EPA/ROD/R10-00/033
2000

EPA Superfund
Record of Decision:

KETCHIKAN PULP COMPANY
EPA ID: AKD009252230
OU 01
KETCHIKAN, AK
06/07/2000

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SF/AR

Ketchikan Pulp Company (KPC)
Ketchikan, Alaska

Uplands Operable Unit

Record of Decision

June 7, 2000

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ACRONYMS AND ABBREVIATIONS

AAC	*Alaska Administrative Code*
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
BTEX	benzene, toluene, ethyl benzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	*Code of Federal Regulations*
CoC	chemicals of concern
Consent Order	Administrative Order on Consent
CoPC	chemicals of potential concern
CSF	cancer slope factor
Dioxins	polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
DRO	diesel range organics
Easement and Covenant	Environmental Protection Easement and Declaration of Restrictive Covenants
EPA	U.S. Environmental Protection Agency
FS	feasibility study
Gateway	Gateway Forest Products Company, Inc.
GRO	gasoline range organics
ICP	institutional control plan
ICs	institutional controls
KPC	Ketchikan Pulp Company
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OSWER	Office Solid Waste and Emergency Response
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD/F	polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
ppm	parts per million
ppt	parts per trillion
PRP	potentially responsible party
QA	quality assurance
RAO	remedial action objective

RBC	risk based concentration
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	remedial investigation
ROD	Record of Decision
RPM	remedial project manager
SPLP	synthetic precipitation leaching procedure
TAH	total aromatic hydrocarbons
TBC	to be considered
TCLP	toxicity-characteristic leaching procedure
TDG	Technical Discussion Group
TPH	total petroleum hydrocarbons
TRV	toxicity reference value
ug/L	microgram per liter
USFWS	U.S. Fish and Wildlife Service

PART 1: THE DECLARATION

Site Name and Location

The former Ketchikan Pulp Company (KPC site is located on the north shore of Ward Cove, approximately 5 miles north of Ketchikan, Alaska. The Environmental Protection Agency (EPA) identification number is AKD009252230 and the Alaska Department of Environmental conservation (ADEC) contaminated site database identification number is 1988130934701. The KPC site is not listed on the National Priorities List (NPL).

The site was divided into 2 operable units for investigation purposes: the Uplands Operable Unit and the Marine Operable Unit. This Record of Decision (ROD) addresses only the Uplands Operable Unit. A separate ROD addresses the Marine Operable Unit.

The early actions conducted under removal authority were implemented to control releases from the site and prepare it for reuse. The upland site is currently being redeveloped in part as Gateway Forest Products' veneer plant. Gateway Forest Products purchased the property (excluding the wood waste and ash disposal landfill and the water pipeline access road) from Ketchikan Pulp Company in November 1999.

The KPC facility began operations as a dissolving sulfite pulp mill in 1953 and terminated operations in March, 1997. Equipment associated with pulp mill operations has largely been dismantled and removed from the site. In November, 1999 the KPC upland mill property, excluding the water pipeline and landfill areas, was sold to Gateway Forest Products Company, Inc. Gateway will be using the site to operate a sawmill and a veneer min and for other redevelopment efforts.

Statement of Basis and Purpose

This decision document presents the joint EPA and ADEC Selected Remedy for the KPC Uplands Operable Unit, in Ketchikan, Alaska, which was chosen in accordance with Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended by SARA, and to the extent practicable, the National Contingency Plan (NCP) and the State of Alaska's Oil and. Hazardous Substance Cleanup Regulations. This decision is based on the Administrative Record file for this site.

Assessment of Site

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of Selected Remedy

Uplands Operable Unit

The cleanup actions that have been completed to date include source material removal (contaminated soil/sediment) from various areas of the facility, closure and post-closure activities (including capping, leachate collection and treatment) for the wood waste and ash disposal landfill, and clean out of roof cisterns at commercial and residential properties in the mill vicinity. These cleanup actions have addressed the contaminated soil/sediment and potential ongoing sources to the off-shore marine environment. The early actions completed at the site are a significant part of the final selected remedy. The remaining elements of the final selected action include the following:

Former Pulp Mill Area

- Compliance with already-existing institutional controls to ensure that the use of the former pulp mill area remains commercial/industrial. Such controls rely on the authorities of various regulatory agencies and include the following:

  -- Compliance with zoning restrictions of the Ketchikan Gateway Borough. The Borough has zoned the former pulp mill area for industrial use only. No residential or retail use of the area will be allowed.

  -- Compliance with an Environmental Protection Easement and Declaration of Restrictive Covenants recorded on October 28, 1999 (Appendix B to this ROD), which includes restrictions on land use to industrial/commercial and prohibits groundwater use.

- Development and implementation by EPA, ADEC, KPC and Gateway of an enforceable Institutional Controls Plan (IC Plan). The IC Plan will set forth procedures and protocols to prevent or minimize the potential for future exposure of residual contamination at the Site and will include the following elements:

-- Procedures to ensure that soils in the nearshore fill area, soils underneath paved areas or structures at the former pulp mill site, or soils that were not evaluated or characterized during the remedial investigation that are exposed in the future, e.g., as the result of excavation or demolition activities, are properly characterized and managed in accordance with applicable disposal requirements.

-- Coordination, notification, record-keeping and reporting requirements between KPC and Gateway and the appropriate regulatory agencies.

Pipeline Access Road

- Development and implementation by EPA, ADEC, KPC and Gateway of an enforceable Institutional Controls Plan (IC Plan). The IC Plan will set forth procedures and protocols to prevent or minimize the potential for future exposure of residual contamination at the Site and will include the following elements:

  -- Procedures to ensure that soils that were not evaluated or characterized during the remedial investigation that are exposed in the future, e.g., as the result of excavation or demolition activities, are properly characterized and managed in accordance with applicable disposal requirements.

  -- Coordination, notification, record-keeping and reporting requirements between KPC and Gateway and the appropriate regulatory agencies.

- KPC shall develop and record an easement and restrictive covenants document (or equitable servitude) for property still owned by KPC, namely pipeline access road areas. The easement/restrictive covenants shall be similar in nature to the Easement/Restriction Covenants for the pulp mill area and shall include prohibitions on use of groundwater and land use restricted to industrial/commercial or recreational. Conveyance of the easement/restrictive covenants to the State of Alaska Department of Natural Resources will also be required.

Wood Waste and Ash Disposal Landfill

- KPC shall close the remaining open cell at the landfill in accordance with ADEC Solid Waste Permit No. 9713-BA001 and all other applicable regulations.

- Development and implementation of provisions in the IC Plan to ensure compliance with the above-described restrictions for the landfill.

- KPC shall develop and record an easement and restrictive covenants document (or equitable servitude) for property still owned by KPC, namely the landfill. The easement/restrictive covenants shall be similar in nature to the Easement/Restrictive Covenants for the pulp mill area and shall include the prohibition of any activities that may result in use of groundwater, potential exposure of waste materials within the landfill, or potential interference with the integrity of the landfill cap. Conveyance of the easement/restrictive covenants to the State of Alaska Department of Natural Resources will also be required.

Requirements applicable to all areas of the site include:

- Compliance with the protocols and requirements set forth in the “Management Plan for Arsenic and Rock and Soil,” prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock.

- Access by authorized representatives of EPA, ADEC or DNR to inspect the areas addressed in this ROD.

Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective and utilizes permanent solutions (or resource recovery) to the maximum extent practicable. The remedy does not satisfy the federal statutory preference for treatment as a principal element of the remedy for the following reasons: 1) source materials constituting principal threats were addressed within the scope of this action through removal actions comprising excavation and off-site disposal, 2) available treatment technologies for contaminated soil were found to be limited, and cost prohibitive due to the remote location of the site and climatic extremes.

Because this remedy will result in low level threat hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a federal and state statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Data Certification Checklist

The following information is included in the *Decision Summary* section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations (see Tables 1 & 2)
- Baseline risk represented by the chemicals of concern (see Section 7, Summary of Site Risks and Table 1)
- Cleanup levels established for chemicals of concern and basis for the levels (see Table 1)
- How source materials constituting principal threats are addressed (see Section 5.5 & 9.1, Upland Nature and Extent of Contamination and Completed Early Actions, respectively)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (see Section 6, Current and Potential Future Site and Resource Uses)
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy (see Section 11, Selected Remedy)
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Section 11.3)
- Key factors that led to selecting the remedy (see Section 10, Comparative Analysis of Alternatives)

Authorizing Signatures

Chuck Clarke
Regional Administrator, Region X
United States Environmental Protection Agency

6/7/00
Date

Lynn J. Tomich Kent
Contaminated Sites Program Manager
Division of Spill Prevention and Response
Alaska Department of Environmental Conservation

Date

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Chuck Clarke
Regional Administrator, Region X
United States Environmental Protection Agency

Date

Lynn J. Tomich Kent
Contaminated Sites Program Manager
Division of Spill Prevention and Response
Alaska Department of Environmental Conservation

Date 6/9/00

PART 2: THE DECISION SUMMARY

1.0 SITE NAME LOCATION, AND BRIEF DESCRIPTION

The former Ketchikan Pulp Company (KPC) facility is located on the north shore of Ward Cove, approximately 5 miles north of Ketchikan, Alaska (Figure 1). The EPA identification number for this site is AKD009252230. The Alaska Department of Environmental Conservation (ADEC) Contaminated Sites database identification number is 1988130934701. The Uplands Operable Unit includes the pulp mill area, which includes all areas directly associated with the production of pulp (including the sawmill area), the dredge spoil subarea, where sediments dredged from Ward Cove historically have been placed, the former storage area along the water pipeline access road, the wood waste and ash disposal landfill area, located on Dawson Point west of the facility, and other upland areas that may have been affected by aerial deposition of stack emissions from the mill and residences where mill solids (wastewater treatment grit and dredge spoils) may have been used for fill or soil amendments. The boundary between the Uplands Operable Unit and the Marine Operable Unit is defined as the mean higher high tide level. Although on-site soil and off-shore marine sediments have been impacted by the facility's operation, this ROD addresses upland operable unit remedial activities only.

EPA and the Alaska Department of Environmental Conservation (ADEC) are co-lead agencies for the Uplands Operable Unit of the KPC site. The investigation at the Uplands Operable Unit and the identification and evaluation of cleanup actions were conducted under an Administrative Order on Consent (Consent Order) between KPC and its parent company, Louisiana-Pacific Corporation, the ADEC, and EPA. Although the KPC site is not listed on the Superfund National Priorities List (NPL), the Superfund process of investigation and alternative analysis is being followed at the site. KPC has agreed to pay all regulatory oversight, investigation, and cleanup costs.

No threatened or endangered species occur within the Upland Operable Unit or the local upland area. The American peregrine falcon, which could potentially be found in the area and was considered an endangered species by the U.S. Fish and Wildlife Service (USFWS), was deleted from the endangered species list in fall, 1999.

In November 1999, Gateway Forest Products purchased the former pulp mill facility from KPC, excluding the wood waste and ash disposal landfill and the water pipeline access road. KPC and Gateway Forest Products have negotiated agreements for addressing all remedial actions identified in this ROD, including the implementation of institutional controls.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Site History

KPC operated a dissolving sulfite pulp mill, from its construction in 1953 until shutdown in March 1997. Prior to state and federal regulations that went into effect in 1971, untreated effluent from the mill was discharged directly to Ward Cove. Beginning in 1972, effluent was treated in an on-site wastewater treatment plant prior to discharge to Ward Cove, and in 1980, a secondary activated sludge treatment system was installed. To supply power for mill operations, hog fuel (consisting of bark and unuseable wood), pulp and wastewater treatment plant sludge, and fuel oil were burned in two on-site power boilers. The power boilers were de-activated in March 1998.

2.2 Actions to Date

Early actions that involved the removal of contaminated soil and/or sediment (access road ditch only) from the Uplands Operable Unit were completed at various locations in order to remove the principal threats for exposures and contaminant migration, and to facilitate redevelopment activities (Figure 3). Soil removal and off-site disposal were completed at the access road ditch, railroad track areas, compressor area, the paint shop/former maintenance shop, the former bulk fuel area, and the former storage areas along the water pipeline access road. Soil contaminated with PCBs, lead and benzo[a]pyrene was removed at the paint shop/former maintenance shop area; PCB-, petroleum-, and lead-contaminated soil was removed from the water pipeline storage areas; low level dioxin-containing sediments were removed from the access road ditch to accommodate widening of the road for large demolition equipment, and fuel-contaminated soils were removed from the other areas. Sediment from the access road ditch was disposed of in the woodwaste and ash disposal landfill prior to closure, and all other contaminated material was shipped offsite for disposal in permitted facilities. Demolition activities have also been extensive, with removal of several buildings and structures and reconfiguration of others to prepare the site for other future industrial and commercial activities.

During the last several years, KPC identified and cleaned out roof cisterns used for the collection and storage of drinking water, located at commercial and residential properties in the mill vicinity. Collection and storage of rainwater provides the primary drinking water supply in the vicinity of the mill, as well as in most of the Ketchikan area. This cistern clean out effort was in response to concerns raised by local property owners after high winds in 1997 distributed foam from large aeration basins onto adjacent properties. To address potential historical air emission contamination and concerns, this effort was expanded. As a final measure, after the power boilers were shut down, KPC offered to clean out cisterns within the vicinity of the mill. This action was completed in fall 1998.

The wood waste and ash disposal landfill was closed in 1997, and a new landfill cell was constructed on top of the wood waste disposal site. All closure and post-closure activities of this landfill were conducted pursuant to ADEC solid waste and all other applicable state regulations, and the new cell is regulated by ADEC Solid Waste Permit No. 9713-BA001. The closure activities conducted included placing a geomembrane cap over the closed landfill; placing topsoil over the cap and contouring the final grade to minimize erosion; establishing a vegetative cover; maintaining the final cover and upgrading the leachate collection and treatment system; and conducting long-term monitoring. The landfill cover was designed to prevent infiltration of rainwater, to eliminate direct exposure to on-site workers or trespassers, to prevent migration of leachate to surface waters and Ward Cove, and to collect surface water runoff. Closure of the final landfill cell is projected to occur in 2001.

2.3 Investigation History

Numerous investigations were conducted at this site prior to the initiation of the Remedial Investigation (RI). EPA conducted preliminary site investigations in 1991 and 1993, and completed an Expanded Site Investigation (ESI) in April 1998. The ESI, an independent EPA investigation which paralleled RI sampling, also included analyses of Ward Cove sediments and offsite cistern and soil sampling. Sampling during these investigations identified elevated levels of metals and organic compounds in soils. In 1997, a Consent Order between KPC, Louisiana-Pacific Corporation, ADEC, and EPA was issued to address uplands site contamination. The Consent Order resulted in extensive investigations that included evaluation of the nature and extent of soil contamination and the potential for releases of contaminants from the uplands site to Ward Cove sediments. Environmental studies of Ward Cove have been conducted to evaluate the potential effects associated with discharges from the KPC facility. Historical studies focused on water quality assessments, and sediment chemistry and toxicity studies. A human health risk assessment and ecological evaluation were completed for both the Uplands and Marine Operable Units.

2.4 Enforcement History

RI and removal work (early actions) on the Uplands Operable Unit were carried out under a 1997 Administrative Order on Consent, under which KPC agreed to perform cleanup under direction and oversight of EPA and the ADEC, under CERCLA and state authority. Concurrently, work associated with the Marine Operable Unit is being carried out separately under a 1995 Clean Water Act (CWA) Consent Decree. As part of the implementation of the Consent Decree, KPC agreed to conduct a remediation project to determine the extent to which sediments in Ward Cove may pose unacceptable risks to humans or the environment, and to identify a remedy as appropriate.

3.0 COMMUNITY PARTICIPATION

There has been extensive public involvement at the KPC site because of the high degree of community interest. In February 1997, a questionnaire was sent to every mailing address in Ketchikan asking individuals to identify concerns regarding the potential contaminant releases associated with the facility and the on-going environmental investigation and cleanup activities. ADEC personnel also conducted a limited number of door-to-door interviews to learn more about community concerns. Information gathered in this process was used by EPA, ADEC, and KPC to prepare a Community Involvement Plan and to help identify areas that should be studied. Also, a technical discussion group (TDG) of concerned citizens was formed. KPC provided funding that the group used to hire independent consultants to assist in reviewing, understanding, and commenting on the complex technical documents.

A mailing list was created to keep interested citizens informed of activities and significant issues. Information repositories were established in Ketchikan and Juneau, Alaska, and the Administrative Record was established in Seattle, Washington. ADEC made site information and documents available on their website. The agencies created flyers and newspaper advertisements announcing the release of significant documents, meetings, and availability sessions. Several newsletters providing more in-depth information were sent out.

At each significant stage of the investigation, EPA, ADEC, and KPC held public meetings. Most of these meetings were preceded by an afternoon availability session where members of the community could meet one on one with EPA, ADEC, and KPC project staff and consultants. In total, 12 public meeting and public availability sessions were held to discuss the uplands and Ward Cove investigations. All public comments were considered in the development of the investigations. In addition, the draft RI was made available for public review and comment from April 1 through May 15, 1998. An availability session, a public meeting, and a meeting with the TDG were held to discuss the report. A summary of public comments and responses to those comments was made available in the information repositories in November 1998. All comments received during the public comment period were considered when revising the RI.

Also, during the investigation, EPA and ADEC hosted an Education Workshop for interested community members, to promote a better understanding of risk assessment. The workshop covered both the assessment process and technical concepts related to assessing risks to human health and the environment.

The Proposed Plan for the Uplands Operable Unit (OU) was made available to the public in May 1999. The Proposed Plan, the RI, Early Action Reports, and the draft Institutional Control Plan for the Uplands OU can be found in the Administrative Record file that is maintained at the U.S. EPA Records Center on the seventh floor of 1200 Sixth Avenue in Seattle, Washington. These documents are also available at the Information Repositories at the offices of the Department of Environmental Conservation in Ketchikan. The notice of the availability of the Proposed Plan was published in the Ketchikan Daily News on May 14, 1999. A public comment period was held from May 17 to June 17, 1999. An extension to the public comment period was requested and as a result, it was extended to July 19, 1999. In addition, a public meeting was held on May 26, 1999 to present the Proposed Plan to the community. EPA's response to comments received during this period is included in the Responsiveness Summary, which is Part 3 of this Record of Decision.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The KPC site is divided into two administrative units: the Marine Operable Unit and the Uplands Operable Unit. The following descriptions convey the scope and role of the Marine and Uplands Units as they relate to the overall site strategy. The Marine Operable Unit consists of approximately 250 acres in Ward Cove, of which approximately 80 acres have been designated as an area of concern where remedial action may be warranted because sediment contamination poses a risk to benthic organisms. To date, work performed in the Marine Operable Unit has generally been referred to as the "Ward Cove Sediment Remediation Project". A Proposed Plan summarizing the proposed remedy for the Marine Unit was released in July 1999, and EPA issued a Record of Decision for the Marine Operable Unit on March 29, 2000. The remedy for the Marine Unit is expected to be initiated in year 2000.

The second operable unit is the Uplands Operable Unit (OU) and is the subject of this ROD. The Uplands OU includes the pulp mill area (including the sawmill site), the wood waste and ash disposal landfill, the former storage areas along the water pipeline access road, and other land-based areas that may have been affected by pulp mill operations. (Figure 2) The boundary between the two operable units is defined as the mean higher high tide level. Although the Uplands OU is the primary subject of this ROD, the investigation and risk assessment included consideration of human exposure and risk related to potential combined exposures in both the Uplands OU and Ward Cove (i.e., exposure and potential risk to a local resident who works at the former mill site and eats fish and shellfish from Ward Cove). This information is presented in Section 7, *Summary of Site Risks*, of this ROD. Implementation of selected remedies for the Uplands and Marine Operable Units is intended to address all potential human health and environmental risks associated with releases of hazardous substances from the KPC site.

