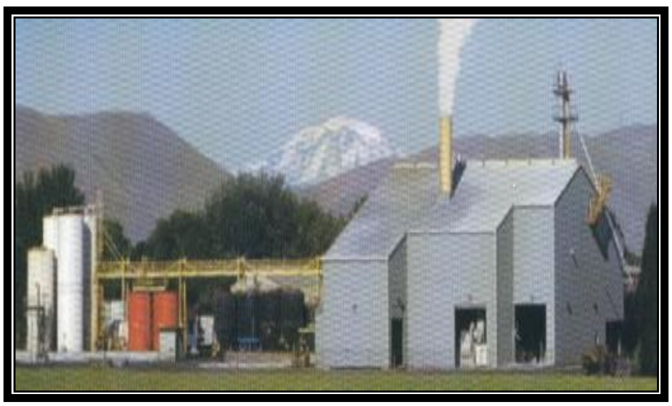
REMEDIAL INVESTIGATION REPORT
AND
VOLUNTARY CLEANUP PLAN



Bay Zinc Company, Inc.
Moxee, Washington

Prepared for: Teck Cominco American, Incorporated

Prepared by:

June 13, 2002

Mr. Greg Caron
Site Manager - Hydrogeologist
Washington Department of Ecology
15 W. Yakima Avenue, Suite 200
Yakima, Washington 98902-3452

Re: Remedial Investigation Report/Voluntary Cleanup Plan
Bay Zinc Company Facility
Moxee, Washington
Linebach Funkhouser Project Number 016-02

Dear Mr. Caron:

Linebach Funkhouser, Inc. (LFI), consultant for Teck Cominco American Incorporated (TCAI) has prepared this report documenting the results of recent remedial investigation activities conducted at the Bay Zinc Company, Inc. (Bay Zinc) facility in Moxee, Washington. The attached document also includes a Voluntary Cleanup Plan to be followed by Bay Zinc for implementing corrective action measures at the site, based on the results of the remedial investigation. The attached report and cleanup plan reflect the discussions and findings presented in preliminary form during past meetings (February, March and April) among LFI, TCAI and Washington Department of Ecology (Ecology) representatives.

As you are aware, TCAI is evaluating options regarding the potential acquisition of production equipment from the Bay Zinc facility, and must adhere to an accelerated schedule to address immediately impending financial implications regarding the site. No real property will be purchased by TCAI as part of the pending transaction or otherwise. LFI and TCAI appreciate the spirit of cooperation Ecology has shown in working through issues at the site, and we look forward to Ecology's continued prompt document review efforts and responses to keep this critical project moving forward.

Please contact Mr. Roy Funkhouser at 502-895-5009 if you have any technical questions about this report or the project in general.

Sincerely,

Bradley L. Coyle
Staff Geologist

Roy V. Funkhouser, P.G.
Principal Hydrogeologist
NGWA Certified Groundwater Professional No. 282

cc: Greg Schoen, TCAI
Lyle Beaudoin, TCAI
Richard Camp, Bay Zinc Company

REMEDIAL INVESTIGATION REPORT/VOLUNTARY CLEANUP PLAN

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1.0 INTRODUCTION

The Bay Zinc Company, Inc. (Bay Zinc) operates a micronutrient fertilizer manufacturing facility in Moxee, Washington, approximately 6 miles east of Yakima (Figure 1). The street address is 301 West Charron Road, Moxee, Washington. The facility occupies approximately 11 acres. Property surrounding the Bay Zinc facility is used for light industry and agricultural purposes.

Bay Zinc purchased the present site from American Excelsior Company in 1971. American Excelsior Company produced shredded cottonwood for apple and other fruit packaging material at the Moxee plant. Bay Zinc made plant modifications and began production of zinc soil amendments in the fall of 1972. The current owner of the property is Katherine Marjorie Swinehart. Current owners of Bay Zinc Company are Richard J. and Jessica Camp and the Testamentary Trust under the will of Richard Camp. Bay Zinc's officers and directors are Richard and Jessica Camp. The operation and control of the site is solely by Bay Zinc and there are no other participants in management except for the employees, officers and directors of Bay Zinc.

Approximately 95 percent of the fertilizer products currently sold by Bay Zinc consist of a dry, 35.5-percent zinc granule used in dry blends to correct deficiencies in row crops such as potatoes, corn, and wheat.

1.1 Manufacturing Process

Bay Zinc has produced zinc micronutrient fertilizer product utilizing two separate processes which are termed as follows:

- Oxysulfate process (inactive)
- New Zinc Sulfate process

The Oxysulfate process was taken off-line prior to June of 1998 and the new zinc sulfate process was constructed in its place.

Oxysulfate Process

Major zinc-bearing raw materials utilized in the oxysulfate dry zinc fertilizer process have included:

- Steel mill flue dust
- Incinerator ash from the combustion of tires
- Other characteristic metallic wastes such as brass dust. These raw materials are dry, powder or granular, fly-ash-like materials.

Steel mill flue dust, also known as electric arc furnace dust generated from the primary production of steel, is a listed hazardous waste (K061). Steel mill flue dust has not been accepted at the facility since February of 1998. Tire ash and brass dust both can be characteristic hazardous waste for cadmium and lead (D006 and D008) and have not been used at the facility since 1998.

The dry, zinc-bearing material was delivered to Bay Zinc via railcar or truck and then unloaded into one of two storage tanks that serve as continuous feeders to the manufacturing process. A system of enclosed mechanical feed devices transfers the material from either of the two storage/feed tanks to the manufacturing process. The dry, zinc-bearing material, along with sulfuric acid and water, was fed to the rotary shell granulator where a chemical reaction converts much of the zinc oxide, and some of the iron oxide and lead oxide, to sulfates. Anti-cake agents were added to the granulator effluent before it is fed into the product dryer, which drives off moisture in the product to produce a dry, granular material. The registered, finished product was sold to retailers, blenders, and other wholesale fertilizer distributors.

There were no byproducts or waste streams generated during the dry fertilizer manufacturing process. All process water is consumed in the manufacturing and drying process, and all sweepings and spillage from the process line are reintroduced into the process.

New Zinc Sulfate Process

The new zinc sulfate plant is located in the process building east of the rail spur. Construction of the new plant began in July of 1998 and was completed in April of 1999. The plant was in full production mode by June of 1999. The primary raw materials used in this process are zinc fines, which are a by-product of galvanizing operations. The zinc fines are delivered to the facility in one ton Supersacks and transferred to one of two mixing tanks, where the zinc dust is combined with water in order to form a pumpable slurry. The slurry is pumped into one of two reactor vessels where it is combined with sulfuric acid, and the subsequent reaction converts the zinc oxide and zinc metal to zinc sulfate. The solubilized zinc sulfate and solid reaction residue are then pumped through a recessed plate filter press, which removes cadmium, lead, other metals, and non-soluble material. The resulting material is stabilized and landfilled at a hazardous waste site or recycled through a smelting process.

The zinc sulfate solution is pumped into holding tanks. From the holding tanks, the zinc sulfate solution is either sold as liquid or sent to the granulating plant for dehydration. Baghouse dust collectors are used to collect dust generated from product handling. Dust collected in the baghouses is reintroduced to the process, so no waste is generated from these devices. Separate bulk storage tanks are used to store finished product. These tanks lead to an outside bulk loading for trucks or railcars, or to packaging equipment for bulk bags.

Since June 2001, zinc solution has been received by truck at the site and used to produce zinc monohydrate granular micronutrient fertilizer. No waste is generated from the use of this zinc solution.

Old Liquid Fertilizer Manufacturing Process

Prior to the construction of the new zinc sulfate plant, liquid zinc sulfate fertilizer product was produced in the present-day area of the new zinc sulfate plant. To produce the liquid zinc sulfate fertilizer, galvanizer byproducts were mixed with water and sulfuric acid in galvanizer pots, and the mixture was routed to settling tanks. In the tanks the mixture separated into a clean liquor, which was the finished liquid zinc sulfate product, and a sludge. The sludge was rinsed and then placed in metal boxes where it was dewatered using a vacuum system. The sludge was ultimately transported off-site for proper disposal.

1.2 Purpose

Bay Zinc's historic manufacturing operations resulted in releases of certain metals and inorganics to soil and groundwater at the site. Site inspections by USPEA Region 10 contractors, environmental consultants for Bay Zinc, and Washington Department of Ecology (Ecology) personnel over the past few years resulted in the identification of several solid waste management units (SWMUs) and areas of concern (AOCs). In February, March, and April of 2002, extensive environmental assessment work was conducted to further investigate SWMUs and AOCs at the site. The purpose of the work was to evaluate the effect that potential past releases may have had on the surface and subsurface, and to assess potential remediation approaches and associated costs. Results of the remedial investigation and a discussion of the proposed remediation approach to the site are included in the following sections of this document.

2.0 HISTORY OF REGULATORY ACTIVITY/PREVIOUS STUDIES

Certain constituents in products used by Bay Zinc to manufacture fertilizer have been detected in soil, and to a lesser extent, groundwater at the site. Key constituents in soil have been cadmium, lead, and zinc. Primary constituents of concern in groundwater have been sulfate, chloride, zinc, cadmium, and manganese. Regulatory activity concerning the plant has been ongoing since 1980. The facility has an EPA ID Number, WADO27530526. A summary of key historical environmental assessment and remediation activities conducted at the site is as follows. A more detailed discussion of Bay Zinc's historic site operations, past regulatory involvement, and voluntary actions is included in the text of the RCRA Facility Assessment (RFA) Report, prepared by a USEPA contractor, which has been included in Appendix A of this report.

<u>1972 – 1979</u>

Bay Zinc began production of zinc soil amendments in 1972. Two documented releases of liquid zinc sulfate occurred in the 1970s, and are described as follows:

- In early 1974, a broken valve on a 20,000 gallon tank, which occurred at night, resulted in the release of approximately 17,000 gallons of liquid zinc sulfate. None of the product was recovered.

- In early 1976, a wooden digest pot failed at night, resulting in the loss of 6,000 gallons of zinc sulfate solution with no recovery. The 1976 release and the 1974 release were reported to have migrated in a northerly direction, pooling in a topographical depression in the area of existing recovery well MW-8.

Approximate locations of these two historic releases are shown in Figure 2.

<u>1980 – 1984</u>

Bay Zinc originally filed for interim permit status under RCRA in 1980. At that time, USEPA Region 10 determined that the facility was exempt from RCRA permit requirements because it was a recycling facility. In 1984, USEPA Region 10 rescinded their previous determination and required Bay Zinc to obtain a RCRA permit for the storage of hazardous waste as raw material prior to introduction to the manufacturing process.

In the spring of 1982, a vertical weld in the bottom ring of a vertical storage tank failed, causing a spill of approximately 12,000 gallons of liquid zinc sulfate solution. More than half of this release was recovered. Most of the spill ran northward, following the railroad spur. The approximate location of the release is shown in Figure 2.

1985 – 1988

Bay Zinc submitted a RCRA Part B Permit Application in October of 1985. In July of 1987, Bay Zinc submitted a revised notification form to Ecology to indicate that in addition to being a treatment, storage, and disposal facility (TSD), Bay Zinc was also a Large Quantity Generator of hazardous waste. Bay Zinc was issued a final Joint Permit for the Storage of Hazardous Waste by USEPA Region 10 and Ecology on November 4, 1988.

In 1985, groundwater monitoring wells were installed and groundwater monitoring was initiated. Levels of sulfate, manganese, and zinc exceeded USEPA secondary maximum contaminant levels (MCLs) for drinking water. It was concluded that past spills of zinc sulfate solution, including those previously referenced, were responsible for the groundwater impacts. Additionally, prior to 1985, the pad for the zinc sulfate reaction vessels was not fully contained, and drained into the process water makeup tank. This lack of containment was also believed to have potentially contributed constituents to groundwater. Ecology entered into a Consent Order with Bay Zinc to remediate the affected groundwater.

As stated previously, the major raw materials historically used in Bay Zinc's micronutrient fertilizer manufacturing operations have been a steel mill byproduct, electric arc furnace dust (K061), and tire ash. Tire ash may be a characteristic hazardous waste for lead and cadmium (D006 and D008). Some of the K061 material was temporarily stored in a waste pile onsite, prior to its use in the fertilizer manufacturing process. Bay Zinc originally had approval from the Ecology to store the material for an extended period of time based on the beneficial reuse of the material.

The waste pile was not regulated under RCRA until April of 1985 according to USEPA Region 10's regulatory interpretation. The pile became regulated when USEPA policy changed to define any storage as active storage. The waste pile was covered after 1986 and had designed run-on and runoff controls.

In February of 1988, Bay Zinc submitted a *Preliminary Remedial Action Plan and Data Summary Report* to USEPA Region 10 and Ecology. The document contained a summary of quarterly groundwater monitoring conducted as part of the site's RCRA permit. The report also described the history of past zinc sulfate releases, including the 1974, 1976, and 1982 episodes previously referenced.

The 1988 Preliminary *Remedial Action Plan (PRAP)* was prepared to address levels of sulfate, manganese, and zinc that had been detected in groundwater from some of the onsite monitoring wells at concentrations exceeding USEPA secondary (aesthetic-based) MCLs established for drinking water. No constituents exceeding USEPA *primary* (health-based) drinking water MCLs were detected. The 1988 PRAP called for the installation of two on-site extraction wells, with consumption of the pumped water as process make-up water at the Bay Zinc plant. Ecology agreed with the remediation concept.