The early actions completed at the Uplands Operable Unit include removal of contaminated soil and/or sediment (access road ditch only) in areas that were generally well-defined and accessible (Figure 3). Cleanup options were straightforward, and given the limitations of available engineering and disposal options within the state of Alaska, and the types, concentrations and amount of contaminated materials, a full-scale feasibility study to explore a range of remedial alternatives was not developed. Completion of early actions provided source control or removal and minimized the risk of additional off-site migration, eliminated the possibility of worker exposure during redevelopment activities, and facilitated site redevelopment efforts. With the completion of these early actions, no additional removal work is currently anticipated for the site.

5.0 SITE CHARACTERISTICS

This section summarizes information obtained as part of RI activities and subsequent early actions at the site. It includes a description of the conceptual site models for human health and ecological receptors at the Uplands OU, which form the basis for all investigations, risk assessment, and response actions. In addition, this section presents sources of contamination, subsequent sampling strategies, and documented types of contamination, affected media, and migration potential.

5.1 Uplands Operable Unit Overview

Located on the north shoreline of Ward Cove, the site covers approximately 85 acres. Ward Cove is a coastal valley bounded by Slide Ridge to the north and Ward Mountain to the south. The predominant orientation of the valley is southwest to northeast. To the north of the pulp mill area, the terrain slopes steeply upward to a peak approximately 2,100 ft above mean sea level at a distance of approximately 1 mile from the shoreline. The area surrounding the pulp mill area is largely forested with small pockets of commercial and residential properties clustered along North Tongass Highway. The shoreline of Ward Cove on the south boundary is steep. Ward Cove is approximately 1 mile long, has a maximum width of 0.5 mile, and connects to Tongass Narrows to the west. Ward Creek, located at the east end of Ward Cove, near the mill property, is the primary source of freshwater to the cove. The Ketchikan area, a maritime climate, characterized by mild, wet conditions, is one of the wettest locations in the United States, receiving an average of 151 inches of precipitation annually.

The pulp mill area will remain an industrialized landscape (Figure 4). The pulp mill was built on fractured bedrock (typical of most of the Ketchikan area), exposed by blasting terraces out of the hillside. Native soils are essentially nonexistent at the pulp mill area due to steep terrain, and natural flushing from heavy rainfall; the ground surface typically consists of exposed bedrock, pavement, or fill material. Over most of the area of the site, the fill ranges from a few inches to several feet in thickness. Fill to a depth of 11 ft was reported at the paint shop area, and more than 25 ft estimated at the near-shore fill subarea (Figure 4). The fill encountered throughout the site during investigations was a mixture of soil, coarse gravel, and “shot rock”. In the near-shore fill area, ash, wood and construction debris was encountered. Areas that are not paved or graveled are generally covered by buildings and processing equipment, or used for storage of rough timber or milled lumber. The Gateway Forest Products sawmill operates in the northeast corner of the former pulp mill site.

Groundwater in the Uplands OU is limited in extent by the local topography and the location of the operable unit on the shore of Ward Cove. Groundwater consists of a transient, shallow aquifer system that exists in the fill areas above the fractured bedrock, a shallow aquifer in the fractured bedrock, and a potential discontinuous deeper aquifer within the fractured bedrock. The shallow fill aquifer and the shallow bedrock aquifer are considered Class III groundwater, as defined in EPA's Groundwater Protection Strategy and the National Contingency Plan and, as such, this groundwater is not considered potable. The ADEC has also determined that groundwater beneath the KPC mill site and the wood waste and ash disposal landfill is not suitable as a potable water supply, as evaluated under 18 AAC 75.350. The ADEC determination includes an assessment that the potentially present deeper aquifer is not considered a reasonably expected future source of drinking water.

A pipeline running from Lake Connell to the former pulp mill facility provides the industrial water supply to the site. Drinking water for Gateway Forest Products is from the City of Ketchikan public water supply system, and is trucked to the facility and placed in a water storage tank prior to use. Institutional controls will be put in place to preclude development or use of drinking water wells at the former KPC mill site, landfill and water pipeline areas.

The wood waste and ash disposal landfill is located on Dawson Point, just west of the former pulp mill facility, and east of Refuge Cove (Figure 2). The landfill is situated on thin soil covering fractured bedrock. Groundwater flow occurs primarily through the fractures. Although the primary groundwater flow is north to "Dawson Cove", groundwater may also flow to Ward Cove and Refuge Cove. Groundwater within the peninsular area of the landfill is limited by the local topography and the limited area of the peninsula, and hydraulically isolated from more regional groundwater flow occurring to the north. Based on its limited extent and hydraulic isolation from regional flow, groundwater in the vicinity of the landfill does not represent a likely aquifer of resource value, and is not used for any purpose. Dawson Point includes forested habitat, and several intermittent streams along the perimeter of the landfill. All are shallow, relatively steep gradient streams that originate from the vicinity of the landfill and are fed by subsurface groundwater flow, draining into Ward Cove or nearby Refuge Cove. The near-vertical gradient and the intermittent nature of the downstream reaches of these streams prevents upstream movement of aquatic organisms from marine waters.

The former storage area along the water pipeline road consists of five discrete areas: four general storage areas and Drum Area 2, a disposal site located between pipeline areas 2 and 3 which was identified during the early action (Figure 5). Area 1 is located approximately one-quarter mile from the Tongass Highway. The other four areas are further from the highway, and all areas are adjacent to the narrow gravel road that parallels the water pipeline. The pipeline areas are graded landings that are covered with either gravel or coarse fill material. Small drainages from each area feed larger streams which ultimately flow into Ward Cove.

5.2 Conceptual Site Models, Human Health and Ecological Receptors

5.2.1. Conceptual Site Model for Human Health

Figure 6 presents an overview of potential sources, receptors and exposure pathways for the KPC site. Figure 7 presents the Conceptual Site Model for human health. (This model presents an overview of pathways for the KPC mill site, including both upland and Marine operable units. However, the marine operable unit is addressed in a separate Record of Decision) Sources of contaminants within the pulp mill area were related to historical spills and leaks of petroleum products, solvents, and process chemicals; placement of wastewater treatment plant sludges and boiler bottom ash in fill areas; and aerial deposition of flyash from the power boilers. The dredge spoil subarea received sediments from maintenance dredging in Ward Cove. The landfill was permitted to receive routine deliveries of wood waste, bottom ash, and flyash and periodic deliveries of filter plant backwash, excavated soil from construction projects at the mill, primary sludge, and dredge spoils. The former storage area along the water pipeline was used as storage and disposal area for miscellaneous materials from the KPC mill.

Incineration of sludge and wood waste in the boilers also resulted in aerial deposition of flyash in areas adjacent to the facility in predominant wind directions to the north, northeast, and northwest. The investigation of potential aerial deposition focused on areas adjacent to the site including forested Slide Ridge to the north, and developed areas north of North Tongass Highway west to Refuge Cove. Another potential source of uplands contamination evaluated was the use of stockpiled dredge spoils and wastewater treatment plant grit that individuals used as fill or topsoil in residential yards.

The conceptual model identified the following potential contaminant transport pathways: Chemicals bound to clays and organic matter in fill solids in the pulp mill area may have leached to subsurface fill or groundwater and then migrated to Ward Cove prior to completion of the early removal actions. Chemicals in the dredge spoil subarea may move to Ward Cove via surface runoff and erosion and by subsurface migration. Chemicals in the wood waste and ash disposal landfill have been contained as part of the landfill closure, but may have been a historical source of contamination to groundwater and then to surface water and sediments on Dawson Point. Areas considered likely to present potential for exposure to human visitors would be sediments within the intertidal zone at Dawson Cove. Chemicals in upland aerial deposition areas may be bound to organic material, where present in forested soils and in developed area soils, and may be washed into marine waters by surface water runoff. Chemicals found in the former storage areas of the water pipeline may have been a historical source of contamination to surface water and sediments on the north side of the Tongass Highway.

Potential human receptors and pathways considered include: 1) future workers in the pulp mill area; 2) visitors to the dredge spoil subarea, the water pipeline area, and the wood waste and ash disposal landfill area; 3) off-site residents in locations where residential soil may have been affected by aerial deposition or by use of grit or dredged sediments as soil amendments; and 4) subsistence level anglers or gatherers or recreational visitors, anglers or gathers in Ward Cove who might be exposed to chemicals migrating from the site that potentially bioaccumulated in fish or shellfish or that are present in intertidal sediments. (Note: During the RI no CoPCs were identified based on transport to Ward Cove via groundwater or in intertidal and subtidal sediments. Therefore, these pathways were not quantitatively evaluated in the baseline risk assessment. However, the Marine Operable Unit risk assessment includes evaluation of intertidal sediments in Ward Cove. The Marine OU ROD concludes that most or all of the sediment contamination in Ward Cove resulted from direct releases, and that groundwater transport of contaminants from the Upland OU is not significant.) Water cisterns were not included in the conceptual model because they had been cleaned out in late 1995/early 1996 and in 1998, and therefore the pathway was not considered to be complete for current or future residents at the time the baseline risk assessment was completed. Additional information on cisterns is presented in Section 6.3 of this ROD.

5.2.2. Conceptual Site Model for Ecological Receptors

Figure 8 presents the conceptual site model for ecological receptors. Based on an ecological survey, and the industrial nature of the pulp mill area, it was determined that sufficient habitat does not exist in the pulp mill area to maintain wildlife populations, thus, exposure pathways to terrestrial organisms are incomplete. No significant transport of chemicals from pulp mill soils to Ward Cove sediments via surface water runoff or groundwater migration was identified. Thus, migration of chemicals from pulp mill area soils to Ward Cove does not appear to be of concern for aquatic receptors inhabiting the cove or consumers of these organisms.

Another potential exposure pathway evaluated for ecological receptors is related to historical releases of leachate and landfill materials from the wood waste and ash disposal landfill on Dawson Point. The wood waste and ash disposal landfill has been capped, with leachate collection and treatment, designed to eliminate any potential contact with these materials by ecological receptors.

The conceptual site model also includes ecological receptors in off-site upland habitats (i.e. Slide Ridge) potentially exposed to contaminants from past deposition of stack emissions. Some terrestrial receptors (e.g., small mammals) are likely to occur on Dawson Point because habitat around the landfill is primarily older second growth forest. This habitat is represented by the risk evaluation for small mammal receptors in forested areas.

Potential impacts to ecological receptors were also qualitatively evaluated for the former storage areas on the water pipeline access road.

5.3 Known or Suspected Sources of Upland Contamination

The following chemicals were known or suspected to have been released in Upland OU areas: petroleum hydrocarbons, PAHs, and PCBs from fuel and oil uses on-site; VOCs and metals from process and ancillary chemicals; PCBs from electrical equipment; and low concentrations of VOCs, SVOCs, dioxins, and metals from sludge, grit, and ash. The sediments from Ward Cove deposited in the dredge spoil subarea were suspected to contain low concentrations of dioxins, metals, and PAHs. The wood waste and ash disposal landfill contains low concentration dioxins, and uplands depositional areas may also contain metals and dioxins from flyash resulting from historical power boiler operations. Residential use of mill solids was evaluated for potential to contribute metals, VOCs, SVOCs, and dioxin concentrations to soils.

Early actions at the Uplands Unit were completed in 1998 and 1999 for areas identified as having unacceptable risks, ongoing potential for off site migration of contaminants and/or identified potential for redevelopment and reuse. Cleanup goals and residual contaminant concentrations are presented in Table 1. PCB, lead and petroleum-contaminated soils in the pulp mill area and along the water pipeline access road were excavated and disposed of off-site at an out-of-state permitted solid waste and hazardous waste landfill. Also, sediments in the access road ditch were removed when the road was widened for demolition activities. The sediments, which contained low levels of dioxins, were disposed of at the Dawson Point wood waste and ash disposal landfill. The wood waste and ash disposal landfill has been capped, with a leachate collection and treatment system, and long-term monitoring requirements in place. Closure of the final landfill cell will meet state and federal requirements.

5.4 Upland Sampling Strategy

The Uplands Operable Unit RI began in March of 1997 as a focused process for characterizing the nature and extent of pulp mill-related contamination, prior to any cleanup/removal actions. Most of the field sampling took place in the fall of 1997, and winter and spring of 1998. Target chemicals were identified for analysis in specific site areas through a review of existing environmental data, review of historical operational data, review of process and other relevant information, and comprehensive chemical analysis of source materials for priority pollutants and dioxins. Specifically, source materials from process wastes (i.e., sludge and grit from the wastewater treatment system, flyash, and bottom ash from the multifuel power boilers) were analyzed for the full suite of chemicals that could be present as a result of historical and permitted site activities. The resulting detected concentrations in source materials were compared with appropriate risk-based concentrations (RBCs) to identify target chemicals for certain site subareas known to have received only these materials. These subareas were then analyzed for these target chemicals.

Areas with a more uncertain site history were analyzed for a full suite of chemicals, including target analyte list metals, target compound list volatile and semivolatile organic compounds, PCBs and PCDD/Fs and pesticides. Chemicals detected in soil, sediment, or water samples were then identified as Chemicals of Potential Concern (CoPCs) for evaluation in the risk assessment if they met the following criteria: 1) the chemicals are toxic; 2) the chemicals are present as a result of site activities; 3) their concentrations exceed background concentrations; and 4) their concentrations exceed the EPA RBC appropriate for the expected land use and receptors. Table 2 summarizes the type of samples collected from each of the Uplands Operable Unit source areas and potential off-site contaminant migration areas.

RBCs initially used in this evaluation were derived by EPA, Region 3 (**U.S. EPA 1996, 1998**) to represent a concentration of a chemical that will not pose an unacceptable level of human health risk based on specified exposure conditions. Because EPA Region 10 began relying on RBCs derived by EPA, Region 9 during the course of the RI, contaminant concentrations were also compared to Region 9 RBCs. No additional CoPCs were identified through this comparison. The EPA RBCs provide a conservative means to identify target chemicals because they incorporate a number of protective assumptions (i.e., a l $x10^{-6}$ cancer risk for carcinogenic effects or a hazard index of 1 for noncarcinogenic effects, exposure to chemicals in soil for 30 years in a residential context or 25 years in an industrial setting). Industrial RBCs were used for all comparisons except for scenarios where residential exposure was more likely to occur (residential areas where mill solids or dredge spoils were used for soil amendment or fill, and residential areas potentially affected by aerial deposition). Areas with likely or possible recreational use, i.e., Slide Ridge and the former storage areas along the water pipeline access road, were evaluated using RBCs for industrial use scenarios. Industrial scenarios were used because RBCs calculated to be protective of a worker's exposure (i.e., 250 days per year for 25 years) would also be protective of children, young adult or adult recreational users who would spend less time there than workers, and therefore have a much lower exposure frequency as occasional visitors.

Off-site background soil and sediment sampling was conducted to compare with on-site sampling results to assist in determining the nature and extent of contamination. Sampling at the former mill site was completed in the following areas (Figures 2 and 4):

- Process subarea: access road and ditch, wood room/log deck area, soils near Evaporator No. 3;
- Mill support subarea: aeration basin soils, grit chamber soils, paint shop/former maintenance shop area, caustic tanks and pipeline, equipment storage area, former bottom ash storage pile, and filter plant soils;
- Nearshore fill subarea;
- Wood waste and sludge disposal subarea;
- Dredge spoil subarea;
- Wood waste and ash disposal landfill; and
- Former storage areas along the water pipeline access road.

Surface water and groundwater characterization was based on routine sampling of surface water and leachate at the wood waste and ash disposal landfill, and routine monitoring of groundwater at the dredge spoil subarea, as part of State of Alaska Solid Waste and EPA NPDES permit requirements. In addition, seep water coming off the site was sampled near the wood room/log deck area and water sampling was conducted in the near-shore fill area.

The water beneath the near-shore fill subarea is predominantly seawater that flushes in and out of the fill with the tide, with additional water coming from surface water infiltration.

Prior to shutdown of the mill power boilers, aerial transport of stack emissions was a potentially important transport mechanism that was evaluated in the RI. To characterize this source, forest soils on Slide Ridge and north of the Tongass Highway were sampled (Figure 9). The sampling locations were chosen because air modeling indicated they would be in the most likely areas of maximum deposition. Sampling was also conducted in residential yards to evaluate dioxin concentrations from grit and possibly stockpiled dredge spoils that residents used for fill or topsoil (Figure 9).

In addition, after the results of the soil, sediment, and water sampling conducted in the fall of 1997 were reviewed, rock products from local quarries were tentatively identified as a potential source of arsenic to the environment. To determine the role of rock products as a potential arsenic source, supplemental sampling was conducted in February 1998 at local rock quarries that had possibly been used as a source of fill. Sampling results indicated high naturally occurring arsenic levels in several types of rock. Soil and crushed rock samples were further analyzed for arsenic mineralogy, leachability, and bioaccessibility.

Confirmational soil sampling was also done as part of the early removal actions. These samples supplemented RI data on contaminant aerial extent and concentrations and confirmed residual contaminant concentrations.

Two ecological surveys were conducted at the KPC site and adjacent areas including the wood waste and ash disposal landfill and Slide Ridge. A preliminary ecological reconnaissance was conducted in February 1997, and a subsequent reconnaissance was conducted in July 1997, with trustee agencies present.

5.5 Upland Nature and Extent of Contamination

The evaluation of the nature and extent of contamination at the Uplands Operable Unit was based primarily on data collected during the RI, data collected during the early action removals, and during routine monitoring conducted by KPC. Where applicable, historical data for the site and data from EPA’s expanded site investigation were also used. Analytes in each area of interest were compared to background concentrations and RBCs to determine chemicals of potential concern (CoPCs) for the site. Petroleum hydrocarbon concentrations were compared to ADEC cleanup levels. Based on this approach, arsenic, lead, manganese, polycyclic aromatic hydrocarbons (PAHs), dioxins, PCBs, and petroleum hydrocarbons were identified as CoPCs at one or more areas. The results of the RI are consistent with the EPA expanded site investigation, which was conducted concurrently with the RI. A summary of the results of field sampling at each Uplands OU source area and the contaminants above screening levels are provided in Table 1. The distribution, and transport and fate of these chemicals is discussed below.

Exposure to contaminated soil, and surface water and groundwater transport are the primary pathways of interest because of the ongoing potential for impact on human or ecological receptors. In areas where contaminated soil was identified during the RI, early removal actions were implemented to eliminate the potential for ongoing exposure to workers, to facilitate demolition activities, and to expedite redevelopment efforts by removing environmental barriers. Removal of small pockets of contaminated soil also eliminated the possibility for contaminant migration offsite or into Ward Cove through surface water or groundwater pathways.

Most arsenic samples in the pulp mill area exceeded the established background concentration of 7.6 mg/kg. Areas in the Uplands OU where arsenic was not detected above screening criteria during remedial investigation sampling were the wood waste and ash disposal landfill area, the dredge spoil subarea, and the forested aerial deposition areas north of North Tongass Highway, on Slide Ridge and in most residential yard samples. Process-related wastes (i.e., electrostatic flyash) may have contributed to some arsenic concentrations of less than 30 mg/kg (based on arsenic concentrations in fly ash from the power boiler); however, the most likely source of elevated arsenic is the use of arsenic-containing rock as fill. Other sources, such as logs treated with arsenical insecticides, pressure-treated lumber, and arsenic-containing rodenticides, may have contributed to elevated arsenic concentrations in localized areas but would not have resulted in either the distribution or concentration of arsenic observed at the Uplands OU.

To more fully characterize the source of arsenic and the potential capacity for migration to groundwater or marine waters, and as part of the facility *Management Plan for Arsenic in Rock and Soil*, toxic characteristic leaching procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) analyses were performed on rock from local quarries that has been used onsite as fill and cover material and on samples from six local quarries. These analyses indicated that less than 1 percent of the total arsenic in the rock is soluble. Therefore, the majority of arsenic detected in the soil and sediment samples is present in a form that would not be available to be leached from the solid phase. The arsenic in the soil is probably a result of the initial deposition of the rock fill (and associated fine material) and, to some extent, as particulate matter suspended in surface water flow. Particulate transport is also a likely source of the slightly elevated arsenic concentrations found in Ward Cove sediments. However, this particulate form of arsenic (as opposed to dissolved arsenic) is less susceptible to migration to groundwater or marine waters. The stability of the arsenic is indicated by the low concentrations in the groundwater samples from the near-shore fill subarea and in the seep from the wood room/log deck area.