<u>1989 – 1993</u>

In 1989, a *Remedial Action Plan Performance Evaluation Report* was prepared for Bay Zinc by John Mathes & Associates. The report described the initial performance and effectiveness of the groundwater recovery system installed to address the aforementioned secondary MCL constituents. Two extraction wells were installed to contain the highest overall levels of constituents. MW-8 was placed near the area where past zinc sulfate spills (previously referenced) had pooled. MW-9 was placed immediately downgradient from the spill pool area, directly upgradient from the covered waste pile (SWMU-5). Groundwater modeling showed that a 1 to 2 gallon per minute (gpm) pumping rate, either collectively or individually from the extraction wells, would produce a capture zone sufficient to contain and recover affected groundwater. Trial period test pumping of wells MW-8 and MW-9 showed that, while MW-8 was capable of sustaining a yield of 5 gpm, MW-9 was only capable of producing 0.5 gpm because of apparent low aquifer transmissivity at that location. The Remedial Action Plan for the site called for water generated by the groundwater recovery wells to be consumed by the fertilizer production process. The volume of water necessary for economical production of the process was less than 5 gpm; consequently, the limiting factor controlling groundwater extraction rates was process water consumption capabilities.

Based on the 1984 change in regulatory status regarding the facility, removal of wastes from the aforementioned waste pile became a necessary component for compliance. Removal of the waste pile, and subsequently the underlying contaminated soil, was completed in November 1992. A *Waste Pile Closure Report* dated February 27, 1993 was submitted by Bay Zinc to Ecology.

Material from the pile itself was removed and used as feed stock for production. Soil borings drilled to establish the depth of residual contamination showed that approximately four to six inches of soil needed to be removed. A total of 571 tons of soil was excavated and transported to Chemical Waste Management's facility in Arlington, Oregon for disposal. Confirmatory soil samples were analyzed for key TCLP metals. No TCLP metal concentrations were detected in the confirmatory samples at concentrations exceeding hazardous-waste-by-characteristic levels.

<u>1994 – Present</u>

Groundwater monitoring, which was initiated at the site in 1985, continues to present day. Monitoring has been conducted on a semi-annual basis, with reports submitted by Bay Zinc to Ecology. Groundwater has been analyzed for various parameters over the period of monitoring, including USEPA Appendix IX constituents (volatile organics, semi-volatile organics, metals, and inorganics). Only the following constituents have been shown to be a concern:

- Chloride
- Sulfate
- Manganese
- Zinc
- Cadmium

In November of 1998, as part of the removal of visible contamination from the Rail Spur Area, approximately 150 tons of soil and railroad ballast were excavated by Bay Zinc and transported off-site for disposal as hazardous waste. However, results of samples taken by both Bay Zinc and Ecology at the level of excavation and below the level of excavation indicated that the excavation efforts did not remove all contaminated soil and ballast material. Soil under the excavated depth exceeded characteristic toxicity values for cadmium and lead (i.e. K061 waste characterization levels) determined by toxicity characteristic leachate procedure testing. Dioxin, believed to be a by-product of the K061 waste, was also detected in certain soil samples from the area.

In 1999, a *Stormwater Runoff Control Plan* was submitted by Bay Zinc to Ecology. The Stormwater Plan was prepared following a site reconnaissance by Ecology and Bay Zinc representatives in August of 1998. The Stormwater Plan was prepared to address areas of observed potential surface contamination caused by stormwater runoff from asphalt and concrete areas of the facility. Nine areas of concern (AOCs) were identified in the Stormwater Plan. Bay Zinc subsequently installed stormwater collection basins and curbs along asphalt areas to direct stormwater back into the on-site holding tank for later use in fertilizer production operations, pending the execution of the soil sampling and analysis components in the Plan.

In 2000, a contractor for USEPA Region 10 (Booz Allen & Hamilton) conducted a RCRA Facility Assessment (RFA) at the site and issued a Final RCRA Facility Assessment Report, dated November 20, 2000 (see Appendix A). The RFA identified 8 solid waste management units (SWMUs) and 10 AOCs. One AOC, a Loading/Unloading Area, was added to the 9 AOCs previously outlined in Bay Zinc's Stormwater Runoff Control Plan.

The SWMUs and AOCs are listed as follows:

SWMUs

1. Rail Spur Area
2. Container Storage Area D
3. Rail Unloading Area/Waste Loading Chute
4. Storage Tanks A and B
5. Former Waste Pile
6. Generator Accumulation Area

7. Former Pickle Liquor Tank
8. Maintenance Shop Accumulation Area

AOCs

1. Railroad Gate
2. Along East Fence
3. Bone Yard
4. Near Edge of Access Road
5. Back Lot Fill Area
6. Runoff at North Edge of Asphalt
7. Western Fence Boundary
8. Western Runoff Area
9. Runoff Area Near Liquid Fertilizer Storage
10. Loading/Unloading Area

The SWMUs and AOCs are shown in Figure 3. A copy of the RFA report text and key figures is included in Appendix A.

3.0 CONCEPTUAL SITE MODEL

Based on a review of available data and reports of past regulatory activities and environmental investigations described in Section 2.0 of this document (including a review of information on file at Ecology's Yakima office), Linebach Funkhouser, Inc. (LFI) has developed the following Conceptual Site Model (CSM). The CSM incorporates the results of a site-wide remedial investigation conducted in February, March and April of 2002. The purpose of the CSM is to serve as a framework for the selection of a remedial alternative(s).

3.1 Statement of the Problem

As a result of past (prior to calendar year 2001) product storage activities, operational practices, and historic liquid zinc sulfate spills at the Bay Zinc facility, releases of certain chemical constituents to the surface and subsurface have occurred. Soil, and to a lesser extent, groundwater, have been affected. Key constituents in soil are:

- Cadmium
- Lead
- Zinc

Certain dioxin constituents were detected in the past in soil samples collected by Ecology personnel within the Railcar Unloading Area (SWMU-1). Follow-up sampling and analysis for dioxin was conducted as part of the remedial investigation completed by LFI. Dioxins are ubiquitous in the environment and are believed to be a possible by-product of a portion of the K061 (arc furnace flue ash) material at the site. Sampling results suggest that dioxins are not widespread at levels of concern at the site, and are predominantly limited to the Railcar Unloading Area (SWMU-1).

Key constituents in groundwater are:

- Chloride
- Sulfate
- Manganese
- Zinc
- Cadmium

The aforementioned constituents in soil and groundwater, respectively, are present at concentrations requiring further action, based on screening levels established by Ecology.

3.2 Source Areas

Sources that contributed the constituents of concern to soil and groundwater are believed to be as follows:

- Historic deposition of constituents to soil via stormwater runoff across paved areas

- The former raw material waste pile (SWMU 5) and historical spills of zinc sulfate solution

- Releases of constituents to soil in unpaved (and formerly unpaved) areas of the site due to past product handling and housekeeping (loading/unloading/storage) procedures.

Virtually the entire area of the site in which active manufacturing operations are being conducted, with the exception of soil between the railspur ties and the tank car unloading area (SWMU-1), is now paved. Curbing and sumps have been installed over the past 2 years to control surface water runoff. All product storage tanks are aboveground and situated above paved areas. The former flue dust waste pile (SWMU 5) has been closed and the area is now capped with a storage building and concrete floor. No currently active source area is believed to be present at the site. Ecology has speculated that groundwater may continue to be recharged with levels of constituents via natural fluctuations in the water table, which could contact some of the limited zones of elevated concentrations of constituents in the overlying capillary fringe. While this scenario cannot be unequivocally ruled out, it is LFI's opinion that the very low solubilities of the constituents of concern (metals and inorganics), and their tendency to strongly sorb to sediments, is not particularly supportive of ongoing leaching to groundwater.

3.3 Site Characterization

LFI reviewed the aforementioned studies, reports, and correspondence prepared by Bay Zinc's consultants, Ecology personnel, and USEPA Region 10 as part of the site characterization work. Additionally August Mack Environmental, Inc. (now LFI personnel) conducted site-wide soil and groundwater sampling activities to address SWMUs and AOCs identified by USEPA and Ecology personnel, and described in USEPA's 2000 RFA Report. August Mack/LFI field activities also encompassed the recommended sampling efforts descried in the 1999 *Stormwater Runoff Control Plan* submitted to Ecology by Bay Zinc. A synopsis of the site characterization is as follows.

3.3.1 Methodology

On February 12, 2002, August Mack/LFI and Teck Cominco personnel met with Ecology representatives in Yakima to discuss the Bay Zinc site and the investigation procedures to be employed. As a result of that meeting, a *Preliminary Sampling and Analysis Plan* (PSAP) was prepared by August Mack/LFI and issued to Ecology on February 25, 2002. General approval of the Plan by Ecology was received. The objective of the work described in the PSAP was to:

- Evaluate effects to soil and groundwater related to past releases at the site including SWMUs and AOCs identified by USEPA and Ecology personnel.
- Provide data necessary for Teck Cominco to evaluate potential environmental liabilities associated with the potential acquisition of production equipment from Bay Zinc, and assess costs to implement alternatives deemed necessary.

To this end, August Mack/LFI conducted extensive site-wide investigation activities over the dates of February 26-29, March 15, and April 4 and 5, 2002. Investigation activities included the:

- Collection of a total of 102 surficial (depths ranging from 0.5 to 1 foot deep) soil samples.
- Advancement of 50 direct-push (Geoprobe) borings to the top of the uppermost groundwater producing zone and the subsequent collection of 82 soil samples from the borings.
- Installation of two doubled-cased/limited interval (telescoping) groundwater monitoring wells into the lower aquifer beneath the uppermost groundwater producing zone.
- Collection of 10 groundwater samples from the aforementioned Geoprobe borings and telescoping monitoring wells.

Laboratory analyses were conducted for key soil parameters including total cadmium, lead and zinc. Certain soil samples were also analyzed for dioxin and TCLP metals. Groundwater samples from Geoprobe borings were analyzed for dissolved lead, cadmium, manganese, zinc, chloride, and sulfate. Groundwater samples from a Geoprobe boring drilled upgradient (east) of the Bay Zinc property, and soil and groundwater in the Maintenance Shop Accumulation Area (SWMU-8) were also analyzed for volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs).

Ecology personnel were on-site and directly observed the majority of the field activities. Certain boring locations were changed and others added as a result of input received from Ecology personnel in the field. Other borings were added based on the results of initial sampling and subsequent meetings with Ecology personnel on March 14 and April 1, 2002. Additional borings and surficial sampling locations included:

- Several advanced along the site perimeter to more thoroughly evaluate potential off-site impacts.
- Several advanced to depths of 0.5 feet to further define the depth of affected soil.
- Several advanced east of the liquid fertilizer production area in locations believed to have been possibly impacted by past operations, based on historic aerial photographs.
- Several advanced between the Main Process Building and the East/West Quonset Hut Storage Buildings, in a former primary production area based on historic aerial photographs.

Soil boring and monitoring well locations are shown in Figure 3.

General procedures for the collection of soil and groundwater samples at the site are included in Appendix B, along with the text of the *Preliminary Sampling and Analysis Plan*, which explains the general rationale for the investigation. Boring logs and well installation records are in Appendix C. Samples collected during the course of the investigation were analyzed by Columbia Inspection, Inc., Portland, Oregon. Analytical methods used by Columbia Inspection are included in the laboratory analytical reports in Appendix D.

3.3.2 Results

Results of the site characterization activities are presented in the following subsections. Much of the discussion on the site geology/hydrogeology presented below has been summarized from information provided in previously referenced reports prepared by Mathes & Associates, Inc. (1989) and the USEPA's RFA Report prepared by Booz Allen & Hamilton (2000).

3.3.2.1 Geologic/Hydrogeologic Conditions

Site soils consist of silty sand and silty clay. The site has a gradual slope to the northwest. The region around Moxee is semi-arid, receiving approximately nine inches of rain per year. Two irrigation canals (Moxee Drain and Roza Canel) are within one mile of the facility, but the Canals only have water flows from March to October. The Yakima River, the primary drainage feature for the area, is more than a mile from the facility.

The uppermost groundwater producing zone underlying the facility consists of silty sand to sandy silt. Depth to groundwater at the time of our investigation was approximately 4 to 6 feet. The uppermost groundwater producing zone extends to a depth of approximately 20 to 28 feet below ground surface (bgs). The uppermost zone is underlain by a silt and clay layer which serves as an aquitard layer ranging in thickness from 15 to 17 feet. A continuous gravel and sandy gravel unit underlies the silty clay aquitard and forms the lower aquifer at the site. The lower aquifer varies in thickness from 11 to 20 feet underneath the site. The lower aquifer in turn is underlain by a clay confining zone approximately 50 feet thick. A deep, confined aquifer in the Ellensburg formation underlies this confining zone at a depth of 90 to 160 feet below ground surface (bgs). The majority of the production water wells in the area are in the Ellensburg formation. According to the 1989 *Remedial Action Plan*, the lower aquifer is the shallowest aquifer suitable for domestic and irrigation use.

The predominant groundwater flow in the uppermost aquifer is west-northwest across the site, following the general topography of the area. There is no significant downward vertical gradient between the uppermost groundwater producing zone and the lower aquifer.

3.3.2.2 Extent of Affected Soil

Levels of cadmium, lead and zinc were detected in soil at various locations at the site; however, sampling results show that the vertical extent of the affected soil is generally limited to the upper six inches of the ground surface. Interpreted naturally occurring concentrations of key metals in Yakima Basin soils are provided as follows.

Interpreted Naturally Occurring Concentrations of Key Metals in Soil
Yakima Basin, Washington*

Constituent	Concentration (mg/kg)
Cadmium	1.0
Lead	11
Zinc	79

* Source: *Natural Background Soil Metals Concentrations in Washington State*. Washington Dept. of Ecology/USGS Water Resources Div. Publication 94-115. October 1994.

A map showing soil sampling locations and the detected concentrations of cadmium, lead, and zinc at each location is provided in Figure 3. Soil sampling laboratory results for each SWMU, specific AOC and General Areas of Concern sampled as part of the RI are included in Tables 1 through 22. Laboratory reports are in Appendix D. A synopsis of affected soil in each SWMU and AOC is as follows.