Lead was detected at concentrations above screening criteria in soil/fill at the paint shop/former maintenance shop area and in former storage area 2 along the water pipeline access road. Lead compounds generally have a very low water solubility, and dissolved-phase lead is rapidly precipitated or sorbed by clays, hydrous oxides, and organic matter. Lead-contaminated soils have been removed from the paint shop area and the water pipeline Area 2 as part of the early actions completed in fall/winter of 1999. Residual lead concentrations at the Paint Shop are below Region 10 industrial cleanup goals. Residual lead concentrations at Area 2 of the pipeline exceed the cleanup goal of 1000 mg/kg in 6 of 55 samples, with concentrations ranging up to 2,300 mg/kg. Leachability tests were completed for this area and lead was found to not pose a risk to groundwater. Additionally, the area with residual lead contamination above the cleanup goal, which comprises approximately 25% of Area 2, is covered with a minimum of six inches of topsoil, or roughly 80 cubic yards, and a vegetative cover.

In soil at areas along the pipeline road, total chromium was detected in four of 55 samples at concentrations exceeding screening levels of 450 mg/kg for chromium (VI). It is important to note that the screening levels are for chromium (VI), which is typically a minor component of the total chromium analysis. (There is currently no EPA approved method for measurement of chromium (VI) in soil). Soils in two of the four areas with chromium were excavated and removed due to the lead concentrations. Chromium (VI) is found in soil under alkaline, oxidizing conditions and would not be expected to be present in soils along the pipeline road. Leachability tests did not indicate a potential for chromium migration to groundwater, and the residual concentrations are in the portion of Area 2 that has been covered with topsoil. Given these factors and the remaining soils total chromium concentrations of 455 mg/kg and 709 mg/kg, these soils are not considered as an area of concern.

Manganese was not detected above screening criteria in soil or sediment samples collected during the remedial investigation. Manganese was detected above marine background in the water sample collected from the intertidal seep near the log deck. The source of the elevated manganese is most likely from infiltration of surface water that has been enriched with manganese, which was mobilized from soil by naturally occurring organic material leached from wood waste historically present in this vicinity of the site (i.e., the hog fuel and chip storage pile). As part of the mill shutdown, the large piles of wood chips and hog fuel have been removed; thus, manganese concentrations in seep water are expected to decrease over time.

Dioxins were detected above screening criteria in the access road ditch sediments, in aerial deposition soils from developed areas, and in forest aerial deposition soils from just north of North Tongass Highway and above forest soil background in aerial deposition samples collected on Slide Ridge. Dioxins in the access road ditch sediments were probably the result of surface water transport of flyash from the power boiler area to the ditch; those sediments were removed as part of early actions. In off-site soils, dioxin transport is expected to be minimal except for that associated with some surface soil erosion and in forest areas, surface transport of conifer needles.

Characterization of the potential aerial deposition of flyash containing dioxins onto offsite residential soils and cisterns was completed. Aerial deposition modeling and public comment was used as a guide to identify sampling locations representing likely maximum depositional areas. Sampling indicated the highest dioxin concentrations in forested soils adjacent to the mill facility, with concentrations decreasing to background prior to encountering the residential areas of Refuge Cove. Additionally, the highest dioxin concentrations were in the range of 10-80 parts per trillion (ppt), which is well below the EPA residential soil cleanup goal of 1,000 ppt. The results of the air modeling and soil samples were used to identify the area in which water cisterns were cleaned. Cisterns within and beyond the projected depositional area were cleaned. Composite samples of cistern sediments were also below the residential soil cleanup value.

One PAH, benzo[a]pyrene, was detected in the paint shop/former maintenance shop area at concentrations exceeding screening criteria. Those soils were removed during removal activities at the paint shop, completed in fall of 1999.

PCBs were detected in soils above screening criteria in the paint shop/former maintenance shop area and the former storage areas 2 and 3 and Drum area 2 along the water pipeline. Early actions for soils in both storage areas excavated the affected material and were completed in late fall/winter of 1999. Approximately 280 cubic yards of PCB contaminated soil were removed from Area 2 and approximately 15 cubic yards of PCB contaminated soil were removed from Area 3 along the water pipeline access road. In addition, Aroclor 1254 was detected above screening criteria in an unfiltered water sample collected from a pit in the near-shore fill subarea. Residual concentrations of PCB at the pipeline areas are below the site specific risk based cleanup goal of 10 mg/kg. Two samples at the paint shop indicated a residual concentration of PCBs above the cleanup goal, at concentrations of 13.5 mg/kg and 60.2 mg/kg. Both samples were residual soils taken on bedrock exposed during removal activities. The higher of the two samples is at a backfilled depth of 12 feet. Because PCBs have a low water solubility and high affinity for organic matter, transport of PCBs in the dissolved phase beyond the area of initial deposition (i.e., into groundwater, surface water or Ward Cove) is expected to be minimal. PCBs are mixtures of many compounds with varying rates of degradation, with the composition of the PCB mixture changing over time, but overall degradation is slow.

Petroleum hydrocarbons were detected above the ADEC soil cleanup standards for the protection of groundwater in soil/fill at the former storage area along the water pipeline, comingled with other contaminants of concern (CoC). The area where petroleum was identified consists of approximately 12 in. of coarse fill mixed with construction debris, underlain by up to 15 ft of loose rock, blasted from the hillside and placed on bedrock to form the storage area pad. Low molecular weight PAHs present in the dissolved phase could move with the flow of water through this rock layer, due to the probable absence of organic matter in the loose rock beneath the 1 ft thick fill. These compounds were excavated and disposed of off site with other contaminated soils. Petroleum hydrocarbons and/or PAHs were also found above ADEC soil cleanup standards at the railroad tracks, compressor and former bulk fuel areas. These soils were also excavated and disposed of off-site.

6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

6.1 Land Use

The former pulp mill area is located in the Ketchikan Gateway Borough. The pulp mill area is currently used for industrial purposes including construction and operation of a veneer plant, and according to local land use planning officials and citizens, such use is expected to continue in the future. Current redevelopment efforts aimed at a complete re-use of the facility are ongoing and include such measures as extensive demolition, infrastructure upgrades, utility modifications, and re-design of roads for better access. The Ketchikan Gateway Borough has zoned the pulp mill area for industrial/commercial use and has indicated that no residential or retail use of the area will be permitted in the future. As a component of the Institutional Control Plan (ICP) for the Upland OU, an Environmental Protection Easement and Declaration of Restrictive Covenants agreement has been filed for the mill site. This agreement reinforces the land use restrictions identified in this ROD and the ICP and includes prohibitions on residential use, installation of wells or use of groundwater and sampling requirements for future activities. Similar easement and covenant agreements are being prepared for the landfill and pipeline access road areas of the Upland OU. Nearby areas are used for industrial/commercial, residential, and recreational purposes.

Approximately 12 businesses are located immediately across from the mill’s water filtration plant north of the North Tongass Highway. Approximately six residences are located immediately north of the pulp mill across the North Tongass Highway, several residences are located near the mouth of Ward Cove, and approximately 1 mile west is Refuge Cove, a mixed residential/light industrial/commercial use area. Steep terrain limits the number of suitable building sites near the mill.

The area near the bridge at the mouth of Ward Creek is a popular fishing location during salmon migration. The area along the water pipeline corridor and access road, although gated private property, is frequented by recreational visitors. Future use is anticipated to be nonresidential, with a possibility to creating formal access for recreational users. Use of the landfill area will remain industrial, and be highly restricted because of controls required to maintain the integrity of the landfill cap. However, although the landfill on Dawson Point is private property owned entirely by KPC, there are no fences in place at the boundary with marine areas, and it is possible that people may occasionally visit the area along the shoreline at “Dawson Cove” or forested areas of Dawson Point. Similarly, people might visit Slide Ridge areas (primarily public land) for recreational purposes. The frequency and duration of these visits in forested areas is expected to be limited by the relative difficulty of access, steep terrain, dense vegetation, and availability of other attractive recreational areas in the vicinity. No recreational infrastructure, such as campgrounds, are located in these areas.

6.2 Groundwater Use

Private drinking water for domestic purposes in the Ketchikan area (outside the city limits) is almost exclusively derived from rainwater captured with roof catchment systems and stored in cisterns. Alaska Department of Natural Resources records indicate only six well installations in a 10 mile radius of the Ketchikan area. Two of these wells are shallow and are considered water storage pits. Of the remaining four wells, only one is located in the Ward Cove area, at a depth of 100 feet in a location north of Refuge Cove.

The groundwater associated with this site is not used as a source of drinking water or for any other purpose. Documented groundwater at the site consists of a shallow fill aquifer and a shallow aquifer in the fractured bedrock. There is a potential deeper aquifer within the fractured bedrock, which is not considered accessible and was not investigated. The groundwater is a mixture of rainfall infiltration and cyclic intrusion of seawater in shoreline areas. The lowest level of the pulp mill is located within 10 ft above the high tide level, and seawater flushes in and out of the coarse fill twice daily with rising and falling tides. At the wood waste and ash disposal landfill, primary groundwater flow occurs through fractures in the bedrock, particularly following precipitation events.

Due in part to the transitory nature of the groundwater and the associated high saline content, the shallow fill and shallow bedrock aquifers in the vicinity of the KPC mill site and the wood waste and ash disposal landfill are considered Class III pursuant to EPAs Groundwater Protection Strategy and the National Contingency Plan, and therefore not potable water sources. ADEC has also determined that groundwater beneath the KPC mill site and the wood waste and ash disposal landfill is not suitable as a potable water supply, as evaluated under 18 AAC 75.350. Groundwater is not:

- currently used for a private or public drinking water system;
- within the zone of contribution of an active private or public drinking water system;
- within a recharge area for a private or public drinking water well, a wellhead protection area, or a sole source aquifer.

Under 18 AAC 75.350, documented shallow groundwater and the potential deeper bedrock aquifer at the mill site and wood waste and ash disposal landfill are not considered reasonably expected future sources of drinking water because:

- bedrock and fractured bedrock drinking water well placement is complex and costly;
- drinking water wells placed in the shallow fill-and shallow bedrock aquifers at these locations will likely be of poor production capacity;
- the mill site has poor water quality due to saltwater intrusion;

- practical siting considerations preclude well development in the immediate vicinity of a permitted landfill facility;
- readily available and less expensive sources of drinking water in the area already exist.

Finally, the groundwater flow direction at the mill site and wood waste and ash disposal landfill will not transport hazardous substances in concentrations that exceed groundwater or surface water cleanup levels under the State of Alaska's Oil and Hazardous Substance Cleanup Regulations to groundwater that is a reasonably anticipated future source of drinking water.

Additionally, as a protective measure, the filed Easement and Covenant agreement for the mill site and the anticipated agreements for the landfill and water pipeline access road will prohibit use and/or placement of a drinking water wells. This prohibition is also written into the site wide Institutional Control Plan.

6.3 Surface Water Use

Surface water at the site is limited to storm water runoff, several small ditches on Dawson Point, and limited discharge from the shallow groundwater system. Shallow groundwater present in the fill and shallow bedrock beneath the site discharges either directly to Ward Cove or through several intertidal seeps. Seep surveys identified several seeps along the shoreline west to Dawson Cove. While no perennial streams flow within the pulp mill area, several intermittent drainages originate on Dawson Point and discharge into "Dawson Cove", Refuge Cove, and Ward Cove. Offsite, and along the water pipeline access road, several intermittent and permanent streams drain Slide Ridge, entering Ward Creek both upstream and downstream of Ward Lake. All streams have high-gradient flows of clear water and numerous small pools interconnected by small cascades and waterfalls.

The Ketchikan municipal water supply draws from the Ketchikan lakes watershed for distribution within the city, but this service does not extend throughout the borough, and is not available within the pulp mill vicinity. Drinking and process water at the mill was obtained via KPC's pipeline from Connell Lake, located approximately 2 miles northeast of the mill. Drinking water for domestic purposes in the areas around Ward Cove has been almost exclusively derived from rainwater captured with roof catchment systems and stored in cisterns.

In late 1995/early 1996, because of concerns raised by local property owners who use roof catchment systems for their water supply, KPC implemented a program for cleaning catchment systems and replacing water supplies for properties immediately downwind of the pulp mill. Roof catchment systems were cleaned out and some were disconnected and covered to prevent further collection of rainwater. During this time, businesses/residences were supplied with bottled water for consumption and bulk water for other uses, until the mill shut down the power boilers, eliminating any further potential sources of air emissions. In March 1998, KPC terminated the program of supplying water to local residences and businesses, and offered to clean out and restore the use of water cisterns located in the vicinity of the mill from Ward Creek to Yeisley Road, approximately 1 mile west of the facility. Between May 26 and June 9, 1998, a total of 26 cisterns were cleaned out; rinsate and sediment were collected, analyzed and disposed of offsite. Figure 11 shows the locations of the 58 cisterns cleaned out in 1996 or 1998 (or both).

The extent of the area to which cistern clean out was offered was based on aerial deposition modeling and the soil sample analysis. The area encompassed most of the residences and businesses between the mill and Refuge Cove and within Refuge Cove. The geographic area was expanded beyond the maximum deposition area predicted by the modeling to include the entire high-density occupancy area surrounding Refuge Cove.

7.0 SUMMARY OF SITE RISKS

A baseline human health risk assessment and an ecological risk evaluation were conducted for the Uplands OU at the KPC site to evaluate the potential for current and future impacts of site-related contaminants on receptors working, inhabiting, or visiting areas within the Uplands OU. This baseline risk assessment was completed using data collected during the Remedial Investigation for the Uplands OU. As such, data collected during the course of completing the early actions was not considered in the baseline risk assessment. For the pipeline access road higher concentrations of the contaminants of concern were found during the early action sampling than during the original RI investigation. These values would have likely resulted in higher baseline risk estimates. These soils were subsequently removed. A separate assessment of human health and ecological risks associated with chemicals in Ward Cove was conducted, and findings are summarized as applicable here. ***The references cited in the following section are listed in Section 14 of the ROD***.

7.1 Human Health Risks

The baseline risk assessment estimates what risks the site poses if no action were taken (i.e., prior to any early removal actions). It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment, which includes the identification of Chemicals of Concern (COCs), an exposure assessment, a toxicity assessment, and risk characterization.

7.1.1 Identification of Chemicals of Concern

Contaminants evaluated in the human health risk assessment included those chemicals where the maximum concentration detected in site media: 1) exceeded the lower of either the 95 percent upper confidence limit (UCL) on the mean concentration or the maximum concentration identified for that chemical in background soils, and 2) exceeded applicable risk-based screening values derived by EPA. Overall, arsenic, lead, dioxins, benzo[a]pyrene (a PAH), and PCBs were identified as COCs in on-site soil (including the former storage area along the water pipeline) although not all contaminants were found in all source areas; arsenic and dioxins were identified as COCs for off-site aerial deposition soils; and dioxins were identified, as a COC for residential yards amended with grit.(Table 1) PCBs were initially evaluated as CoPCs in subsurface water (seep and intertidal), but were eliminated from further study, based on limited extent (single sample results), Manganese was found in seeps down gradient from the hog fuel and chip piles and was thought to be released from soil due to naturally occurring organic materials in wood. Because hog fuel and chips were removed, manganese was no longer considered a CoC. In addition, there was no indication of these contaminants in Ward Cove sediments.

7.1.2 Exposure Assessment

The objective of the exposure assessment was to identify potential exposure scenarios by which contaminants of concern in site media could contact humans and to quantify the intensity and extent of that exposure. It considers the current and potential future uses of the site, characterizes the potentially exposed populations, identifies the important exposure pathways, and quantifies the intake of each COC from each medium for each population at risk. The conceptual site model depicting potential receptors and exposure pathways is presented in Section 5.2 (Figures 6 and 7).

The exposure pathways that were quantitatively evaluated in the human health risk assessment are the following:

- Current and future adult workers in onsite areas and in areas where aerial deposition has affected industrial (KPC) soils were evaluated for potential exposures to COCs via ingestion, dermal contact, and inhalation.
- Current or future adult workers who might contact soils along the former pipeline access road via ingestion, dermal contact or inhalation.[1]
- Off-site residents (adults and children) in aerial deposition areas were evaluated for potential exposures to COCs via ingestion, dermal contact, inhalation, and consumption of homegrown produce.

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[1]After the RI was completed, additional sampling data indicated higher concentrations in soils at some areas at the pipeline road and these soils were removed to levels acceptable for industrial use. Thus, although the risk assessment did not include these areas that were subsequently identified, soils were remediated to levels protective of human health based on current and future land use.

- Off-site residents who have amended their yards with grit were evaluated for potential exposures to dioxins in soil via ingestion, dermal contact, inhalation, and consumption of homegrown produce.

Several pathways were fully evaluated, but did not require quantitative risk calculations due to the lack of a complete exposure pathway. No CoPCs were identified for two pathways: future workers within the dredge spoil subarea who may be exposed to chemicals from dewatered sediments and recreational visitors and anglers who may have contact with intertidal sediments in Dawson Cove, downgradient from the wood waste and ash disposal landfill. Because no CoPCs were present for these pathways, they are not complete and no excess exposure or risk would be associated with use of these areas.

In addition, potential exposures for residents who use water from cisterns that may have historically been affected by aerial deposition of power boiler stack emissions was considered in the RI and in a separate consultation by ATSDR (**ATSDR 1998**). The ATSDR assessment determined that no adverse effects were expected to be associated with exposure to contaminants in water or sediments in cisterns prior to the cleaning of cisterns. KPC cleaned drinking water cisterns within the deposition area, defined in the RI by both modeling and soil sampling data, and in areas beyond where there was no apparent deposition to soils. Because risk assessments are based on current or future conditions, and the cisterns have been cleaned, there is no current or future complete exposure pathway and no excess risk associated with the cisterns. Therefore, the cisterns were not quantitatively evaluated in the risk assessment.

Finally, in the assessment of the Marine Operable Unit, a comprehensive human health evaluation was conducted and no CoPCs were identified for human health, i.e. there were no complete current or future exposure pathways. However, as part of the development of remedial action objectives, a cumulative estimate was calculated for a hypothetical person who consumes fish and shellfish from Ward cove at a subsistence level, works at the site (after remediation has occurred i.e. residual risk) and is exposed to chemicals in soil via ingestion and dermal contact; and who resides within the aerial deposition zone and is exposed to chemicals in soil via , ingestion, dermal contact, and consumption of produce. (See Section 12.1 for further discussion of cumulative risks).

The parameters used to calculate exposure were obtained from EPA human health risk assessment guidance and other EPA guidance. (**U.S. EPA 1990, 1991, 1992, 1994, 1995**) in consultation with EPA Region 10. The exposure frequency for a residential exposure was adjusted to account for local climatic conditions which reduced residential exposure frequency from the default value of 350 days per year to 330 days per year, consistent with spending less time outdoors due to rainfall, snowfall, temperature and daylight extremes..

7.1.3 Toxicity Assessment

The human health toxicity assessment quantified the relationship between estimated exposure (dose) to a contaminant of concern and the increased likelihood of adverse effects. Risks of contracting cancer due to site exposure are evaluated based on toxicity factors (cancer slope factors, or CSFs) published by EPA in the Integrated Risk Information System (IRIS). Quantification of non-cancer injuries relies on published reference doses (RfDs).

CSFs are used to estimate the probability that a person would develop cancer given exposure to site-specific contaminants. This site-specific risk is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates generated in risk assessments are frequently referred to as “incremental” or “excess lifetime” cancer risks.