<u>SWMU-1 Rail Spur Area – Container Storage Area C</u>

SWMU-1 is unpaved and includes the railspur line extending north-south through the property. Container Storage Area C, adjacent to the East Storage Building, is where steel mill flue dust (K061), incinerator ash from the combustion of tires, and brass dust were managed and off-loaded from railcars. Container Storage Area C is also where past spills of liquid zinc sulfate pooled, and is where the exiting groundwater recovery well (MW-8) is located. Approximately 150 tons of soil visually determined to be affected was removed from this area in 1998. Soil to a depth of approximately 18 inches was removed.

Remedial investigation (RI) data indicate that most of the heavily impacted soil has been removed from Storage Area C; however, concentrations of key metals and certain dioxins still remain at concentrations above cleanup criteria (see Section 5.0 of this report). The vertical extent of impact appears to extend another 1 to 2 feet below the existing excavated surface level. Surficial soil between the ties along the railroad spur was not sampled, but rather is considered to also contain elevated concentrations of key metals based on knowledge of the site history and operations.

SWMU-2 Container Storage Area D

SWMU-2 consists of an enclosed building with a poured concrete floor. The area around the building is paved. One shallow soil sample collected adjacent to the north side of the building contained zinc at a concentration slightly in excess of the zinc cleanup level. Other samples collected in the vicinity of SWMU-2 indicate that the elevated zinc detection is extremely limited in areal extent, and vertically does not extend beyond a depth of two feet. The SWMU-2 area is completely capped by asphalt pavement. Remedial action regarding SWMU-2 is considered optional, but not particularly necessary based on the limited area and asphalt pavement cover.

SWMU-3 Rail Unloading Area/Waste Loading Chute

No constituents were detected in SWMU-3 at concentrations warranting further action. The adjacent railspur line (part of SWMU-1) will be handled as part of SWMU-1 remedial work.

SWMU-4 Storage Tanks A and B

Tank A rests on a concrete floor in the Main Process Building. Tank B is on a concrete pad adjacent to the Main Process Building. Site logistics impaired the ability to collect soil samples in the immediate locations around these tanks; however, samples collected north south and west of the Process Building showed no significant affects to soil in the area. No further action regarding SWMU-4 is warranted.

SWMU-5 Former Waste Pile

Sampling data shows that surficial (less than 2 feet deep) soil bordering the west and south sides of SWMU-5 has been affected by cadmium at levels exceeding site cleanup criteria. The area bordering the site to the north and northeast shows elevated lead levels in the depth range of 2 to 4 feet. Areas adjacent to SWMU-5 on the north and west are unpaved. Remedial efforts are warranted.

SWMU-6 Generator Accumulation Area

Shallow soil (less than 2 feet deep) at the southern end of SWMU-6, which was unpaved prior to 1992, has been affected by lead and zinc at concentrations above site cleanup criteria. The impact does not exceed 2 feet in depth and is limited in extent. The area is also currently paved. A small area of affected soil in SWMU-6 may require remediation; however, there is no currently complete exposure pathway in the area. Active remedial action for this SWMU is considered optional.

SWMU-7 Former Pickle Liquor Tank

No significantly affected soil was detected at SWMU-7. No further action regarding this area is warranted.

SWMU-8 Maintenance Shop Accumulation Area

Cadmium was detected in shallow soil (less than 2 feet deep) in SWMU-8 at a level exceeding cleanup criteria. No VOCs or PAH constituents were detected. SWMU-8 is a small area and paved. Several sampling locations were established within a 50-foot radius of SWMU-8 as part of the site-wide investigation. The extent of affected soil in SWMU-8 is limited and the area is paved. A small area of affected soil in SWMU-8 may require remediation; however, there is no currently complete exposure pathway in the area. Remedial action is considered optional.

AOC-1 Railroad Gate

AOC-1 is an approximately 2 feet by 6 feet depressed area adjacent to the southwest corner of the liquid storage area. Shallow soil (less than 1 foot deep) has been affected by cadmium and lead at concentrations exceeding cleanup criteria. The area is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-2 Along East Fence

AOC-2 was a possible stormwater runoff collection area from asphalt pavement. The area is unpaved, and surficial soil (0 to 1 foot in depth) contains cadmium, lead and zinc at concentrations exceeding cleanup criteria. The affected area extends approximately 30 feet east of the fence line, and is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-3 Bone Yard

The bone yard was used for storage of used equipment, track ballast, and gravel. It was not used for storage of production raw materials. Shallow soil (0 to 1 foot deep) in the bone yard has been affected predominantly by lead at concentrations exceeding cleanup criteria. Zinc was detected at concentrations exceeding cleanup levels in the southwestern portion of the area. The highest overall levels of constituents were detected along the west (and particularly, southwest) side of the bone yard. The bone yard is unpaved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-4 Near Edge of Access Road

This area was listed as a concern because of potential stormwater runoff impacts from the adjacent paved road. Concentrations of lead exceeding cleanup criteria were detected in the area. The area is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-5 Back Lot Fill Area

AOC-5 was originally described in the 1999 *Stormwater Runoff Control Plan* as "Soil at north end of fill observed to be red-brown." The fill material area appears to have been expanded since the 1999 Plan was submitted, and the area mentioned in the 1999 Plan is believed to have been covered over. The expanded AOC-5 area is shown in Figure 3. Lead was detected in AOC-5 at concentrations exceeding cleanup criteria. The thickness of the fill in AOC-5 is estimated to be approximately 3 feet on average. The area is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-6 Runoff at North Edge of Asphalt

AOC-6 was described in the 1999 Stormwater Plan as being an "area of discoloration at the edge of the asphalt north of the West Storage Building." Since 1999, the area has been excavated and a stormwater collection basin has been installed. The area is now paved. No further action is warranted regarding AOC-6.

AOC-7 Western Fence Boundary, Near Monitoring Wells

AOC-7 was listed on the basis of discolored surficial soil in the area. Shallow soil (0-1 foot deep) in the area has been affected by lead, chromium, and zinc at concentrations exceeding cleanup criteria. The horizontal extent of impact appears to be limited to the visually affected area. AOC-7 is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-8 Western Runoff Area, Near Fence

AOC-8 constitutes a historic runoff pathway from nearby asphalt to the east, and was listed as an AOC due to visually discolored soil in the area. AOC-8 contains lead, cadmium, and zinc in surficial soil (0 to 1 foot deep) at concentrations exceeding cleanup criteria. The horizontal extent is limited to visually affected areas along the fence line. AOC-8 is not paved. Remedial action regarding the exposed affected soil will likely be warranted.

AOC-9 Runoff Area Near Liquid Fertilizer Storage at Grass Island

AOC-9 was identified as a concern based on observed black powdery material at the north end of the grass island. No constituents were detected in soil at concentrations requiring further action in AOC-9.

AOC-10 Loading/Unloading Area

AOC-10 was added to the original 9 AOCs by the USEPA RFA contractor. AOC-10 comprised the loading/unloading area for the zinc sulfate process. The area's location is south of and adjacent to the building that houses the new zinc sulfate process. No reason for the designation of AOC-10 was given by the USEPA contractor in the RFA report; however, the area is in the general vicinity of past storage operations observed on historic aerial photos provided by Ecology to LFI for review. Lead, cadmium, and zinc were detected at concentrations exceeding cleanup criteria southeast of the existing loading dock. The area of affected soil is limited and the area is paved. No complete exposure pathway currently exists in the area. Limited soil removal is considered to be an option for the area.