RfDs represent a daily contaminant intake below which no adverse human health effects are expected to occur. To evaluate noncarcinogenic health effects, the human health impact of contaminants is approximated using a hazard quotient (HQ). Hazard quotients are calculated by comparing the estimates of site-specific human exposure doses with RfDs. (Values of less than 1.0 indicate that non-cancer effects are unlikely to result from exposure to a site contaminant.)

Of the site-related contaminants of concern in soil that potentially impact human health, PCBs, dioxins, arsenic and some PAHs are considered to be carcinogenic. The potential cancer risks posed by dioxin and PAHs were evaluated using EPA's toxicity equivalency factor (TEF) approach. (Table 3)

For PAHs, only benzo(a)pyrene [B(a)P] was identified as a CoPC and risk estimates for B(a)P were derived using the B(a)P CSF identified in EPA’s Integrated Risk Information System (IRIS; **www.epa.gov/ngispgm3/iris**). Similarly, the EPA IRIS CSF for arsenic was applied in risk estimates

Dioxin and furan compounds were also evaluated using a TEF approach, by which 2,3,7,8-TCDD equivalents were derived by multiplying each individual dioxin and furan congener concentration by its equivalency factor and summing the results. The EPA CSF for dioxin from the Health Effects Assessment Summary Tables and the EPA TEFs were used in deriving risk estimates for dioxins (Table 4).

RfDs for effects other than cancer were applied for PCBs and arsenic. (Table 5) No RfDs were available for dioxin, or benzo[a]pyrene. However, noncarcinogenic effects of benzo[a]pyrene would be expected to result in a less stringent cleanup level than that derived from the CSF and thus potential risks are adequately evaluated by the CSF. In addition, the non-carcinogenic effects of dioxins were evaluated in the uncertainty assessment through application of ATSDR’s minimum risk level for dioxins which was derived considering all adverse effects related to dioxin.

7.1.4 Risk Characterization

In a human health risk assessment, EPA estimates *cancer risk* for carcinogens and *non-cancer health effects* for non-carcinogens.

For cancer-causing chemicals, risks are generally expressed as *excess cancer risk*. *Excess cancer risk* is defined as the risk of cancer over a lifetime that is in excess of the risk from all other sources besides contact with contaminated soils from the pulp mill area. An excess cancer risk of $1x10^{-4}$ indicates that an individual experiencing the *reasonable maximum exposure* has an estimated 1 in 10,000 chance of developing cancer as a result of site-related exposure. In other words, for every 10,000 people that could be exposed, one extra cancer *may* occur as a result of exposure to site contaminants. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as 1 in 3. As defined in the National Contingency Plan, the framework regulation for the Superfund program, EPA's generally acceptable risk range for site-related exposure is 1 in 10,000 to 1 in 1,000,000 (i.e., 10^{-4} to 10^{-6}), which represents EPA's opinion on what are generally acceptable levels. For sites where the cumulative risk to an individual based on the *reasonable maximum exposure* for both current and future land use is less than $1E^{-4}$, action generally is not warranted unless there are unacceptable non-cancer health effects or adverse ecological impacts.

For *non-cancer health effects*, the potential for non-cancer toxicity to occur to an individual is evaluated by using a ratio of "exposure" to "toxicity"; it is <u>not</u> expressed as the <u>probability</u> of an individual suffering an adverse effect. The ratio of exposure to toxicity is called a Hazard Quotient (HQ), and the sum, as appropriate, of all HQs is called a Hazard Index (HI). An HQ less than 1 indicates that toxic non-cancer effects are unlikely to result from exposure to that chemical at the site. Similarly, an hazard index (HI) less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-cancer effects are unlikely to result from exposure to all chemicals at the site. As defined in the National Contingency Plan, acceptable exposure levels for non-carcinogens should represent levels to which the human population, including sensitive subpopulations, may be exposed without adverse effect during a lifetime. In contrast to the numerical target risk range described for carcinogens, a numerical target value is not described in the National Contingency Plan.

Cancer Risks

The results of the human health risk characterization (prior to the removal of contaminated soils) indicated that cancer risks to the on-site worker would be the primary concern if no action were to be taken on the paint shop/former maintenance shop soils. Cancer risks represent an individual's chance of developing cancer due to ingestion, dermal contact and inhalation of vapors from soil in the Uplands Unit, over and above those exposures associated with general activities in a lifetime. Under no-action conditions, total cancer risks for the RME individual (on-site worker) would be 3 additional cancers in 10,000 ($3x10^{-4}$), when arsenic, PCBs, and benzo[a]pyrene are considered. (Table 1) Given the uncertainties associated with estimating risks, this probability is considered accurate within an order of magnitude. All other pulp mill areas had total risk estimates (primarily due to arsenic) less than or equal to 4 in 100,000 ($4x10^{-5}$). Risk estimates and detailed risk calculation sheets for each subarea are summarized in Table 6.

The reasonably anticipated future use for the mill site is commercial/industrial and for the water pipeline access road area it is recreational. Cleanup levels were established for early action sites based on these future land uses. As such, institutional controls are required to ensure the land use on which the cleanup levels were based.

For the offsite resident in aerial deposition areas, the total combined excess cancer risk estimate from potential soil ingestion, dermal contact, and ingestion of produce grown in affected soils was $3x10^{-5}$. The majority of this risk is attributable to arsenic, with a risk estimate of $1x10^{-5}$ for dioxins alone. The risk associated with residential use of grit as soil amendment in yards was similarly evaluated for soil ingestion, dermal contact, and ingestion of homegrown produce. The total excess cancer risk from dioxins for all three pathways from grit was $2x10^{-6}$. (Table 7)

An evaluation of risks due to widespread, naturally occurring arsenic was also completed. Imported soils and crushed rock products were evaluated for industrial exposure. The evaluation showed that a concentration of 125 ppm of arsenic in crushed rock and 75 ppm arsenic in soil correlates to an estimated excess cancer risk of $1x10^{-5}$, and concentrations as high as 1,200 mg/kg in D1 rock and 750 mg/kg in soil would be associated with a $1x10^{-4}$ risk level. This evaluation incorporated estimates of reduced bioavailability for soil and rock based on *in vitro* tests that evaluate the amount of arsenic that can be absorbed into the body from soils and rock.

The bioavailability testing was conducted to more fully characterize the potential human exposure from incidental ingestion (water and/or soil) of arsenic in rock or soil particles, studies to determine leachability and relative bioavailability were completed. (Leachability study results presented in Section 5.5). The relative bioavailability of arsenic in the topsoil samples ranged from 5.5 to approximately 40 percent with an average of 25 percent. Generally, the topsoil relative bioavailability values were substantially higher than estimates for any other samples, and thus reflect the highest potential for exposure. The testing of local rock and soil indicated these materials have a limited potential for leaching and low relative bioavailability. Application of the lower relative bioavailability findings to the RI baseline risk assessment, which more accurately reflects local conditions, would result in lower risk estimates for residual arsenic in upland soil.

A supplemental risk evaluation was conducted to assess facility-wide residual risks after completion of early actions, and cumulative risks that could result from potential exposure to chemicals in both the Uplands and Ward Cove Operable Units following removal of soils at the early action areas. Exposure and risk were assessed for a local resident who might work at the former mill site and eat fish and shellfish from Ward Cove. A range of exposure assumptions were used in the calculations. Total excess lifetime cancer risk estimates ranged from was 1×10^{-4} to 3×10^{-5}, with the majority of risks related to arsenic in soil. These findings indicate no further removal actions were necessary for protection of human health.

Non-Cancer Risks

For the on-site worker scenario, only exposure to paint shop/former maintenance shop area soils resulted in noncancer risks greater than 1. The total hazard index for incidental ingestion of soil and dermal contact was 8, primarily related to PCBs. For the storage area along the water pipeline, the hazard index was 1.0, also primarily related to PCBs. All other areas evaluated had hazard indices less that 1.0, indicating that non-cancer effects are likely minimal for the site.

7.1.5 Uncertainties

Risks to human health may be over- or underestimated based on the appropriateness of the assumptions regarding exposure, the availability and assumptions associated with the derivation of toxicity factors, and the use of conservative estimates (i.e., the 95 percent UCL or the maximum concentration) of exposure point concentrations. These inherent uncertainties were accounted for by making assumptions that tended to conservatively estimate risk. For example, the risk assessment assumes that workers will spend all of their time in one small site subarea; it is more likely that they would be working in both affected and unaffected areas in the future. Also, the use of the 90th percentile duration for residency and time spent at a job (i.e., 30 years and 25 years, respectively) is likely to overestimate site exposures and risks for most individuals. However, the uncertainties in any risk assessment affect the estimations of risk such that EPA believes that the estimates are only accurate to within an order of magnitude.

As noted earlier, risk estimates may have increased with higher COC concentrations found during removal activities than the initial RI sampling. However, since all early action removals have been completed and these soils no longer pose a risk, new baseline risk calculations are not considered necessary. Residual risks are presented in Table 1.

7.2 Ecological Risks

The ecological risk evaluation addressed current and future impacts, and potential risks posed by source related contaminants to the on-site and off-site upland areas in the absence of remedial actions. The ecology of the site and surrounding habitats were evaluated to identify animals and plants that may be exposed, and exposure pathways. From this evaluation, dioxins in forested areas on Slide Ridge and north of North Tongass Highway were identified for further study. An ecological assessment using a food-web model was conducted to evaluate risks to a receptor (plant or animal) most likely to be exposed to the highest levels of dioxins.

7.2.1 Identification of Chemicals of Concern

Dioxins in forested areas on Slide Ridge and north of North Tongass Highway were identified as COCs and were evaluated in a food-web model. Dioxin 2,3,7,8-TCDD toxic equivalent concentrations (TECs) in the 12 forest soil samples within the aerial deposition area ranged from 5.2 to 80 ng/kg with an average concentration of 23 ng/kg. The 95 percent UCL on the arithmetic mean of the dioxin TEC (37 ng/kg) exceeds the background concentration (7.4 ng/kg), thus, dioxins were retained for further evaluation. Nickel levels (15 mg/kg) exceeded background levels (9.6 mg/kg), but did not exceed ecological screening levels for plants, earthworms, or soil organisms, and therefore, was not retained for the ecological assessment. Slide Ridge was selected as the focus of the screening ecological risk assessment because of the combination of potentially good quality habitat for some wildlife species and the location of the predicted maximum deposition area (based on air modeling and soil sample results) of past emissions from the KPC facility.

7.2.2 Exposure Assessment

Habitat on the lower forested portions of Slide Ridge northeast of the pulp mill area is relatively high quality for some wildlife species, although limited in areal extent by the surrounding topography. The terrain is steep, rugged, and densely forested. Stand conditions are characterized by extremely dense regeneration of cedar, western hemlock, and Sitka spruce. A dense understory of shrubs is also present in areas without extensive tree generation.

Potential exposure pathways for ecological receptors relate to aerial deposition of dioxins in forest soils. The pathway of concern is from soil and forest leaf litter to small mammals and higher trophic level predators. Other potential pathways include ingestion of soil invertebrates, and ingestion of herbivorous material. Based on the two ecological surveys that were conducted, soil invertebrates were uncommon (typical of cold, poorly drained, acid forest soils), thus, unlikely to be an important food source for small mammals. Ingestion of herbivorous material is also not likely to be a significant pathway because plants do not take up dioxins from soil via their root system to any appreciable extent, and translocation of dioxins to edible plant foliage is negligible (**Fries 1995**). Further, ingestion of arboreal or flying insects is not considered a major exposure pathway for insectivorous birds, because the flying insects are not in contact with soils, thus, their exposure is considered minor.

Potential ecological receptors in forest habitat that were evaluated in the food-web exposure model included a small rodent (Sitka mouse), and a mammalian carnivore (short-tailed weasel). Based on their habitat requirements and geographic distribution, both species are likely to occur in the forested habitat of the aerial deposition area, and are common in the Ketchikan area. Small rodents, such as Sitka mice, are potentially exposed to dioxins through the dietary pathway and incidental soil ingestion. Weasels are potentially exposed to dioxins through consumption of small mammals (i.e., Sitka mice) and incidental soil ingestion.

Upper-trophic level avian predators were not included as potential receptors because the second growth forest on Slide Ridge is considered too dense for these birds to forage efficiently. Deer and bear were not evaluated in this assessment for two reasons: 1) their diet includes a large proportion of plant matter (which do not appreciably up take dioxins via their root system), so the potential for bioaccumulation through the diet is lower in an omnivorous species than in a more strictly carnivorous species, such as the short-tailed weasel; and, 2) larger bodied species have foraging ranges which exceed the forested aerial deposition area, lowering their overall exposure. With a home range (as small as 11 acres) smaller than the size of the hillside on Slide Ridge, the short-tailed weasel was assumed to obtain all of its food from the hillside, thus, conservatively maximizing exposure potential for evaluation purposes.

Consistent with the approach used in the human health risk assessment, the lower of either the maximum concentration or the 95 percent UCL was used as the exposure point concentration in the exposure assessment. The 95 percent UCL for dioxins in Sitka mouse tissue (1.6 ng/kg) was used to evaluate risk to weasels from prey consumption. Similarly, the 95 percent UCL for dioxins in forest soils (37 ng/kg) within the KPC aerial deposition area was used to evaluate risk from incidental soil ingestion.

7.2.3 Ecological Effects Assessment

The assessment endpoint for this risk evaluation was selected to assess the probability of adverse effects through the food-web to higher trophic level consumers. Specifically, the assessment endpoint is protection and population maintenance of carnivorous mammals inhabiting aerial deposition areas around the KPC site. This assessment endpoint was addressed by food-web exposure modeling using short-tailed weasels as the receptor species. The primary measurement endpoints used in this evaluation were empirical data on dioxin concentrations in small rodents and soil, and a toxicity reference value (TRV) for a representative mustelid species (i.e., mink). A TRV was not available for the toxicity of dioxins in weasels; however, the toxicity of planar halogenated hydrocarbons (PHH), including dioxins, has been extensively studied in the mink, which is of the same genus as the weasel. The empirical data applied in this risk evaluation were body burden data for small mammals from an ecological risk assessment at a similar site in southeastern Alaska, the Alaska Pulp Corporation (APC) site in Sitka. It was determined that the use of data from the APC site would provide a more realistic estimate of bioaccumulation in small mammals living near the KPC site than the use of literature-derived biota accumulation factor (BAF) values.

7.2.4 Risk Characterization

Risk characterization for the food-web exposure model is based on hazard quotients obtained by dividing the modeled estimate of the site-specific dose by the corresponding TRV.

The potential for adverse ecological effects may exist if the exposure estimate exceeds the TRV (i.e., the hazard quotient is greater than 1). A hazard quotient less than one indicates that a COC is unlikely to cause adverse ecological effects. Comparison of predicted dietary exposure to dioxins at Slide Ridge for weasels with the TRV derived from the mink reproductive toxicity study (Tillitt et al. 1996) resulted in a hazard quotient of 0.81 (Table 8) indicating that adverse ecological effects are not expected for upper trophic level mammalian carnivores (represented by weasels) exposed to dioxins in soil or prey items at Slide Ridge.

A qualitative ecological risk assessment was completed for the pipeline access road. Potential exposures for ecological receptors within the affected areas of the pipeline road are expected to be limited because of the small size of the areas relative to the available habitat and the physical nature of the areas. The areas are covered with gravel or coarse fill, and in a few small spots, covered with topsoil and seeded to eliminate a surface soil exposure pathway.

Because of the physical properties of these areas, the soil invertebrate population is considered insignificant. Thus, there is not a complete pathway from residual soil contamination through soil invertebrates to higher tropic levels, such as small mammals. Additionally, the residual contaminants are lead, PCBs, and petroleum compounds. These organic molecules, as well as lead, are largely retained in the soil organic matter, hence, potential uptake through root systems into plants which may be used as a herbivore food source is considered minimal.

The small drainages for these areas were also evaluated. At the point where these drainages could provide aquatic habitat, sediment concentrations for the contaminants of concern were not detected. Thus, complete pathways for ecological receptors do not exist along the pipeline road.

7.2.5 Uncertainties

Risks to ecological receptors may be over-or underestimated based on the appropriateness of the exposure assumptions, the accuracy of food-web model input variables, and the use of a food-web model to predict chemical concentrations in the diet of the receptors. Risks to mammalian carnivores at Slide Ridge are expected to be overestimated based on the use of prey concentration data collected from mice at the APC site. The use of the 95 percent UCL of dioxin concentrations measured in mice collected at the APC site is a more conservative assumption than the use of a mean body burden level in mice, because weasels do not feed only on the individual prey items with the highest body burdens, but instead capture prey randomly from the population. Also, soil dioxin concentrations in the mouse trapping areas at the APC site were approximately two times higher than concentrations measured in soil at Slide Ridge. Transfer of dioxins into the food-web is largely determined by the concentration in soil; therefore, it is likely that concentrations would be lower in mice at Slide Ridge due to the lower soil dioxin concentrations associated with the KPC site. The food-web model is also considered to be conservative because it assumes that weasels forage exclusively at the hillside, and if the foraging range also includes

areas other than the hillside that have lower dioxin concentrations, then the total exposure will decline. Similar to the approach used for conducting the human health risk assessment, these inherent uncertainties were accounted for by making assumptions that generally conservatively estimate risk.

7.3 Basis for Response Action

One site area, the paint shop/former maintenance shop area, had a carcinogenic risk estimate ($3x10^{-4}$) and a non-carcinogenic hazard index (HI=8) for an on-site worker exceeding the acceptable risk range identified in the NCP, related primarily to PCBs. Baseline risk estimates for the pipeline access road soils are not considered representative because additional contamination was identified during early action activities. Other areas within the pulp mill vicinity had total carcinogenic risk estimates in the range from $5x10^{-6}$ to $4x10^{-5}$, related primarily to arsenic, and non-carcinogenic hazard indices less than or equal to 1. Recommended industrial soil concentrations for both PCBs and lead were exceeded at both the paint shop and the pipeline access road. Based on sampling from local rock quarries, the potential for transport and onsite use of crushed rock and soil that could exceed 10^{-4} risk concentrations does exist. State of Alaska soil standards cleanup levels were exceeded for benzo[a]pyrene at the former paint shop. State soil standards cleanup levels for petroleum compounds were also exceeded at the railroad tracks, compressor and former bulk fuel areas.

The response action selected in this Record of Decision, including the early removal actions, is necessary to protect the public health or welfare or the environment from actual or threatened releases from hazardous substances that occur in the soils of the Uplands Operable Unit. While not quantified, risks would be higher if, in the future, land use predictions of industrial/commercial were wrong and the site was used for residential purposes. The response action is necessary to preclude land use which is not protective.

8.0 REMEDIATION OBJECTIVES

The remedial action objectives for the Uplands Operable Unit are: 1) reduce cancer and noncancer risks to current and future workers from exposure to soil contaminants, 2) minimize future cancer and noncancer risks to off-site or future residents from contaminated soil or groundwater exposure, 3) minimize on-site workers arsenic exposure from future use of imported rock products, and 4) minimize potential migration of contaminants to Ward Cove from the landfill. These objectives were partially met through the completion of the early removal actions. Implementation of additional remedial measures, such as institutional controls developed for anticipated current and future land use and development and implementation of the institutional control plan, will ensure that the early actions remain protective.

8.1 Key Applicable or Relevant and Appropriate Requirements

The key ARARs are the State of Alaska cleanup and solid waste management standards and the Toxic Substances Control Act (TSCA) risk based standards.

9.0 DESCRIPTION OF ALTERNATIVES

9.1 Completed Early Actions

Early cleanup actions were completed to address threats posed by contaminated soil in the Uplands OU, consistent with the reasonably anticipated future use of the site. Included in these actions were removal and off-site disposal of soil/sediment from the paint shop/former maintenance shop, the access road ditch, railroad track areas, compressor area, the former bulk fuel area, and the former storage area along the water pipeline access road. PCB-, lead- and petroleum-contaminated soil was removed at the paint shop and water pipeline storage areas, very low level dioxin-containing sediments were removed from the access road ditch to accommodate widening of the road for large demolition equipment. Fuel-contaminated soils were removed from the other areas.

The wood waste and ash disposal landfill was closed in 1997, and a new landfill cell was constructed on top of the wood waste disposal site. All closure and post-closure activities were conducted pursuant to ADEC Solid Waste and all other applicable regulations, and the new cell will be closed in the same manner. The closure activities conducted included placing a geomembrane cap over the closed landfill; placing topsoil over the cap and contouring the final grade to minimize erosion; establishing a vegetative cover; maintaining the final cover and upgrading the leachate collection and treatment system; and conducting long-term monitoring.

KPC also cleaned out cisterns (water and sediment) within the vicinity of the mill potentially impacted by past aerial deposition of stack emissions.

Early actions were completed throughout the RI/FS process, particularly in areas where cleanup actions were necessary to avoid exposures related to workers involved in demolition and redevelopment efforts, and where remedial options were limited, straightforward, and cost effective. The early actions completed at the site are a significant part of the final selected remedy. As such, development and detailed evaluation of a series of cleanup alternatives in the form of a Feasibility Study was not completed for the Uplands Operable Unit.

9.1.2 Requirements to Ensure Actions Remain Protective

Institutional Controls

Institutional controls are the use of legal or administrative systems to limit or prohibit activities that may interfere with the integrity of the remedial action or potentially result in human exposure to contaminated material in the Uplands Unit. As described in Section 6, the current and projected future land use of the Upland OU is industrial/commercial, or recreational for the pipeline access road, and the groundwater beneath these areas will not be used as a potable water supply. The institutional controls for the former pulp mill site, water pipeline access road and wood waste and ash disposal landfill are necessary to ensure restricted land use is maintained until if and when cleanup objectives can be met, and land use in the interim does not pose a threat to human health or the environment or otherwise affect the protectiveness of the remedy.

An Easement and Covenant document has been filed between KPC and the State of Alaska Department of Natural Resources for ADEC, which codifies the institutional controls agreed to for the pulp mill area. This document had been filed with the Ketchikan Gateway Borough and would be examined during a routine title search. An appropriate easement and covenant document (or equitable servitude) will also be prepared relating to institutional controls for the wood waste and ash disposal landfill area and for the disposal areas along the water pipeline road. The Easement and Covenant documents stipulate management methods for contaminants of concern identified in the KPC RI, and are conferred with the land regardless of the owner. The KPC property was sold to Gateway Forest Products (Gateway) effective November 1, 1999, for use as a light manufacturing facility. As part of the sale agreement between KPC and Gateway, a cost and work sharing arrangement has been formalized between the two parties.

9.2 Uplands Operable Unit Alternatives

Because of the completion of early actions for the Uplands OU, only two alternatives were considered, as follows:

9.2.1. No Action

Under the no-action alternative, no additional remedial measures would be taken at the site. The no-action alternative does not include any monitoring, institutional controls or future use restrictions of any kind.

Development of the no-action alternative is required by the NCP to provide a basis of comparison with the remaining alternatives. This alternative serves as a baseline by reflecting current conditions without any additional effort or controls. The no-action alternative was evaluated consistently with the NCP requirements. No costs are associated with the no-action alternative.

9.2.2. Limited Additional Actions

Limited additional actions include:

For all areas in the Uplands Unit:

- Implement institutional controls to insure land use remains industrial/commercial, or recreational for the pipeline access road.
- Implement institutional controls to prohibit any activities that may result in drilling of water wells or use of groundwater for drinking water purposes.
- Compliance with the protocols and requirements set forth in the "Management Plan for Arsenic and Rock and Soil", to limit concentrations of arsenic on site from crushed rock.
- Compliance with all current or future easement and restrictive covenant documents (or equitable servitude).
- Develop and implement an Institutional Control Plan (ICP)

Additional actions for the former pulp mill and pipeline access road areas include:

- Major components of the ICP for the former pulp mill and pipeline access road include, but are not limited to:
  - Procedures to ensure that soils that were not evaluated or characterized during the RI that are exposed in the future, are properly characterized and managed in accordance with applicable disposal requirements;
  - Coordination, notification, record-keeping and reporting requirements for the responsible land owner with regard to interactions with the regulatory agencies.

Additional actions for the wood waste and ash disposal landfill include:

- Close the remaining cell of the wood waste and ash disposal landfill when it reaches capacity, in a manner similar to that of the other cells, which KPC has already closed (i.e., in accordance with the ADEC solid waste permit and all applicable regulations);
- Conduct long-term monitoring at the landfill in accordance with all applicable permits (i.e., ADEC solid waste permit and regulations, EPA NPDES permit)
- Develop and implement an operation and maintenance program for the landfill to ensure long term viability of the cap system, including ensuring no tree growth occur that could compromise the integrity of the cap.
- Major components of the ICP for the wood waste and ash disposal landfill include, but are not limited to, implementing institutional controls to limit access to the site and to ensure future land use activities do not compromise the integrity of the landfill cover.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Two alternatives were considered for this site: no action, or completion of the early actions and continuation of the remedial actions identified above. The no action/no cost alternative was determined to not be protective of human health and the environment, particularly without the implementation of institutional controls to ensure protectiveness in the future. Thus, the no action/no cost alternative is not considered further in the comparative analysis. This section evaluates the preferred remedial action for the Uplands OU in accordance with the following nine criteria.

10.1 Overall Protection of Human Health and the Environment *evaluates whether an alternative achieves and maintains adequate protection of human health and the environment.* The selected remedial action is protective of human health and the environment, by eliminating, reducing, or controlling risks posed by the site through engineering controls and institutional controls. Early actions have been conducted for areas at the mill that have the highest risk levels. The early actions include soil removal, which has eliminated short-term and potential long-term on-site exposure and reduced the overall risk at the former Mill area to within acceptable levels (2E-5) for workers. Removed soil has been placed in solid waste landfills with engineering controls (e.g., bottom liners, leachate collection systems, geomembrane caps) to provide for longterm containment of the soil. The mill area has been used for industrial purposes since 1954 and has been zoned industrial by the Ketchikan Gateway Borough. Institutional controls will be implemented to control future land use and ensure groundwater remains unused at the former miff area in the future.

Early actions at areas along the pipeline access road have been completed. The early actions included soil and debris removal, and covering of several small areas with topsoil and reseeding to ensure no exposure pathways exist. Land use restrictions to ensure non-residential land use and excavation and sampling requirements outlined in the Institutional Control Plan address future use concerns.

The Ketchikan community has been provided access to relevant information regarding the potential risks associated with naturally occurring arsenic in the Ketchikan area, including ways to reduce exposure, through inclusion of the Management Plan for Arsenic in Rock and Soil in the information repositories and administrative record.

The wood waste and ash disposal landfill has controlled access and there are no complete exposure pathways that exceed acceptable risk levels. Most of the landfill has already been closed in accordance with the solid waste permit and standard engineering practices. The remainder of the landfill will be closed in a similar manner. Institutional controls will restrict future use of the property and any use of groundwater.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) *evaluates how each alternative complies with federal and state statutes and regulations that pertain to the site.* All selected remedial actions comply with state and federal laws and regulations. The remedial actions would comply with the current solid waste and wastewater discharge permits. Potential ARARs are State of Alaska Solid Waste Management Regulations (18 AAC 60), State of Alaska Water Quality Criteria (18 AAC 70), State of Alaska Oil and Hazardous Substances Pollution Control Regulations (18 AAC 75), the Resource Conservation and Recovery Act, and the Toxic Substances Control Act.

10.3 Long-Term Effectiveness and Permanence *evaluates the ability of an alternative to maintain protection of human health and the environment over time.* The early actions involving soil removal provide a long-term remedy for those areas at the mill and along the pipeline access road. The past and future closure activities at the wood waste and ash disposal landfill have been and will be conducted in a manner that provides long-term containment of the solid waste; however, there is inherent uncertainty with predicting the long-term reliability and effectiveness of the cover. The Institutional Control Plan and the Covenant and Easement restrictions provide long term protectiveness of human health and the environment through implementation of land use restrictions and other monitoring requirements. Five-year reviews will be conducted to evaluate, among other things, the ongoing protectiveness of the landfill cover and the effectiveness and reliability of institutional controls.

10.4 Reduction in Toxicity, Mobility and Volume Through Treatment *evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present*. The remedial actions do not provide treatment of site soils. Treatment was considered for on-site soils, but was screened out from further consideration due to a lack of effective in-situ treatments, site specific topography and climatic conditions, and cost. Some ongoing natural attenuation of low-level residual organic contamination, such as petroleum hydrocarbons, is expected to continue. Treatment of leachate at the wood waste and ash disposal landfill has been and will be conducted in the future, as needed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) permit.

10.5 Short-Term Effectiveness *evaluates the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.* Most remediation activities have been implemented and have not adversely affected workers. Workers conducting remedial actions are required to wear protective clothing and equipment to minimize potential exposures. Remedial actions have not adversely affected nearby residents because contaminants have relatively low concentrations and low volatility, and the climate is extremely wet. Construction activities have resulted in additional noise and traffic, but the impacts are expected to be minimal relative to when the mill was fully operational. The implementation of institutional controls is expected to occur immediately following finalization of this ROD, without any adverse impacts to workers, residents, or the environment. Remaining closure activities at the landfill will take place when the final cell reaches capacity.

10.6 Implementability *evaluates the technical and administrative feasibility of implementing the alternative.* Implementability includes the ease of construction, the availability and capacity of materials and/or facilities, and logistical and/or administrative practicability. All remedial actions have been readily implementable. Landfill closure activities were temporarily delayed due to concern over arsenic concentrations in rock being used as cover material. The issue was resolved by sampling the rock, and requesting alternative cover material, in accordance with practices identified in the arsenic management plan. Soil excavations at the paint shop were also temporarily delayed due to a lack of containers for shipping out the removed soils for disposal. Institutional Controls are implementable through the use of Covenants and Easements, zoning requirements and compliance with the institutional control plan.

10.7 Cost *includes estimated capital and operation and maintenance costs as well as present worth costs.* Cost estimates have not been prepared for the remaining actions for the Uplands OU, with the exception of costs associated with closing the remaining landfill cell. The remaining actions are largely the development and implementation of institutional controls. While there are costs associated with the remaining portion of the remedy, they are relatively small compared to the past costs of early actions. Costs would include those necessary for reporting and filing of deeds and covenants and other administrative requirements. Other costs which could be incurred for future sampling and potential excavation activities cannot be projected and are not included in this Record of Decision.

10.8 State Acceptance *evaluates whether the State of Alaska agrees with the analyses and recommendations of the RI and the Proposed Plan*. The ADEC has fully participated throughout this process as co-lead at this site and concurs with the selected remedial actions.

10.9 Community Acceptance *evaluates whether the local community agrees with U.S. EPA's and ADEC's analyses and preferred alternative.* Many comments were received from members of the community, the Technical Discussion Group, environmental groups, and local government representatives. Those comments and the agencies' responses are included as Part 3, the Responsiveness Summary of this ROD. In general, these comments support the decisions and proposed remedial actions selected for this site.

11.0 SELECTED REMEDY

11.1 Summary of the Rationale for the Selected Remedy

Based on an evaluation of risks from contaminants at the Uplands OU, EPA and ADEC have determined that cleanup objectives will be met by implementing the selected remedial actions. Early cleanup actions were completed to directly address threats posed by contaminated soil in the Uplands OU. The early actions for soils removed the most contaminated source material, eliminated unacceptable risks from direct contact with soils, eliminated soil transport to Ward Cove, eliminated leaching of surface soil contaminants to groundwater, and minimized potential future direct contact with subsurface soils at the site. In the future, institutional controls will require sampling and characterization for excavations in the near-shore fill area, for soils underneath paved areas or structures, for soils in areas that had not been previously evaluated in the remedial investigation, and for any on-going demolition activities. Through zoning and deed restrictions, land use at the former mill area and wood waste and ash disposal landfill will be maintained as industrial, and land use along pipeline access road will be recreational, and any use of groundwater will be prohibited. The purpose of the restrictions are to ensure that human exposure and associated health risks do not increase as a result of unintended land use, such as residential development, or through excavation activities in areas that were not characterized because there was not indication of a contaminant release.

The cleanup level for PCBs in the soil of 10 ppm has been selected using both the NCP Nine Criteria and the TSCA Remediation Waste Risk Based Disposal Approval at 40 CFR 761.61(c). The selected remedy and cleanup level meets the TSCA regulatory requirement that the risk-based method for disposal of PCB remediation waste (in other words, the selected remedy and on-site clean up level) will not pose an unreasonable risk of injury to health and the environment. This has been demonstrated through the NCP nine criteria analysis which includes a threshold criterial for overall protection of human health and the environment as well as consideration of both short-term and long-term protectiveness. Current and future land use at this site is commercial/industrial and, at the pipeline storage areas, recreational. The CERCLA risk analysis shows that this remedy and the resultant residual concentrations will not pose an unreasonable risk of injury to human health at these concentrations. This remedy and resultant residual concentrations will also not pose an unreasonable risk of injury to the environment because the landscape of the former mill site is industrialized and does not provide acceptable habitat. The area of use at the former storage areas along the water pipeline access road is minimal and also provides very poor habitat given the availability of undisturbed land.

11.2 Description of the Selected Remedy

The selected remedy for the Uplands OU is as follows:

Former Pulp Mill Area

- Compliance with already-existing institutional controls to ensure that the use of the former pulp mill area remains commercial/industrial. Such controls rely on the authorities of various regulatory agencies and include the following:

    -- Compliance with zoning restrictions of the Ketchikan Gateway Borough. The

Borough has zoned the former pulp mill area for industrial use only. No residential or retail use of the area will be allowed.

-- Compliance with an Environmental Protection Easement and Declaration of Restrictive Covenants recorded on October 28, 1999 (Appendix B to this ROD). This document includes restrictions on use of the former KPC mill property now owned by Gateway and is enforceable by the State of Alaska Department of Natural Resources. Such restrictions include the following:

" The Site shall not, at any time, be used, in whole or in part, for human habitation, schooling of children, hospital care, child care or any purpose necessitating around-the-clock residence by humans.

" Drilling of drinking water wells is prohibited.

" Use of groundwater for drinking water is prohibited.

- Compliance with the protocols and requirements set forth in the "Management Plan for Arsenic and Rock and Soil," prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock.

- Development and implementation by EPA, ADEC, KPC and Gateway of an enforceable Institutional Controls Plan (IC Plan). The IC Plan will set forth procedures and protocols to prevent or minimize the potential for future exposure of residual contamination at the Site and will include the following elements:

  -- Procedures to ensure that soils in the nearshore fill area, soils underneath paved areas or structures at the former pulp mill site, or soils that were not evaluated or characterized during the remedial investigation that are exposed in the future, e.g., as the result of excavation or demolition activities, are properly characterized and managed in accordance with applicable disposal requirements.

  -- Coordination, notification, record-keeping and reporting requirements between KPC and Gateway and the appropriate regulatory agencies.

Pipeline Access Road

- Compliance with the protocols and requirements set forth in the "Management Plan for Arsenic and Rock and Soil," prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock.

- Development and implementation by EPA, ADEC, KPC and Gateway of an enforceable

Institutional Controls Plan (IC Plan). The IC Plan will set forth procedures and protocols to prevent or minimize the potential for future exposure of residual contamination at the Site and will include the following elements:

- Procedures to ensure that soils that were not evaluated or characterized during the remedial investigation that are exposed in the future, e.g., as the result of excavation or demolition activities, are properly characterized and managed in accordance with applicable disposal requirements.

- Coordination, notification, record-keeping and reporting requirements between KPC and Gateway and the appropriate regulatory agencies.

• KPC shall develop and record an easement and restrictive covenants document (or equitable servitude) for property owned by KPC, namely pipeline access road areas. The easement/restrictive covenants shall be similar in nature to the Easement/Restriction Covenants for the pulp mill area and shall include the following elements:

  - Prohibition of any activities that may result in drilling of water wells or use of groundwater.

  - Access by authorized representatives of EPA, ADEC or DNR to inspect the pipeline access road areas. The pipeline access road area may be available for recreational use.

  - Conveyance of the easement/restrictive covenants to the State of Alaska Department of Natural Resources.

Wood Waste and Ash Disposal Landfill

• KPC shall close the remaining open cell at the landfill in accordance with ADEC Solid Waste Permit No. 9713-BA001 and all other applicable regulations. Closure activities include the following:

  - Placing a geomembrane cap over the closed cell.

  - Placing topsoil over the cap and contouring the final grade to minimize erosion.

  - Establishing a vegetative cover.

  - Maintaining the final cover, passive gas venting system, and leachate treatment system.

-- Conducting long-term monitoring, including visual and surface water monitoring. Surface water monitoring shall include collection of water samples to assess whether surface water leaving the Site could potentially endanger public health, ecological receptors, or cause a violation of water quality standards or permit conditions.

- Development and implementation of provisions in the IC Plan to ensure compliance with the above-described restrictions for the landfill.

- Compliance with the protocols and requirements set forth in the "Management Plan for Arsenic and Rock and Soil," prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock.

- KPC shall develop and record an easement and restrictive covenants document (or equitable servitude) for property owned by KPC, namely the landfill. The easement/restrictive covenants shall be similar in nature to the Easement/Restriction Covenants for the pulp mill area and shall include the following elements:

  -- Prohibition of any activities that may result in use of groundwater, potential exposure of waste materials within the landfill, or potential interference with the integrity of the landfill cap.

  -- Access by authorized representatives of EPA, ADEC or DNR to inspect the landfill.

  -- Conveyance of the easement/restrictive covenants to the State of Alaska Department of Natural Resources.

11.3 Summary of the Estimated Remedy Costs

Projected future costs include long term operation and maintenance (O & M) of the landfill cap and closure of the remaining cell. The estimated 30 year present worth costs for landfill O & M are $1.1 million. The cost associated with closure of the remaining cell at the landfill (ash cell) is estimated to be $650,000. Costs associated with early actions and removals are not included in this Record of Decision. Costs associated with implementation and compliance with the requirements of the Institutional Control Plan cannot be reasonably estimated. While there are costs associated with the ICP, they are considered relatively small compared to the costs already incurred by KPC for completion of the early action. Institutional Control costs could include potential future sampling, analysis and reporting requirements and coordination with regulatory agencies, costs of filing deed and covenant restrictions and administrative costs for report submittals, etc. However, these costs cannot be quantified due to the uncertain nature of when, or if, these requirements win be triggered.

11.4 Estimated Outcomes of the Selected Remedy

The Selected Remedy will reduce the potential for ongoing human health and environmental impacts from the Upland OU, including the pulp mill area, the pipeline access road and the wood waste and ash disposal landfill. As a result of the early actions, land was available for reuse on an ongoing basis with minor and temporary restrictions, allowing for demolition and redevelopment activities to proceed without delay, while maintaining a safe level of protection for on-site workers. Future re-use of the property as an industrial facility has been enabled and expedited by completion of early actions. Cleanup actions have resulted in significant support for redevelopment efforts, in the form of community support and financial incentives from the Ketchikan Gateway Borough. Clean out of nearby business and residential cisterns has reduced community concerns related to use of these systems for collection of rainwater as a drinking water source. As a result of the early action at the areas on the water pipeline access road, future use could include a recreational public use trail along the pipeline corridor. The residual risk, cleanup levels and statutory or other basis are presented in Table 1.

12.0 STATUTORY DETERMINATIONS

EPA believes the Selected Remedy provides the best balance of tradeoffs in comparison to the no-action alternative with respect to the evaluation criteria. The EPA expects the Selected Remedy to satisfy the statutory requirement in CERCLA Section 121 (b) to: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reasons: source materials constituting principal threats were addressed at the site through removal actions comprised of excavation and off-site disposal because available treatment technologies for contaminated soils were found to be limited, and cost prohibitive due to the remote locations of the site and climatic extremes. The selected remedy is consistent with state authorities and requirements under AS 46.03.020,.050,.710,.745,.822, AS 46.08.070, AS 46.09.020, and 18AAC 75.300-.396 but does not resolve issues of natural resource damages.