General Areas of Concern

In addition to the 8 SWMUs and 10 AOCs previously identified by USEPA and Ecology representatives, sampling activities were expanded to other areas of the site based on:

- LFI's review of historic file information at Ecology's Yakima offices.

- Teck-Cominco and Bay Zinc's desire to address USEPA and Ecology concerns regarding potential on-site and off-site contamination affects potentially caused by historic wind tracking of raw materials.

- Input received in the field from Ecology representatives as sampling work was being conducted.

- LFI and Ecology's review of historic aerial photographs of the site maintained by Ecology.

Investigation work was expanded to cover the following areas:

- Virtually the entire site perimeter.
- The entire unpaved grass-covered portion of the north side of the property.
- Areas within the paved interior of the site shown to contain past storage or production operations in historical aerial photographs.

Based on the expanded sampling efforts, lead was detected in shallow soil in excess of cleanup criteria in certain portions of the north lot area, along the southern property boundary, and in limited areas within the interior of the facility.

3.3.2.3 Extent of Affected Groundwater

Groundwater monitoring has been ongoing at the site since 1985. During the past 16 years of monitoring, the only constituents that have been detected with any consistency above drinking water standards are primarily those of secondary (non-health based) concern. Sulfate is the parameter present at the highest overall levels. Prior to the 2002 RI work, a network of 10 monitoring wells had been installed at the site since 1985, including 7 in the uppermost groundwater producing zone and 3 in the next lower aquifer.

An isopleth map showing the interpreted extent of sulfate in the uppermost groundwater producing zone is provided in Figure 4. The map was prepared based on our review of historic groundwater data, and past interpretations made by others. Concentrations shown on the map reflect average levels over the time period of 1998-2000 (the latest information available in Ecology files). As previously stated, sulfate is the most predominant constituent detected at the site; other constituents are at concentrations significantly less. Consequently, the interpreted sulfate isopleth map represents what LFI believes to be the most conservative projection of affected groundwater extent.

Eight grab groundwater samples were collected from soil test borings advanced with Geoprobe equipment during the course of the RI. No dissolved metals were detected at concentrations exceeding drinking water standards in any of the Geoprobe groundwater samples. A few of the non-filtered Geoprobe groundwater samples were analyzed for total sulfate and chloride; however, the reported results for these two constituents are not considered reliable because the collected samples were heavily laden with sediment, which likely biased the results. Groundwater sampling results are summarized in Table 23. Analytical reports are in Appendix D.

The vertical extent of affected groundwater is generally limited to the uppermost aquifer. In the 2000 RFA Report, USEPA Region 10 expressed concern that large past fluctuations in the concentrations of several constituents in the three existing monitoring wells screened in the lower aquifer suggested potential leakage of contamination from the upper to the lower aquifer, potentially with regard to cadmium, chloride, lead, sodium, sulfate, zinc and manganese. Double-cased/single interval (telescoping) wells were installed into the lower aquifer as part of the March 2002 RI to further evaluate this issue. Care was taken not to create a conduit through the clay layer, believed to be serving as an aquitard between the upper and lower groundwater producing zones. One of the two wells, MW-8D, was installed near the existing groundwater recovery well (MW-8), in the area of some of the highest overall levels of constituents historically detected on site. Results showed that the lowermost groundwater producing zone remains largely unaffected by any of the constituents detected at elevated levels in the upper zone. Sulfate was detected in the lower zone (280 mg/l) essentially at the aesthetic secondary MCL level (250 mg/l). Similar comparative levels were seen in new downgradient well MW-10D, which had no significant detections of metals of concern and a sulfate level of 240 mg/l. Sampling results are summarized in Table 23. It should be noted that, according to Mr. Byron Adams with the City of Moxee Public Works Department, the uppermost groundwater producing zone throughout the Moxee area is known for containing elevated levels of sulfate and other aesthetic (secondary) parameters.

4.0 EXPOSURE PATHWAY/RECEPTOR EVALUATION

The following discussion of exposure pathways, exposure points, and receptors identifies possible means and locations where human or other biotic receptors may come in contact with constituent-containing media either now or at some point in the future. The purpose of this exposure pathway/receptor evaluation was to:

- Assess potential risks and help to establish the type of remedial actions needed at the site.

- Provide a basis for establishing clean-up levels and determining levels of constituents that can remain in the soil and groundwater and still be adequately protective of human health and the environment.

An exposure pathway is the course a constituent takes from a source to an exposed receptor. According to the USEPA (1989), an exposure pathway must be considered *complete* for a risk to be present. A complete exposure pathway must include *all* of the following:

- ➢ Source and Mechanism for Release
- ➢ Transport Medium
- ➢ Receptor at an Exposure Point
- ➢ Route of Uptake (e.g. ingestion)

4.1 Human Health Evaluation

As stated previously, the source of constituents detected in soil and groundwater at the site is believed to be past releases of zinc sulfate solution and former housekeeping practices associated with the storage of product raw materials. An evaluation of pathways and receptors is as follows. Much of the following information was taken directly from USEPA Region 10's 2000 RFA Report.

<u>Surface Water</u>

The closest surface water bodies are irrigation canals, including an unnamed canal, the Moxee Drain, and the Roza Canal. The Moxee Drain and Roza Canal, considered surface waters under the Washington State statutes, are located less than a mile from the facility. Water flows in these irrigation canals from March through October of each year. The Yakima River is more than one mile away from the site. Recent improvements to the facility aid in the collection of stormwater runoff from paved areas of the facility. Furthermore, the site is not within a 100-year floodplain. Therefore, the potential for exposure of human or environmental receptors to constituents from the site via surface water is not likely. There is no current complete exposure pathway with regard to surface water.

<u>Groundwater</u>

Assessment data indicate that the predominant constituents of concern in groundwater are considered by the USEPA as secondary parameters, regulated on the basis of cosmetic or aesthetic effects rather than health-based effects. USEPA recommends secondary standards to water systems but does not require systems to comply. The area of affected groundwater is a relatively narrow band extending through the north-central portion of the site. The direction of groundwater flow is westward across the site. Affected groundwater is largely contained on-site; however, recent data suggest that off-site migration of groundwater containing elevated levels of certain secondary constituents may be starting to occur. The depth to the uppermost groundwater producing zone is approximately 4 feet.

The uppermost groundwater producing zone is the affected zone of concern. There are no wells immediately downgradient of the site producing from the affected zone and no discharge of affected groundwater to a surface water body is occurring. A municipal supply well for the City of Moxee is located approximately 3,000 feet southeast of the site. A second municipal supply well is located more than 3,000 feet to the east of the facility. Because the predominant groundwater flow in the uppermost aquifer is directed west-northwest across the site, the potential for contamination to migrate from underneath the site to these wells is unlikely. There is no current complete exposure pathway with regard to groundwater.