Under CERCLA Section 121 and the NCP, the lead agencies must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements, are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility or hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

12.1 Protection of Human Health and the Environment

The Selected Remedy will be protective of human health and the environment. Early actions have resulted in a reduction of human health risks at the pulp mill area by an order of magnitude or more in all subareas (i.e., for the worst case, from $3x10^{-4}$ to $2x10^{-5}$, for the reasonable maximally exposed individual). All remaining exposure levels have been reduced to well within EPA's generally acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$ for carcinogenic risks and below an HI of 1 for noncarcinogens. A facility-wide evaluation of cumulative risks, following early action remediation, indicated a carcinogenic risk of $3x10^{-5}$ and a non-cancer hazard index of 0.2 for an offsite resident residing in the aerial deposition area, working onsite, and relying on subsistence-level fish and shellfish consumption from Ward Cove. By capping and installing engineering controls at the wood waste and ash disposal landfill, pathways for human and ecological exposure through direct contact, ingestion, and inhalation have been eliminated and the potential for future exposure will be controlled. Implementation of the institutional controls for the Uplands OU will ensure that the protection provided by the early actions is maintained. Finally, no short-term risks or cross-media impacts will result from implementation of the Selected Remedy.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedies for the KPC Upland OU will comply with all ARARs of federal and state environmental and public health laws, including compliance with all location-, chemical-, and action-specific ARARs as listed below. The Applicable or Relevant and Appropriate Requirements (ARARs) for KPC include:

12.2.1 Chemical Specific Applicable or Relevant and Appropriate Requirements

- **Alaska Water Quality Standards for Protection of Class (1)(A) Water Supply, Class (1)(B) Water Recreation, and Class (1)(C) Aquatic Life and Wildlife Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife (18AAC70)**
  These regulations are applicable to surface water and groundwater discharges from the landfill.

- **Alaska Oil and Other Hazardous Substances Pollution Control Regulations (18 AAC75, as amended through January 22, 1999)** These regulations are applicable and stipulate that responsible parties are required to clean up oil and hazardous substance releases in Alaska. These regulations include soil cleanup standards of 1,000 mg/kg for total lead.

- **Toxic Substances Control Act (TSCA), 40 CFR 761.61**. The TSCA regulations for the disposal of PCB remediation waste are applicable to the selection of the clean up level for PCBs in soil at this site, and to the disposal of soil off-site above the clean up concentration. The risk-based disposal approval in 40 CFR 761.61(c) was used for the selection of the cleanup level at this site.

12.2.2 Action-Specific Applicable or Relevant and Appropriate Requirements

- **RCRA Subtitle C, (40 CFR 261-264).** RCRA Subtitle C governs the management of materials that meet the definition of a hazardous waste. Hazardous wastes are either specifically listed in 40 CFR 261 Subpart D, or exhibit one of four hazardous characteristics: ignitability, corrosivity, reactivity, or toxicity as determined by the TCLP. Future activities at the KPC Upland OU are not expected to trigger the definition of hazardous waste. However, if they do, the RCRA generator standards requirements, RCRA land disposal restrictions and RCRA treatment, storage and disposal requirements will apply.

- **Alaska Solid Waste Management Regulations, (18AAC 60).** Substantive provisions of Alaska regulations for solid waste management are identified as ARARs for managing solid wastes that do not meet the definition of a RCRA hazardous waste. Therefore, the following solid waste regulations may be relevant and appropriate to excavated and/or treated soil and landfill activities:

  - Disposal requirement for polluted soil (18 AAC 60.025)
  - Accumulation, storage, and treatment of solid waste (18 AAC 60.010)
  - Transportation requirements (18 AAC 60.015)

- **Federal Endangered Species Act of 1973.** This statute is applicable to any remedial action performed at the site because the area represents potential habitat for threatened or endangered species. The endangered species potentially occurring with the local area is the American peregrine falcon. The activities associated with the remedial action comply with this statute, and the USFWS concur with EPA's determination that the activities associated with this action would not likely adversely affect the peregrine falcon or critical habitat.

12.2.3 To-Be-Considered Information

The following To-Be-Considered (TBC) information has been used in remedy selection and implementation:

- EPA Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12 (1994)

- EPA Region 9 Industrial Preliminary Remediation Goals.
- EPA Region 3 Risk Based Concentration Tables and Region 9 Preliminary Remediation Goals.
- OSWER Directive 9200.4-26, Approach for Addressing Dioxin in Soil at CERCLA and RCRA sites.

12.3 Cost-Effectiveness

The Selected Remedy is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: “A remedy shall be cost-effective if its costs are proportional to its overall effectiveness”. (NCP 300.430(f)(ii)(D)). The Selected Remedy provides greater protection of human health and the environment than the no-action alternative, while meeting cleanup goals. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence the Selected Remedy represents a reasonable value for the money to be spent.

The estimated present worth cost of the Selected Remedy is $1.75 million, which is based primarily on the costs of operation, maintenance and sampling of the landfill and future close out activities. Costs for implementation of the institutional controls for the site cannot be quantified, but are considered relatively small compared to the costs of completing the early actions and landfill operation and maintenance costs. EPA and ADEC believe that the cost of the Selected Remedy provides a significant increase in protection of human health and the environment, and is cost-effective.

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

EPA and ADEC have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at this site. The Selected Remedy does not include treatment of site soils. Removal and off-site disposal was selected because in-situ options were limited and cost prohibitive for the treatment of PCBs in soil. A parallel objective was to expeditiously reduce or eliminate risks to on-site workers involved in demolition and redevelopment activities. Capping of the wood waste and ash disposal landfill will effectively reduce the mobility of and potential for direct contact with landfill contents. The Selected Remedy satisfies the criteria for long-term effectiveness by removing contaminated soils at the pulp mill area and the pipeline storage area, and therefore eliminating risks posed by those areas. No “principle threat” wastes, as defined in EPA guidance, have been left at the site. Components of the Selected Remedy have been effectively implemented with no short-term risks or cross-media impacts.

12.5 Preference for Treatment as a Principal Element

Treatment of contaminated soil to reduce toxicity or mobility of contaminants was not considered feasible. As stated previously, treatment was evaluated for on-site cleanup, but was not considered further for the following reasons: 1) there are currently no effective in situ treatments (i.e., treating in place) for PCB-contaminated soils, and 2) any ex situ treatment would require significant material handling (excavation, de-watering, transport, and processing) and extreme cost, due to the lack of treatment facilities in Alaska. In general, the availability of treatment technologies in Alaska is extremely limited, due to climate extremes, remote location, challenging conditions, and very high operating costs.

12.6 Five-Year Review Requirements

CERCLA and the NCP require that a review be conducted every five years of all remedial actions that do not achieve cleanup levels for unrestricted land use. Because hazardous substances, pollutants, or contaminants will remain on-site at the wood waste and ash disposal landfill, the pipeline access road, and within the pulp mill area, above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, and will continue to be, protective of human health and the environment.

The five-year review will be conducted in accordance with the most current OSWER Directive on completing five year reviews. The review will include, but not. be limited to:

- Evaluation of whether the response action remains protective of public health and the environment;
- Evaluation of Final Reassessment of Dioxin report and any Revised Guidance or Preliminary Remediation Goals (PRGs). If, and when, the dioxin risk values are revised the recommended PRGs will be re-evaluated throughout the national Superfund program and presented in agency guidance. At a minimum, revised dioxin risk and subsequent recommended PRGs will be considered in the five year review for this site;
- Evaluation of any new sampling data that is pertinent to the site, or any other new information, draft or otherwise or considerations relevant to an assessment of protectiveness;
- Assessment of current and reasonable future land use of the site and surrounding area to ensure that the ROD assumptions of land use are still reasonable;
- Assessment of the effectiveness of the Institutional Control Plan.
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13.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The Proposed Plan for the Uplands Operable Unit of the KPC site was released for public comment in May 1999. The Proposed Plan identified completion of all early actions and continuation of the preferred remedial actions for the pulp mill area and the wood waste landfill, including institutional controls, as the preferred alternative. EPA and ADEC reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

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PART 3: RESPONSIVENESS SUMMARY

INTRODUCTION

A total of 55 comments were received during the 60-day comment period on the KPC Upland Operable Unit Proposed Plan. Seven pieces of correspondence comprising 40 comments were received from Concerned Alaskans for Resources and Environment, The Ketchikan Gateway Borough, the Department of the Interior, the Agency for Toxic Substances and Disease Registry (ATSDR), the Tongass Conservation Society, and two individuals. Additionally, a total of six individuals provided formal comment during the proposed plan public meeting, comprising 15 comments. Each of the comments was reviewed and evaluated by the Remedial Project Manager and other agency staff. The comments and their associated responses are described below. Many of the comments on the Proposed Plan are addressed through the development of the institutional control plan, which sets out monitoring and reporting responsibilities and land use restrictions to ensure long term protection of human health and the environment at the site. Additional comments were addressed directly through ROD language and text revisions.

Sources of comments on Proposed Plan

Commenter	Comment Response #	Description
Georgiana Zimmerle - KGB	**KBB 1**	**Comment letter dated 6/22/99 Borough Manager, Ketchikan Gateway Borough**
Dick Coose CARE	**DC 1**	**E-mail comment dated 7/15/99 Concerned Alaskans for Resources and Environment**
George Winter	**GW 1-4**	**Comment letter dated 7/20/99**
Karen Larson ATSDR	**KL 1**	**Comment letter dated 7/19/99 Agency for Toxic Substances and Disease Registry**
Eric Hummel TCS	**TCS 1-28**	**Comment letter dated 7/19/99 Tongass Conservation Society**
Aaron McDonald	**AM 1-4**	**Comment letter dated 5/31/99**
Pamela Bergmann USDOI	**PB 1**	**Comment letter dated 7/19/99 U.S. Department of Interior Fish and Wildlife Service**

Lloyd Gossman	**LG 1**	**Comment provided at public meeting**
Allyn Hayes	**AH 1**	**Comment provided at public meeting**
Paul Slenkemp	**PS 1**	**Comment provided at public meeting**
Eric Hummel	**EH 1-5**	**Comment provided at public meeting**
Marty Gillen	**MG 1-3**	**Comment provided at public meeting**
George Winter	**GW 5-8**	**Comment provided at public meeting**

A response to each of the comments is provided in the following section. Each response includes a paraphrased summary of the original comment(s), as well as a reference to the source of the comment. Several comments were made more than once, either by different individuals or by the same individual in both written and oral form. In these cases, a full response is provided to the comment where most appropriate, and a cross-reference is provided for subsequent comments. Numerous comments were received in several topic areas, including arsenic management and migration, risks associated with water cisterns, near-shore fill area waste characterization, landfill practices and institutional controls. Generally, the responses to these comments are grouped together to provide a more sequential and comprehensive response.

RESPONSES TO COMMENTS

1. KGB 1. The commenter requested that the Borough receive a draft copy of the Institutional Control Plan and be provided an opportunity to comment.

The draft Institutional Control Plan (ICP) was provided to the Borough and other interested parties for informal review and comment. Comments received from all parties on the ICP have been reviewed and evaluated, and changes have been made to the draft ICP where appropriate. The ICP is provided as Appendix A to this ROD.

2. DC 1. The commenter expressed appreciation to the ADEC and EPA for a making timely decisions at the KPC site that use good science and common sense and built trust between the community and government The commenter also noted that the decisions made will be beneficial to the community.

Comments noted.

3. GW 1. Characterization of the site and surrounding area is inadequate and site boundaries are not defined.

Characterization of the site and completion of the Remedial Investigation was done in a manner consistent with CERCLA RI/FS guidance. Site boundaries were considered in terms of both land ownership and potential contaminant migration pathways. During development of the RI and sampling programs extensive public input was solicited, consistent with the authority conferred on EPA through CERCLA. A community wide health and environmental investigation that goes beyond the boundaries of the extent of contamination from the facility is not provided for under CERCLA.

4. GW 2. Several commenters expressed an opinion that institutional controls are needed to address long-term monitoring and control of the Upland Operable Unit (OU) sites, to determine future responsibilities and roles and to address.soils and debris management during demolition.

Specific institutional control requirements are provided in the ROD. They include development of Easement and Covenant Agreements for the landfill, the mill site and the pipeline access road and to limit site use to commercial/industrial activities, and recreational activities for the water pipeline access road. These requirements also preclude future groundwater use of the site and require compliance with the *Management Plan for Arsenic in Soil and Rock*. Additionally, KPC was required to, and has developed, an Institutional Control Plan (ICP) which provides a framework for defining and implementing land and water use restrictions for the Uplands Operable Unit, including the mill site, the water pipeline access road, and the landfill. This plan specifies notification, sampling, coordination, reporting and record keeping requirements for conducting excavations/demolitions at the site. It also specifies management, operation and maintenance responsibilities for the landfill. Requirements apply to activities under paved areas or structure, in the near-shore fill area or in areas which were not evaluated or characterized in the RI. The ICP also sets out steps to be followed should any contamination be identified during excavation or demolition. The draft ICP was made available to the Ketchikan community. The ICP is Attachment A to the ROD and will become an enforceable document upon signature of the Consent Decree.

EPA and ADEC will have ongoing oversight on any site issues regarding toxic substances, and the future owner will be responsible for following applicable environmental regulations.

5. GW 3. A health study is needed for the KPC facility.

In the course of the remedial investigation and decision process, baseline and residual risks were calculated for the site and the potential receptors. Regarding potential risks associated from past exposures to site contaminants, the Agency for Toxic Substances and Disease Registry (ATSDR) is completing an independent health assessment for the Ketchikan area that will be available at a future date. In addition to the baseline risk assessment that was completed as part of the RI/FS, ATSDR also completed a petitioned health consultation regarding potential impacts to cisterns from KPC air emissions.

6. GW 4. The landfill is unlined and has not been adequately characterized.

See TCS 10-20

7. KL 1. The commenter emphasizes the need to ensure the property remains industrial or commercial and that institutional controls be developed and maintained, including future controls on excavated soil and continuation of the management practices set forth in the arsenic management plan.

See GW 2

8. TCS 1-8. Eight comments were provided by TCS regarding water cistern issues. Comments raised concerns that there were no means to identify which cisterns were to be cleaned, all tanks were not individually tested during clean out, risk estimates were not presented for the consumption of water and sediments, and there was no explanation of the polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans ("dioxins") found in the sediments of the cleaned-out cisterns.

The approach to characterization of exposure and risks related to aerial deposition of flyash containing dioxins onto offsite residential soils and to cisterns was described in the work plan (PTI 1997) and the remedial investigation report (Exponent 1998). This approach was agreed upon with the U.S. Environmental Protection Agency (EPA), Alaska Department of Environmental Conservation, and KPC after consideration of comments from the public and from other regulatory agencies, including the Agency for Toxic Substances and Disease Registry (ATSDR). The rationale for this approach and the outcomes are briefly summarized in the following paragraphs.

Aerial deposition modeling was used to delineate a maximum deposition area for flyash from the former power boilers. The modeling results served as a guide for offsite soil sampling, which was used to evaluate the range of aerial deposition and associated contaminant concentrations. During the remedial investigation, 21 soil samples were evaluated within aerial deposition areas.

Twelve soil samples collected in the forest soils of Slide Ridge were useful in confirming the aerial deposition modeling results, because they were located away from any other (non-KPC) sources of dioxins such as automobile exhaust, open burning of wrecked automobiles, and emissions from wood stoves and residential burn barrels. Therefore, the dioxin concentrations detected in the Slide Ridge forest soils are believed to reflect historical deposition of KPC flyash. Seven of these 12 sampling locations consisted of a transect going uphill in the area of Slide Ridge predicted to have received the maximum deposition. Dioxin concentrations in these samples, collected in October 1997, were about 2-3 times the forest background concentration of about 5 parts per trillion (ppt) identified in the remedial investigation. Although well below any risk level (e.g., EPA's current residential soil cleanup goal is 1,000 ppt, or 1 ppb), the detections indicated that dioxin in flyash had accumulated in these forest soils over the 40+ years of operation of the KPC boilers. These concentrations also did not exceed ecological risk thresholds.

Five additional samples were collected at the base of Slide Ridge in a transect from the mill to Refuge Cove in June 1998. This supplemental sampling was conducted in response to community concerns that the aerial deposition model did not account for a potential “funneling” effect in the valley along the North Tongass Highway between the mill and Refuge Cove. The dioxin concentrations in these samples showed a strong decline going away from the mill. The sample collected adjacent to the mill had a concentration of 80 ppt; the next four samples had concentrations of 28, 36, 33, and 5 ppt. The furthest station (near Yeisley Road) had a concentration equivalent to background (5 ppt). The soil sampling confirmed that any measurable effects of aerial deposition of dioxin from the power boilers were restricted to the forested areas directly northwest of the mill and did not extend to the residential areas beyond Refuge Cove.

Results of the air modeling and soil sample analyses were considered in identifying the area where cisterns were cleaned. This area encompassed most of the residences and businesses between the mill and Refuge Cove and within Refuge Cove. In its *Petitioned Health Consultation* (ATSDR 1998), ATSDR evaluated potential risks associated with chemicals, including dioxins, detected in water and/or sediment samples from four cisterns within the aerial deposition zone. ATSDR concluded that no adverse health effects were expected to result from exposure to chemicals in water or sediments from these cisterns. However, because the cisterns collect pollutants from various sources not necessarily related to the KPC site (i.e., air pollutants, dust, dirt, animal droppings, leaves, paint, and roofing materials), ATSDR did recommend that the cisterns be cleaned and noted that the four cisterns might not be representative of other cisterns, or of past conditions. The CERCLA process does not provide for evaluation of past exposures, but rather focuses on current and/or future risks.

When KPC cleaned the cisterns within and beyond the aerial deposition zone, dioxins were detected in the composite sediment samples at concentrations similar to those previously detected during EPA’s cistern sampling. ATSDR also evaluated these data and again concluded that the dioxins posed no significant risk. As mentioned above, KPC cleaned drinking water cisterns within the maximum deposition area and in areas beyond where there was no apparent deposition to soils (i.e., up to and including the contiguous residential areas of Refuge Cove). Because the risk assessment is based on current and future conditions, and because the cisterns have been cleaned, no current or future exposure will occur. Thus, the cistern data and the associated exposure pathways were not included in the risk assessment. Moreover, ATSDR’s evaluation of water and sediments from cisterns near the maximum deposition zone did not identify unacceptable risks. This ATSDR finding indicates that risks associated with cisterns in areas more remote than those cleaned by KPC (i.e., further from the maximum deposition zone) would be well within acceptable levels.

9. TCS 9. KPC was responsible for release of air contaminants, and EPA and ADEC have

responsibilities to protect air quality.

Both EPA and ADEC do have statutory and regulatory obligations to protect air quality. However, because the KPC mill has been shut down, and air emissions are no longer occurring, these responsibilities are not applicable.

10. TCS 10-20. Thirteen comments from TCS and other commenters were received regarding the adequacy of the landfill closure and on past and current transport and fate issues at the landfill. Commenters suggested that the landfill design was not adequate, the landfill contained wastes in excess of ATSDR guidelines, more specific monitoring requirements were needed, and monitoring should continue for more than the 30-year time frame identified in the State permit. In addition, concerns were expressed regarding exposure to contaminants within the landfill, in downgradient areas that may have been affected by past releases from the landfill (i.e., drainages on Dawson Point and beaches on "Dawson Cove" and Refuge Cove). There were also contaminant migration concerns because the landfill is unlined. These comments are briefly addressed here and discussed in greater detail in the institutional control plan (Exponent 1999), which specifies future monitoring and controls for the landfill.

The landfill was constructed and closed in keeping with the ADEC guidelines applicable at the time of landfill closure and following public input. The construction methods are consistent with the level of contamination present. Engineering controls are in place at the landfill to minimize surface water flow onto the landfill and groundwater flow through the landfill. The drainage system at the landfill is intended to decrease flow and potential leachate generation from the landfill. The current federal NPDES permit requires monitoring of surface water drainages and leachate at the landfill. The existing State solid waste landfill permit specifies monitoring, reporting and closure requirements.

The landfill components of the institutional control plan include requirements that state and federal permit stipulations be complied with. Additionally, the draft institutional control plan precludes use of groundwater, any activities that could result in exposure of humans to landfill materials and any activities that could compromise the integrity of the landfill cap. Institutional controls will remain in effect at the landfill until land use no longer is restricted, with no time limitation. Therefore, even if state or federal permit requirements applicable to the landfill should change or if the state permit is "closed out" after 30 years, the institutional control plan specifies that for purposes of site management under CERCLA, the requirements will remain in effect until otherwise agreed. Proper operation and maintenance of the landfill is a requirement of the state permit and is also reflected in the ROD and ICP language.

With the construction of a drainage system around the landfill, flow into and through the landfill is reduced, and the potential for contaminant transport from the landfill through leachate generation or release to groundwater is reduced. Additionally, the leachate collection basin provides a further buffer to control landfill discharge into Ward or Dawson Coves by collecting leachate, which is sampled and analyzed prior to discharge through the permitted outfall into Ward Cove. Concerns specific to transport of dioxins from the landfill were also raised. Typically, dioxin and dioxin like compounds are not very mobile because they effectively bind to organic matter. With proper maintenance of the landfill cap, transport of contaminants through surface transport or erosion is controlled. The ROD, the state permit and the ICP specify requirements for landfill cap maintenance that remain in effect until the land use becomes unrestricted.

A comment references the RI/FS statement that ATSDR notes that at concentrations greater than 1000 ng/kg(ppt) potential public health actions are considered. This recommended value is for residential soils, and is consistent with the residential soils remediation goals used by EPA. However, this value is not applicable to an industrial/commercial setting. Actions are being taken at the landfill in the form of institutional controls, which are designed to ensure that no complete human health or ecological exposure pathway exists, either now or in the future.

Direct exposure to contaminants is prevented by the cap and by ongoing land-use restrictions preserving the cap. In addition, concentrations of dioxins and furans detected in sediments in the drainages around the landfill are similar to typical background levels. No chemicals of concern were found in sediment samples from the beach area of "Dawson Cove," which was identified as the most likely area for recreational use. Areas up gradient between "Dawson Cove" and the landfill would have less frequent recreational visits. Several of the streambeds were sampled and did not have concentrations above the established screening levels.

11. TCS 21-24. A number of comments were provided by TCS on the near-shore fill area which suggested that it was incompletely characterized with regard to transport of polychlorinated biphenyls (PCBs) to Ward Cove and that more discussion was needed regarding how any excavated soils would be handled.

The near-shore fill subarea sampling program was designed during the remedial investigation with input from the public. Sampling results were considered conservatively in a model to evaluate the potential for contaminant migration to Ward Cove. Specifically, the model assumed that the entire volume of soil in the near-shore fill subarea is a source of PCBs to Ward Cove. Instead, PCBs are more likely to be present in limited areas, perhaps associated with paint chips. As outlined in the draft institutional control plan, any excavation in the near-shore fill subarea would require further characterization and appropriate evaluation and management.

12. TCS 25. The commenter identified concerns regarding demolition sampling at the mill site.

Specific requirements for sampling in areas of future demolition activities are included in the institutional control plan. Additionally, the institutional control plan includes a sample and analysis plan and reference to the quality assurance project plan developed for the original remedial investigation.

13. TCS 26-28. Several comments were made in the category of institutional controls which concerns the need to consider new contaminant risk information or future releases from the landfill.

See GW 2

While institutional controls do address some of these issues, the five year review required under CERCLA is an important aspect of maintaining protectiveness. Superfund guidance and the ICP require that whenever waste is left in place and land use is restricted, reviews of the remedy must be made every five years until such time as land use is not restricted. These reviews are designed to ensure that the remedies remain effective and protective and that land use has not changed, to consider new information that would affect risk decision making, and to confirm that institutional controls remain protective. These reviews will be done every five years from the date of commencement of post ROD remedial actions.

14. PB 1. The commenter expressed concern regarding the potential effect of arsenic in runoff from the site on Ward Cove organisms.

Sampling and analysis show that arsenic in runoff from the site is not of concern. No arsenic samples from the site exceeded EPA criteria for protection of ecological receptors. Also, leachability analysis show that no significant leaching of arsenic would be expected from crushed rock products used at the site and landfill. Finally, estimated arsenic concentrations in seafood did not exceed background levels, and arsenic was not identified as posing a risk to humans or marine organisms. Additional details are provided in the following paragraphs.

Arsenic Concentrations in Subsurface and Surface Water

Limited subsurface water sampling was conducted during the remedial investigation. Surface water sampling of storm water and water in drainages at the landfill have been ongoing as part of permit requirements. The arsenic concentrations in surface water (e.g. from drainages and storm water runoff) are compared to EPA's ambient water quality acute and chronic criteria of 69 and 36 *m*g/L, respectively. The acute criterion is not to be exceeded during a 1-hour average sample and the chronic criterion is not to be exceeded in a 4-day average sample. EPA requires that the criteria for arsenic be compared with dissolved arsenic in water at the point of discharge or at the boundary of a permitted mixing zone. In contrast, in agreement with EPA, ADEC requires that total recoverable (unfiltered sample) results be used for comparison at the point of discharge. In 1998, EPA adopted dissolved criteria as the basis for comparison because dissolved concentrations represent metals that are available to affect aquatic organisms. In this discussion, both dissolved and total recoverable arsenic concentrations are compared with the criteria. However, it is important to recognize that the comparison with total arsenic is a very conservative (i.e., health protective) means to evaluate potential threats to ecological receptors.

The onsite groundwater sampling included four water samples (including one field duplicate) collected from the three 12-ft deep test pits excavated along the shoreline of the nearshore fill subarea during an ebbing tide and one water sample collected during low tide from a seep near the log deck. Samples were analyzed for both total recoverable and dissolved concentrations of arsenic. None of the concentrations exceeded the EPA acute or chronic marine ambient water quality criteria for protection of ecological receptors. These results suggest that any offsite migration of arsenic in subsurface water is not at levels with the potential to cause harm.

As part of KPC's National Pollutant Discharge Elimination System (NPDES) permit, 18 storm water samples were collected from six storm water outfall locations during three storm events in 1999 and were analyzed for total recoverable arsenic. Two results (41.3 and 37.9 *m*g/L) for samples collected on September 17, 1999, exceeded the chronic criterion of 36 *m*g/L, and one result (81.1 *m*g/L) for a sample collected on November 22, 1999, exceeded both the acute (69 *m*g/L) and the chronic criteria for protection of ecological receptors. These storm water exceedances were short-term (i.e., subsequent samples had lower concentrations) and thus are not directly comparable to the chronic criterion. In addition, all of the concentrations exceeding the criterion were those of total recoverable metals rather than the ecologically relevant dissolved fraction. Total suspended solids (TSS) concentrations were greater than 100 mg/L for two of the three samples, and there is a trend of increasing arsenic concentrations with TSS, both of which suggest that the arsenic is generally associated with solids in the water samples.

As part of compliance with the landfill permit, water sampling is ongoing for drainages around the landfill. Under the current landfill permit, surface water data have been collected from six locations around the landfill. Of the 83 samples, 60 were analyzed for dissolved arsenic and 23 were analyzed for total recoverable arsenic. None of the results exceeded the marine ambient water quality criteria of 36 and 69 *m*g/L for protection of ecological receptors.

In conclusion, no dissolved arsenic samples exceeded the current EPA criteria for protection of ecological receptors. In evaluating the data in comparison with ADEC's more stringent criteria for total recoverable arsenic in water, three storm water samples exceeded the chronic criterion, one of which also exceeded the acute criterion. As stated previously, because these samples are individual samples, not 4-day averages, they are not directly comparable. In subsequent sampling events, the ADEC criteria were not exceeded. Dissolved arsenic concentrations provide a more realistic basis for evaluating the potential for effects on aquatic environments such as Ward Cove. No samples had dissolved arsenic concentrations exceeding the criteria, which is consistent with low leachability indicated in TCLP and SPLP results. Considering the more realistic basis for comparison, these data indicate that migration of arsenic in surface water has minimal potential for adverse effects on organisms in Ward Cove.

Leachability of Arsenic in Soil and Rock

The potential for migration of arsenic from soil and rock was evaluated through SPLP analyses conducted on 28 samples of rock from local rock quarries. In addition, SPLP analyses were conducted as part of a separate evaluation of leachability and bioavailability of 12 topsoil and rock samples from crushed rock products used at the site. Both of these analyses indicated low potential for arsenic to migrate from soil or rock. Specifically, of the 40 total samples, only one quarry rock sample had an SPLP result of 1.26 mg/L (all other quarry SPLP results were undetected). That particular rock sample had a very high total arsenic concentration with 7,690 mg/kg associated with the fine particle size fraction.

The results of the leachability analyses indicate that no significant leaching of soluble arsenic would be expected from topsoil used at the landfill or from imported rock products. The arsenic in the soil is probably a result of the initial deposition of the rock fill (and associated fine material) and, to some extent, as particulate matter suspended in surface water flow. Crushed or shot rock used as road cover material would be subject to grinding and abrasion from vehicle traffic; however, the results indicate that minimal soluble arsenic would be released under these conditions. The primary pathway for arsenic from crushed rock would be through surface water transport of fine particles containing arsenic. This particulate form of arsenic (in contrast to dissolved arsenic) would be less susceptible to migration to groundwater or marine waters.

Evaluation of Arsenic in Sediments

In the human health risk assessment, arsenic was conservatively assumed to accumulate into seafood based on the maximum concentration in sediments of 39 mg/kg. Even with this assumption, estimated arsenic concentrations in seafood did not exceed background concentrations and arsenic was not identified as a chemical of concern for human health. Similarly, in comprehensive tests of sediment toxicity, arsenic was not identified as a chemical posing potential risks to marine organisms. Arsenic concentrations in sediments were also evaluated in ecological food-web modeling, and no potential adverse effects on marine species were identified. The lack of effects predicted or seen in ecological investigations was also consistent with the fact that the arsenic concentration in sediments did not exceed the Washington State sediment management standards (i.e., sediment quality value of 57 mg/kg and minimum cleanup level of 93 mg/kg) for protection of marine species.

15. AM 1. The commenter is concerned with migration of contaminants to groundwater and Ward Cove.

See TCS 10-20 and PB 1

16. AM 2. The commenter is concerned with impacts to Ward Cove, including degradation of the cove and decrease in marine organisms.

Investigation of the past and present potential of contaminants from the Upland Operable Unit to Ward Cove has not indicated the presence of any significant contaminant transport. Other activities to remediate Ward Cove are presented in the KPC Marine Operable Unit ROD, dated March 29, 2000.

17. AM 3. The commenter suggests that a system be put in place to monitor the wood waste and ash disposal landfill.

See GW 2 and TCS 10-20

18. AM 4. The commenter has concerns with dioxin levels on Slide Ridge.

See TCS 1-8

19. LG 1. The commenter expressed satisfaction with the process that has been used at the site and the decisions that have been made.

Comment noted

20. AH 1. The commenter commended the agencies on how well they worked together and expressed satisfaction with the decisions.

Comment noted

21. PS 1. The commenter expressed satisfaction with the process used at the site to date and encouraged continued monitoring and quick decision making.

See GW2

22. EH 1-5. The commenter noted they were generally satisfied with the process and outcomes at the site and felt that their concerns had been listened to in most instances. Three remaining areas of concern were identified, including: 1) the continued need to characterize the contents of people's water tanks, 2) presentation of a rational decision framework for what water tanks were cleaned out and, 3) the limitation of land use and repercussions to the community by requiring institutional controls at the site.

See GW 2
See TCS 1-8

23. MG 1-3 The commenter commended the involved agencies for a good job, and noted that institutional controls such as future soil sampling are standard practice for both residential and commercial excavation activities. The commenter also expressed support for the company's current worker safety program.

Comment noted

24. GW 5-6. The commenter expressed disagreement with the assumptions used in the air model for determining areas of maximum aerial deposition from the KPC power boilers and requested additional sampling be completed.

See TCS 1-8

25. GW 7-8. The commenter expressed concern that only potential health issues associated with KPC operations and practices were being addressed, rather than looking at area wide community health issues. The current status of dioxin risk evaluation and "safe" levels of exposure were also identified as an area of concern.

EPA agrees that there is ongoing discussions in the scientific community with regard to acceptable levels of exposure to dioxin and dioxin-like compounds. EPA has been in the process of reassessing dioxin exposure and human health effects since 1991, and will shortly release a Draft Reassessment of Dioxin report for peer review. If, and when, the dioxin risk values are revised the Preliminary Cleanup Goals will be re-evaluated throughout the national Superfund program and presented in agency guidance. At a minimum, remedial decisions presented in RODs are evaluated every five years to ensure cleanup goals remain protective of human health and the environment. Revised risk and subsequent recommended cleanup concentrations would be considered in the five year review for this site. However, until that time EPA continues to rely on the preliminary remediation goals established in existing agency guidance of 1 ppb for residential areas and 5 - 20 ppb for commercial/industrial land use.

Under the authorities of the NCP and CERCLA, EPA is mandated to evaluate contaminant releases and the potential current and future risks these pose for specific NPL or NPL caliber sites. This is the process that was used at the KPC site. EPA does not have the authority to evaluate community wide risks associated with numerous potential sources of contamination. However, this is the type of evaluation that would be completed by ATSDR. Please see comment GW 3.

TABLES

Table 1. Summary of chemical concentrations, risk estimates, early actions, and residual concentrations and risks

Area (scenario/pathways evaluated)	Chemicals Above Screening Levels	Baseline: Concentration Range	Baseline: Screening Level [a]	Baseline: Excess Risk Estimate	Action or Note	Residual: Residual Concentration Range	Residual: Residual Risk
Pulp Mill Area							
Process Subarea							
Access Road and Ditch (occupational)	Arsenic[b]	56–182 mg/kg	7.6 mg/kg	4×10^{-5}	Ditch sediment removed in 1998 as part of early action, some fill added to road with regrading.	5.5–157 mg/kg	4×10^{-5}
	PCDD/F	5.5–162 ng/kg (TEC)	38 ng/kg (TEC)	5×10^{-6}	No Cleanup Level	8.2–30.2 ng/kg (TEC)	9×10^{-7}
Wood Room/Log Deck Area (occupational)	Arsenic[b]	84 mg/kg	7.6 mg/kg	2×10^{-5}		84 mg/kg	2×10^{-5}
Wood Room/Log Deck Seep Water (Migration to Ward Cove)	Manganese	0.267 mg/L (seep water)	0.0285 mg/L background[c]		Hog fuel removed in spring 1998[c]	- -	- -
Soils near Evaporator No. 3 (occupational)	Arsenic[b]	65 mg/kg	7.6 mg/kg	1×10^{-5}		65 mg/kg	1×10^{-5}
Mill Support Subarea							
Aeration Basin Soils (occupational)	Arsenic[b]	1.3–90 mg/kg	7.6 mg/kg	2×10^{-5}		1.3–90 mg/kg	2×10^{-5}
Grit Chamber Soils (occupational)	Arsenic[b]	10–100 mg/kg	7.6 mg/kg	2×10^{-5}		10–100 mg/kg	2×10^{-5}
Paint Shop/Former Maintenance Shop (occupational)		0.94–670 mg/kg	7.6 mg/kg	2×10^{-4}	Soil removed in 1999 as part of early action. Cleanup Levels:	1.53–33.9 mg/kg	8×10^{-6}
	Lead	<10–4,270 mg/kg	1,000 mg/kg		1,000 mg/kg	<10–274 mg/kg	- -
	Benzo[a]pyrene (cPAH RPC)	<0.013–4.42 mg/kg	0.90 mg/kg	5×10^{-6}	0.90 mg/kg	0.0143–0.0444 mg/kg	1×10^{-7}
	PCBs	<0.050–499 mg/kg	10 mg/kg	1×10^{-4}	10 mg/kg	<0.067–8.46 mg/kg	8×10^{-6}[d]
Former Bottom Ash Storage Pile (occupational)	Arsenic[b]	4.9 and 44 mg/kg[e]	7.6 mg/kg	5×10^{-6}		4.9 and 44 mg/kg[e]	5×10^{-6}
Caustic Tanks and Pipeline (occupational)	None					None	- -
Equipment Storage Area (occupational)	None					None	- -
Filter Plant Soils (occupational)	None					None	- -
Near-shore Fill Subarea							
(occupational)	Arsenic[b]	0.5–132 mg/kg	7.6 mg/kg	3×10^{-5}		0.5–132 mg/kg	3×10^{-5}
	PCBs	0.49 µg/L (Undissolved)[f]	0.00017 µg/L[f]			0.49 µg/L (undissolved)[f]	- -
Wood Waste and Sludge Disposal Area							
(occupational)	Arsenic[b]	1–22 mg/kg	7.6 mg/kg	5×10^{-6}		1–22 mg/kg	5×10^{-6}

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Table 1. (cont.)

Area (scenario/pathways evaluated)	Chemicals Above Screening Levels	Baseline Concentration Range	Baseline Screening Level [a]	Baseline Excess Risk Estimate	Action or Note	Residual Concentration Range	Residual Risk
Petroleum Soils Areas							
Railroad Tracks Area (comparison with ADEC regulations)	Benz[a] anthracene	<0.007–56 mg/kg	9 mg/kg	- -	Soil removed in 1999 as part of early action. Cleanup Level: 9,000 ug/kg	<0.0067–1.18 mg/kg	- -
	Benzo[b] fluoranthene	<0.007–28 mµg/kg	9 mg/kg	- -	9 mg/kg	<0.0067–1.2 mg/kg	- -
	Benzo[a]pyrene	<.007–16 mg/kg	0.9 mg/kg	- -	0.9 mg/kg	<0.0067–0.73 mg/kg	- -
	Dibenz[a,h] anthracene	<.007–2 mg/kg	0.9 mg/kg	- -	0.9 mg/kg	<0.0134–0.204 mg/kg	- -
Compressor Area (comparison with ADEC regulations)	DRO	17,000–50,000 mg/kg	8,250 mg/kg	- -	Soil removed in 1999 as part of early action. Cleanup Level: 8,250 mg/kg	885–8,960 mg/kg	- -
	RRO	39,000–120,000 mg/kg	8,300 mg/kg	- -	8,300 mg/kg	2,160–22,800 mg/kg	- -
Bulk Fuel Tank Area (comparison with ADEC regulations)	DRO	8.4–31,000 mg/kg	8,250 mg/kg	- -	Soil removed in 1999 as part of early action. Cleanup Level: 8,250 mg/kg	<25–14,500 mg/kg	- -
	RRO	23–36,000 mg/kg	8,300 mg/kg	- -	8,300 mg/kg	<50–14,200 mg/kg	- -
	Benz[a] anthracene	0.120–24 mg/kg	9 mg/kg	- -	9 mg/kg	0.00978 mg/kg	- -
	Benzo[a]pyrene	0.110–19 mg/kg	0.9 mg/kg	- -	0.9 mg/kg	0.0132–22.7 mg/kg	- -
Dredge Spoils Area							
(occupational)	None					None	- -
Wood Waste and Ash Disposal Landfill							
(occupational)	None					None	- -
Former Storage Area along the Water Pipeline Road							
(occupational)	Arsenic [b]	1.21–72.6 mg/kg	7.6 mg/kg	$6x10^{-6}$	Soil removed in 1999 as part of early action.	<0.5–89.5 mg/kg	$9x10^{-6}$
	Lead	<10–2,210 mg/kg	1,000 mg/kg	- -	Cleanup Level: 1,000 mg/kg	<10–2,210 mg/kg	- -
	PCBs	<0.400–6,410 mg/kg	10 mg/kg	$1x10^{-5}$	10 mg/kg	0.468–7.9 mg/kg	$4x10^{-6}$
	TPH–oil	1–34,000 mg/kg	9,700 mg/kg	- -	9,700 mg/kg	None	- -
Aerial Deposition Areas							
Forested and Developed Area Soils (residential/ingestion, dermal contact, produce consumption)	Arsenic [b]	2.4–138 mg/kg	7.6 mg/kg	$2x10^{-5}$		2.4–138 mg/kg	$2x10^{-5}$
	PCDD/F	0.89–137 ng/kg (TEC)	7.4 ng/kg	$1x10^{-5}$		0.89–137 ng/kg (TEC)	$1x10^{-5}$
Grit in Residential Yards							
(Residential/ingestion, dermal contact, produce consumption)	Arsenic [b]	3.73–7.9 mg/kg	7.6 mg/kg	- -		3.73–7.9 mg/kg	- -
	PCDD/F	5.1–28.2 ng/kg (TEC)	7.4 ng/kg	$2x10^{-6}$		5.1–28.2 ng/kg (TEC)	$2x10^{-6}$

Footnotes continued on following page.