Air

The primary potential exposure scenario via the air pathway would be wind dispersal of product or affected soil. Extensive soil sampling throughout the site, including the site perimeter, did not show that constituent-containing dust had been blown throughout the area. Rather, historic stormwater runoff appears to have been the primary mechanism for the dispersal of constituents around the site. Bay Zinc has health and safety procedures and personal protective equipment for on-site workers involved in the fertilizer manufacturing process, who may continue to be exposed to dust as a result of ongoing operations. Air does not constitute a significant exposure pathway to other human or ecological receptors.

Soil

Surficial soil has been affected by elevated levels of lead, cadmium, and zinc at various locations of the property. Soil beneath approximately 60 percent of the site is covered by asphalt and concrete pavement, and buildings with slab concrete floors. The recently completed remedial investigation showed that the affected soil was predominantly limited to the site property and a few limited areas immediately adjacent to the property boundaries. Sampling data showed no evidence of widespread off-site soil contamination.

As stated in the USEPA RFA Report, “exposure of human or environmental receptors to hazardous materials in the surface soils onsite is unlikely due to a secured fence system that was installed around the entire site to prevent access.” A complete exposure pathway with regard to soil currently exists for on-site employees and possible future construction workers who may dig through affected soil.

4.2 Ecological Evaluation

No threatened or endangered species exist on site. The site is completely fenced, and is an active manufacturing operation. Sixty percent of the site is covered by buildings, tanks, and pavement. The site is zoned for industrial use and is not a conducive habitat for environmental receptors.

Based on the results of the extensive site sampling and the pathway/receptor evaluation described in the previous subsections, a State Environmental Policy Act (SEPA) checklist and a Simplified Terrestrial Ecological Evaluation (STEE) were completed in accordance with Model Toxics Control Act (MTCA) requirements. Documentation regarding the SEPA checklist and the STEE is in Appendix E. Ecology has determined that the site does not present a risk to significant wildlife populations.

5.0 CLEANUP CRITERIA SELECTION

Based on the results of LFI's review of historical environmental data regarding the Bay Zinc site, our meetings with Ecology personnel, and the March 2002 remedial investigation work, the key parameters that will be driving cleanup work at the site are as follows:

Soil	Groundwater	
Cadmium	Chloride	Manganese
Lead	Sulfate	Zinc
Zinc	Cadmium	

The site is located in the midst of an area zoned for industrial use, is fenced, and maintains 24-hour site security. The site and immediately surrounding area is served by municipal water supplies. There are no surface water features on-site and there are no continuous off-site discharges to surface water. There is no complete exposure pathway at the site with respect to groundwater. There is a limited complete soil exposure pathway in unpaved areas of the site, with the exposure generally limited to on-site workers and potential construction workers (who also may dig through asphalt/concrete paved areas). USEPA Region 10's concerns regarding possible widespread off-site impacts to surficial soils via historic wind tracking of raw materials were not confirmed by the extensive remedial investigation sampling. Off-site affects, in the limited areas where they were confirmed, were restricted to small areas within the immediate vicinity of the site.

Based on the abovementioned site factors and extensive discussions with Ecology personnel, the following cleanup criteria, included in the regulations implementing Washington's Model Toxics Control Act, WAC 173-340-900 (Table 749-2) have been developed for the site. The criteria encompass both human and ecological exposure scenarios.

<u>Soil</u>

Cadmium	36 mg/kg
Lead	220 mg/kg
Zinc	24,000*

*If the zinc standard of 24,000 mg/kg is exceeded, cleanup will be conducted to meet a standard of 570 mg/kg.

<u>Groundwater</u>

Chloride	250 mg/l*
Sulfate	250 mg/l*
Cadmium	0.005 mg/l
Manganese	0.05 mg/l*
Zinc	5.0 mg/l*

*Represents USEPA Secondary Maximum Contaminant Levels (MCLs) for drinking water supplies. Secondary MCLs are based on aesthetic (not health-based) criteria. USEPA recommends secondary standards to water systems, but does not require systems to comply. According to Mr. Byron Adams with the City of Moxee (Public Utilities Section), elevated levels of sulfate in shallow groundwater are representative of background conditions in and around Moxee due to the highly agricultural nature of the area and the extensive application of fertilizers containing sulfate. If background conditions in the future are shown to be in excess of USEPA Secondary MCLs, cleanup standards will be adjusted to reflect the background concentrations.

6.0 VOLUNTARY CLEANUP PLAN

Based on the remedial investigation and exposure pathway/receptor assessment results, surficial soil is the primary medium of concern at the site. Subsurface soil and groundwater are secondary concerns. All three media will be addressed by the Voluntary Cleanup Plan (VCP) outlined in the following subsections.

6.1 Objectives

The overall objective at the site is to eliminate or manage environmental risk to human health and the environment. Much of this objective has been met in that:

- The waste pile source area has been removed and past storage and operational procedures that lead to past releases have been mitigated by the additions of paving, curbing, stormwater collection basins, and other operational changes within the past few years.
- Approximately 150 tons of the most highly affected soil have already been excavated and removed from the rail car unloading area.
- The majority of the site is covered by buildings and pavement.
- The area is served by a public water supply.
- The primary complete exposure pathway is limited to on-site employees and potential construction workers possibly involved in future excavation.

6.2 Evaluation of Remedial Alternatives

The physical and chemical nature of the primary constituents of concern (certain metals and inorganics) limits the options for remediation. The constituents of concern (COCs) do not readily break down in the environment. COCs tend to tightly bind to soil, do not volatilize, and have very low water solubilities. Considering the nature of the COCs and the logistics of site operations, the following alternatives were identified and evaluated as potentially viable remediation options for soil:

- Excavation and Off-Site Disposal (Soil)
- Engineered Control with Asphalt Cover (Soil)
- On-Site Treatment (Soil)

- Construct Buildings or Other Permanent Structure Over Contaminated Soils (Soil)
- Natural Attenuation (Groundwater)
- Slurry Well Containment Structure (Groundwater)
- Groundwater Recovery and Discharge to Local POTW (Groundwater)
- Groundwater Recovery and Discharge to Infiltration Gallery or Surficial Feature (Groundwater)

With regard to soil, excavation and off-site disposal is the selected option based on the following:

- ➢ Based on our preliminary conversations with Ecology, to install an engineered control (i.e. cap over the site) that would likely be acceptable to Ecology, the initial removal of at least 6 inches to 1 foot of soil will be required prior to emplacement of the cap. Much of the affected area of the site is only limited to the upper 6 inches to 1 foot, and remediation will be completed simply by the removal of the upper veneer of soil. After the affected soil has been removed, final capping with pavement will not be necessary.
- ➢ Ecology has expressed concerns that leaving a significant volume of affected soil in place, even with a cap, may still result in an ongoing source of groundwater contamination by way of interaction with a fluctuating groundwater table. As stated previously, the solubility of the COCs are very low, and LFI does not believe that dissolution of COCs into a potential fluctuating groundwater table will be a significant mechanism for ongoing contributions. Nevertheless, LFI understands that soil removal and off-site disposal from the highest overall affected areas of the site will allay much of Ecology's concerns regarding potential long-term source areas for groundwater contamination.
- ➢ On-site treatment options, particularly solidification, would reduce the potential for leaching of COCs from soils. However, total levels of constituents would remain and extensive site capping would still be necessary.
- ➢ Site logistics and future use plans for the site are not conducive to the construction of additional buildings or other permanent structures over affected soil.

With regard to groundwater, pumping to control potential off-site migration and enhance the removal of the aforementioned secondary constituents is the selected option based on the following:

- A potential increasing trend of off-site migration of affected groundwater in the uppermost groundwater producing zone greatly hinders the viability of natural attenuation to satisfy Ecology's concerns at this time.

- Existing recovery wells already exist and only require a more aggressive pumping rate to achieve site control.

The discharge of the pumped groundwater will be conducted in accordance with applicable permitting requirements. Preliminary discussions with Ecology personnel indicate that the nature and concentration of constituents present in groundwater will not require extensive permitting for discharge, and as far as Ecology is concerned, could be handled by the City of Moxee's Publicly Owned Treatment Works (POTW) without any pretreatment. In the case that the City of Moxee will not allow disposal of the pumped groundwater into the city sewer, groundwater will discharged into an on-site ditch of onto the ground by way of an infiltration gallery. The pumped groundwater will be pretreated, as necessary to meet Ecology or City of Moxee, discharge requirements. An ion exchange treatment system will be emplaced, if deemed necessary, to pretreat groundwater prior to discharge.

6.3 Selected Options

As indicated previously the selected options for remediation are as follows:

- Soil: Excavation and Off-Site Disposal

- Groundwater: Extraction via pumping with discharge surfically or to the local POTW following pretreatment (as necessary) to comply with Ecology and City of Moxee applicable permit requirements

Deed restrictions/institutional controls may be included to address areas that may lie under existing buildings and paved areas.

6.3.1 Soil

Areas of the site from which soil will be excavated, and anticipated excavation depths, are shown in Figure 5. Excavated soil will be properly characterized, manifested, and disposed of at disposal facilities certified to receive the material. Excavated soil from the railcar unloading area and adjacent areas to the east bordering the paved access road will likely be characterized with a K061 waste code, and disposed of at a hazardous waste disposal facility (most likely Waste Management's Arlington, Oregon facility). Excavation work will include the removal of soil between ties along the railspur line. Replacement fill for the excavated areas will likely originate from borrow areas to be established on "greenfield" property owned by Mr. Richard Camp immediately adjacent to the east side of the Bay Zinc facility property line.

6.3.2 Groundwater

Existing groundwater extraction well MW-8 will be initially used to contain groundwater migration and remove affected water from the uppermost groundwater producing zone. Simple capture zone calculations made by LFI indicate that a pumping rate of 4 to 5 gpm from MW-8 will provide a capture zone that will extend to the edge of the western (downgradient) property boundary. LFI's capture zone calculations are provided in Appendix E. LFI's capture zone calculations are consistent with previous modeling results presented by Mathes & Associates (1989) that showed a pumping rate of 3 to 4 gpm producing the desired radius of capture.

MW-8 which is currently pumping at a rate less than 0.5 gallons per minute (gpm) will initially be pumped at a rate of approximately 4 gpm over a 90-day performance evaluation period. During the 90-day performance evaluation period, water levels in on-site monitoring wells will be collected on a monthly basis. Additionally, the monitoring wells will be sampled and analyzed for sulfate, chloride, zinc, manganese, and cadmium. Collected data will be analyzed to confirm the effectiveness of the groundwater extraction system. Existing recovery well MW-9, or an additional new recovery well, may be added to the system based on the system performance evaluation.

Pending formal approval and receipt of applicable discharge requirements that may need to be issued by Ecology or the City of Moxee, pumped groundwater either be discharged surfically or to the City of Moxee sewer system for discharge through Moxee's publicly owned treatment works (POTW). An ionization system will be installed to pretreat groundwater prior to discharge, should pretreatment be deemed necessary to meet state and local discharge requirements. The timeframe for operation of the groundwater recovery system is estimated to be approximately 3 to 5 years, based on the levels of COCs present and the hydraulic characteristics of the uppermost groundwater zone.

6.4 Monitoring/Confirmation Sampling

The effectiveness of soil and groundwater remediation work will be monitored and confirmed as follows.

Soil

A field professional will document the work conducted by the soil excavation contractor. The field professional will see that material is properly staged and manifested, and will monitor health and safety procedures to assure compliance with a site Health and Safety Plan that will be developed for the project. Confirmatory sampling will be conducted throughout each of the excavated areas to document that cleanup levels have been achieved. Sampling locations and strategies similar to those used for the remedial investigation will be used for confirmatory sampling. A Remediation Confirmation Sampling Plan will be prepared and submitted to Ecology for review prior to the initiation of soil excavation activities. Cadmium, lead and zinc will be the key parameters analyzed.

Groundwater

After the 90-day performance evaluation period, groundwater monitoring and system operation and maintenance activities will be initiated. Select monitoring wells, to be approved by Ecology, will be sampled and analyzed for key constituents of concern. Once cleanup criteria have been met for four consecutive quarters, the recovery system will be shut down. If, subsequent to the shut-down of the recovery system, groundwater concentrations remain below cleanup levels for four consecutive quarters and show no significant increasing trends, groundwater remediation will be considered complete.

6.5 Data Management/Reporting

The following reports will be issued to Ecology following the completion of key remedial action activities.

- Report of Soil Remediation Efforts and Confirmation Sampling
- Report of Groundwater Recovery System Performance Evaluation
- Quarterly Reports of Groundwater Monitoring/Corrective Action Progress

Reports will include summary tables of collected data, laboratory analytical reports, and key figures showing interpretations of groundwater flow direction and other critical parameters, as appropriate.

7.0 HEALTH AND SAFETY

A detailed Health and Safety Plan will be developed and will be in place during the course of soil excavation and groundwater remediation field activities.

8.0 SCHEDULE

Field work on the project will be scheduled to begin after the finalization of an Agreed Order between Bay Zinc and Ecology. The groundwater performance evaluation and initial soil removal activities have been tentatively scheduled for late summer 2002. Because of the large volume of soil to be excavated and disposed of, and the substantial costs involved, soil excavation and disposal work will be spaced over a three year timeframe. Affected areas around the site perimeter, and possibly a portion of the railcar unloading area (SWMU-5) will be dealt with first (anticipated late summer/early fall of 2002). Other areas will be removed in 2003 and 2004. Ecology will be notified at least one week prior to excavation field work.

9.0 REFERENCES

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Appendix A

RCRA Facility Assessment Report Text

Appendix B

Field Sampling Procedures/Preliminary Sampling and Analysis Plan Text

Appendix C

Boring Logs/Well Installation Records

Appendix D

Laboratory Analytical Reports

Appendix E

SEPA Checklist and
Simplified Terrestrial Ecological Evaluation

Capture Zone Calculation

Tables

Figures