Table 1. (cont.)

Note: Boxes indicate those areas where soil has been removed.

- -	-	not applicable
ADEC	-	Alaska Department of Environmental Conservation
cPAH	-	carcinogenic polycyclic aromatic hydrocarbon
DRO	-	diesel-range organics
EPA	-	U.S. Environmental Protection Agency
PAH	-	polycyclic aromatic hydrocarbon
PCB	-	polychlorinated biphenyl
PCDD/F	-	polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran
RPC	-	relative potency concentration
RRO	-	residual-range organics
TEC	-	toxic equivalent concentration
TPH	-	total petroleum hydrocarbon

[a] Screening levels were as follows: EPA Region 10 PCB risk-based cleanup level for nonresidential soils of 10 mg/kg; EPA OSWER guidance for lead in nonresidential soils of 1,000 mg/kg (U.S. EPA 1989a); ADEC TPH soil cleanup standard for protection of groundwater (18 AAC 75); EPA risk-based concentrations for PCDD/F in industrial soils (U.S. EPA 1998). Screening levels for arsenic onsite and offsite based on background concentrations. Screening level for PCDD/F in grit based on background concentrations.

[b] Arsenic levels are addressed in the arsenic management plan (Exponent 1998). Arsenic bioavailability estimates described in the arsenic management plan suggest that risks associated with exposure to arsenic in soil may be much lower than those shown here.

[c] Screening level based on background in Tongass Narrows (E&E 1991). Hog fuel was identified as a source of manganese. Removal of hog fuel from the site in spring of 1998 eliminated this source. In addition, manganese was not identified as a chemical of potential concern in the Ward Cove investigation. For these reasons, manganese was not carried through the risk assessment.

[d] Two additional samples with PCB concentrations of 60.2 and 13.5 mg/kg, which were collected from rock at the bottom of the excavation, were not included in the residual risk calculations given their inaccessibility and low volume.

[e] Field duplicate results.

[f] Screening level based on marine human health criteria (U.S. EPA 1999). During the remedial investigation, dissolved concentrations of PCBs were estimated to reach 0.00017 µg/L within 0.1 meter of the shoreline.

Table 2. Summary of sampling for laboratory analysis

Area of Interest	Media	Number of Samples[a,b]	Analytes
Source material	ESP flyash	5	TAL metals, SVOCs, PCDDs/Fs
	Breslove flyash	5	TAL metals, SVOCs, PCDDs/Fs
	Bottom ash	5	TAL metals, SVOCs, PCDDs/Fs
	Primary sludge	5	TAL metals, VOCs, SVOCs, PCDDs/Fs
	Mixed primary and secondary sludge	5	TAL metals, VOCs, SVOCs, PCDDs/Fs
	Reconstituted grit	5	TAL metals, VOCs, SVOCs, PCDDs/Fs
Rock quarries	Rock	28	TAL metals SPLP-extractable arsenic
Onsite gravel	Rock	1	Arsenic, arsenic bioavailability and mineralogy
Background soil	Soil	14	TAL metals, SVOCs, PCDDs/Fs
Background sediment	Sediment	3	TAL metals, SVOCs, PCDDs/Fs
Access road and ditch	Soil	1	TAL metals, VOCs, SVOCs, PCDDs/Fs
	Soil	3	TCLP-extractable arsenic
	Sediment	4	TAL metals, VOCs, SVOCs, PCDDs/Fs
Wood room/log deck	Soil	1	TAL metals, VOCs, PAHs, PCBs, petroleum hydrocarbons, grain size, pH, TOC, arsenic bioavailability and mineralogy
	Seep water	1	Total and dissolved TAL metals, VOCs, PCDDs/Fs, PAHs, PCBs, petroleum hydrocarbons, TSS, field parameters (pH, Eh, dissolved oxygen, temperature)
Soil near No. 3 evaporator	Soil	1	TAL metals
Aeration basin	Soil	5	Arsenic, grain size, pH, TOC
	Dried foam	1	Arsenic
Grit chamber	Grit	2	Arsenic, mercury, zinc, PCDDs/Fs
Paint shop/former maintenance shop	Soil/subsurface soil	32	TAL metals, VOCs, PAHs, PCBs, petroleum hydrocarbons, grain size, pH, TOC
Caustic tanks and pipeline	Soil	1	Mercury
Equipment storage area	Soil	6	PCDDs/Fs, PAHs, PCBs, petroleum hydrocarbons, grain size, pH, TOC
Former bottom ash storage pile	Soil	1	Arsenic, mercury
Filter plant	Soil	1	Lead
Near-shore fill subarea	Soil	9	TAL metals, VOCs, SVOCs, PCDDs/Fs, PCBs, grain size, pH, TOC, arsenic bioavailability and mineralogy
	Subsurface soil	10	TAL metals, VOCs, SVOCs, PCDDs/Fs, PCBs, petroleum hydrocarbons, grain size, pH, TOC
	Groundwater	3	Total and dissolved TAL metals, VOCs, PCDDs/Fs, PAHs, PCBs, petroleum hydrocarbons, TSS, field parameters (pH, Eh, dissolved oxygen, temperature)
Wood waste and sludge disposal subarea	Sludge	1	TAL metals, grain size, pH, and TOC

Table 2. (cont)

Area of Interest	Media	Number of Samples[a]	Analytes
Dredge spoil subarea	Sediment	4	TAL metals, VOCs, SVOCs, PCDDs/Fs, PCBs, petroleum hydrocarbons, grain size, pH, TOC
	Subsurface sediment	4	TAL metals, VOCs, SVOCs, PCDDs/Fs, PCBs, petroleum hydrocarbons, grain size, pH, TOC
Wood waste and ash disposal landfill	Sediment	3	Arsenic, copper, mercury, nickel, PCDDs/Fs
Former storage area along water pipeline	Soil/subsurface soil	88	TAL metals, VOCs, SVOCs, PCBs, petroleum hydrocarbons, organochlorine pesticides, chlorinated herbicides, TCLP-extractable metals, SPLP-extractable lead, TOC
	Drum contents	16	Hazardous characteristics
	Bottom ash	1	TAL metals
	Sediment	22	TAL metals, SVOCs, PCBs, petroleum hydrocarbons, TOC
Aerial deposition areas - forest soils	Soil	7	TAL metals, PCDDs/Fs
		3	Arsenic, PCDDs/Fs
		1	Grain size, pH, TOC
	Sediment	2	Arsenic, PCDDs/Fs
Aerial depsoition areas - developed area soils	Soil	2	Arsenic, beryllium, mercury, PCDDs/Fs
Residences with grit	Soil	8	Arsenic, PCDDs/Fs
Petroleum-contaminated soil areas (railroad tracks, bulk fuel tank, compressor, former underground storage tank)	Foundation sand (bulk fuel tank)	15	PAHs, PCBs, petroleum hydrocarbons
	Soil/Subsurface soil	138	Lead, PAHs, petroleum hydrocarbons, BTEX

Note:
BTEX - benzene, toluene, ethylbenzene, and xylenes
ESP - electrostatic precipitator
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran
SPLP - synthetic precipitation leaching procedure
SVOC - semivolatile organic compound
TAL - target anylyte list
TCLP - toxicity characteristic leaching procedure
TOC - total organic carbon
TSS - total suspended solids
VOC - volatile organic compound

[a] Does not include field duplicates.

[b] Not all samples were analyzed for all listed analytes.

Table 3. Oral toxicity values for estimating excess cancer risks associated with CoPCs

Chemical	Oral Carcinogenic Slope Factor $(mg/kg\ day)^{-1}$	EPA Weight-of-Evidence Classification[a]	Type of Cancer	Basis of Carcinogenic Slope Factor
Arsenic	1.5	A	Skin	Human population drinking water
Lead	NA	B2	- -	- -
Benzo[a]pyrene	7.3	B2	Forestomach, squamous cell papillomas and carcinomas	Mouse diet
PCBs	2	B2	Liver hepatocellular adenomas, carcinomas,	Rat diet
PCDDs/Fs[b]	$1.5x10^5$	B2	Respiratory system, liver	Rat diet

Note: Toxicity values obtained from EPA's Integrated Risk Information System, unless otherwise indicated.

- - - not applicable
CoPC - chemical of potential concern
EPA - U.S. Environmental Protection Agency
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran

[a] A - Human carcinogen
B2 - Probable human carcinogen

[b] Toxicity information reported for PCDDs/Fs and 2,3,7,8-tetrachlorodibenzo-p-dioxin obtained from EPA's Health Assessment Summary Tables (HEAST) (U.S. EPA 1997).

Table 4. Toxicity equivalence factors for dioxins and furans

Compound[a]	TEF
Polychlorinated dibenzo-p-dioxins	
2,3,7,8-TCDD	1
2,3,7,8-substituted PeCDDs	0.5
2,3,7,8-substituted HxCDDs	0.1
2,3,7,8-substituted HpCDDS	0.01
OCDD	0.001
Polychlorinated dibenzofurans	
2,3,7,8-TCDF	0.1
2,3,4,7,8-PeCDF	0.5
1,2,3,7,8-PeCDF	0.05
2,3,7,8-substituted HxCDFs	0.1
2,3,7,8-substituted HpCDFs	0.01
OCDF	0.001

Source: U.S. EPA (1989a).

Note:
HpCCD - heptachlorodibenzo-*p*-dioxin
HpCDF - heptachlorodibenzofuran
HxCDD - hexachlorodibenzo-*p*-dioxin
HxCDF - hexachlorodibenzofuran
OCDD - octachlorodibenzo-*p*-dioxin
OCDF - octachlorodibenzofuran
PeCDD - pentachlorodibenzo-*p*-dioxin
PeCDF - pentachlorodibenzofuran
TCDD - tetrachlorodibenzo-*p*-dioxin
TCDF - tetrachlorodibenzofuran
TEF - toxicity equivalence factor

[a] All other congeners not listed here are assigned a TEF equal to 0.

Table 5. Oral toxicity values for estimating excess noncarcinogenic effects associated with CoPCs

Chemical	Oral Chronic RfD (mg/kg-day)	Critical Effect	RfD Basis	Confidence Level	Uncertainty Factor/ Modifying Factor
Arsenic	$3x10^{-4}$	Hyperpigmentation, keratosis	Human chronic drinking water	Medium	1/1
Lead	NA	--	--	--	--
PCBs[a]	$2x10^{-5}$	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased antibody (IgG and IgM) response to sheep erythrocytes	Monkey clinical and immunologic		300/1

Note: Toxicity values obtained from EPA's Integrated Information System.

--	-	not applicable
CoPC	-	chemical of potential concern
NA	-	not available
PCB	-	polychlorinated biphenyl
RfD	-	reference dose

[a]Toxicity information reported for PCBs are for Aroclor⁷ 1254.

Table 6. **Summary of upper-bound carcinogenic risk estimates and noncancer hazard indices for CoPCs in soil--worker scenario**

Site Area	EPC (mg/kg)	Upper-Bound Excess Carcinogenic Risk Estimate: Soil Ingestion[a]	Upper-Bound Excess Carcinogenic Risk Estimate: Dermal Contact	Upper-Bound Excess Carcinogenic Risk Estimate: Total	Upper-Bound Noncancer Hazard Index: Soil Ingestion	Upper-Bound Noncancer Hazard Index: Dermal Contact	Upper-Bound Noncancer Hazard Index: Total
Pulp mill area							
Process subarea							
Access road ditch soils and sediments							
Arsenic	157	$2x10^{-5}$	$1x10^{-5}$	$4x10^{-5}$	0.1	0.09	0.2
PCDDs/Fs	0.00016	$3x10^{-6}$	$3x10^{-6}$	$5x10^{-6}$	--	--	--
Total		**$2x10^{-5}$**	**$2x10^{-5}$**	**$4x10^{-5}$**	**0.1**	**0.09**	**0.2**
Wood room/log deck soils							
Arsenic	84	$1x10^{-5}$	$8x10^{-6}$	$2x10^{-5}$	0.07	0.05	0.1
Total		**$1x10^{-5}$**	**$8x10^{-6}$**	**$2x10^{-5}$**	**0.07**	**0.05**	**0.1**
Soils near No. 3 evaporator							
Arsenic	65	$9x10^{-6}$	$6x10^{-6}$	$1x10^{-5}$	0.05	0.04	0.09
Total		**$9x10^{-6}$**	**$6x10^{-6}$**	**$1x10^{-5}$**	**0.05**	**0.04**	**0.09**
Mill support subarea							
Aeration basin soils							
Arsenic	90	$1x10^{-5}$	$8x10^{-6}$	$2x10^{-5}$	0.07	0.05	0.1
Total		**$1x10^{-5}$**	**$8x10^{-6}$**	**$2x10^{-5}$**	**0.07**	**0.05**	**0.1**
Grit chamber soils							
Arsenic	100	$1x10^{-5}$	$9x10^{-6}$	$2x10^{-5}$	0.08	0.06	0.1
Total		**$1x10^{-5}$**	**$9x10^{-6}$**	**$2x10^{-5}$**	**0.08**	**0.06**	**0.1**
Paint shop/former maintenance shop soils							
Arsenic	670	$9x10^{-5}$	$6x10^{-5}$	$2x10^{-4}$	0.5	0.4	0.9
Lead	2,410	--	--	--	--	--	--
Benso[a]pyrene	2	$3x10^{-6}$	$3x10^{-6}$	$5x10^{-6}$	--	--	--
Total PCBs	116	$4x10^{-5}$	$6x10^{-5}$	$1x10^{-4}$	3	4	7
Total		**$1x10^{-4}$**	**$1x10^{-4}$**	$3x10^{-4}$	3	5	**8**
Former bottom ash storage pile soils							
Arsenic	24	$3x10^{-6}$	$2x10^{-6}$	$5x10^{-6}$	0.02	0.01	0.03
Total		**$3x10^{-6}$**	**$2x10^{-6}$**	**$5x10^{-6}$**	**0.02**	**0.01**	**0.03**
Near-shore fill subarea soils							
Arsenic	132	$2x10^{-5}$	$1x10^{-5}$	$3x10^{-5}$	0.1	0.08	0.2
Total		**$2x10^{-5}$**	**$1x10^{-5}$**	**$3x10^{-5}$**	**0.1**	**0.08**	**0.2**
Woodwaste and sludge disposal subarea soils							
Arsenic	22	$3x10^{-6}$	$2x10^{-6}$	$5x10^{-6}$	0.02	0.01	0.03
Total		**$3x10^{-6}$**	**$2x10^{-6}$**	**$5x10^{-6}$**	**0.02**	**0.01**	**0.03**
Former storage area long water pipeline soils							
Arsenic	26	$3x10^{-6}$	$2x10^{-6}$	$6x10^{-6}$	0.02	0.02	0.04
Total PCBs	15	$5x10^{-6}$	$8x10^{-6}$	$1x10^{-5}$	0.4	0.6	0.9
Total		**$9x10^{-6}$**	**$1x10^{-5}$**	**$2x10^{-5-}$**	**0.4**	**0.6**	**1.0**
Area Deposition Areas							
Forested and developed area soil (occupational use)							
Arsenic	11	$1x10^{-6}$	$1x10^{-6}$	$2x10^{-6}$	0.01	0.01	0.02
PCDDs/Fs[b]	$6.2x10^{-5}$	$1x10^{-6}$	$1x10^{-6}$	$2x10^{-6}$	--	--	--
Total		**$2x10^{-6}$**	**$2x10^{-6}$**	**$5x10^{-6}$**	**0.01**	**0.01**	**0.02**

Footnotes on next page.

Table 6. (cont.)

Note: Boxed value indicates risk estimate exceeds the upper decision risk level of 1 x 10^{-4} excess cancer risk or a noncancer hazard index > 1.

CoPC	-	chemical of potential concern
EPA	-	U.S. Environmental Protection Agency
EPC	-	exposure point concentration
PCB	-	polychlorinated biphenyl
PCDD/F	-	polychlorinated dibenozo-*p*-dioxin and polychlorinated dibenzofuran
TEC	-	toxic equivalent concentration based on data for 2,3,7 8-tetrachlorodibenzo-*p*-dioxin
TEF	-	toxicity equivalence factor

[a] Oral absorption from soil assumed to be 50 percent for arsenic, 60 percent for PCDDs/Fs, and w00 percent for lead, benzo[a}pyrene, and PCBs (see text).

[b] PCDDs/Fs represent TECs based on data for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin and on TEFs provided in U.S. EPA (1989a) using one-half the detection limit for undetected congeners.

Table 7. Summary of upper-bound carcinogenic risk estimates and noncancer hazard indices for CoPCs in soil ! offsite residential scenario

Area	EPC (mg/kg)	Upper-Bound Excess Carcinogenic Risk Estimates: Soil Ingestion[a]	Dermal Contact	Produce Ingestion[b]	Total	Upper-Bound Noncancer Hazard Indices: Soil Ingestion	Dermal Contact	Produce Ingestion[b]	Total
Aerial Deposition Areas									
Arsenic	11	$1x10^{-5}$ [c]	$7x10^{-6}$ [c]	$4x10^{-6}$	$2x10^{-5}$	0.2	0.1	0.04	0.4
PCDDs/Fs[d]	$6.2x10^{-5}$	$8x10^{-6}$ [c]	$2x10^{-7}$ [c]	$2x10^{-6}$	$1x10^{-5}$	--	--	--	--
Total		$2x10^{-5}$	$5x10^{-6}$	$5x10^{-6}$	$3x10^{-5}$	0.2	0.1	0.04	0.4
Residential Yards Amended with Grit									
PCDDs/Fs[d]	$1.4x10^{-5}$	$2x10^{-6}$	$5x10^{-8}$	$4x10^{-7}$	$2x10^{-6}$	--	--	--	--
Total		$2x10^{-6}$	$5x10^{-8}$	$4x10^{-7}$	$2x10^{-6}$	--	--	--	--

Note: -- - not applicable
CoPC - chemical of potential concern
EPC - exposure point concentration
PCDD/F - polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran

[a] Oral absorption from soil assumed to be 50 percent for arsenic and 60 percent for PCDDs/Fs (see text).

[b] Produce pathway risk represent highest risk estimates (i.e., adult risks for carcinogens and child risks for noncarcinogenic effects).

[c] Pathway based on child and adult receptors.

[d] PCDDs/Fs represent toxic equivalent concentrations based on data for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin and on toxicity equivalence factors provided in U.S. EPA (1989a) using one-half of the detection limit for undetected congeners.

Table 8. Food-web exposure model calculations for assessment of risk to short-tailed weasels in forested areas offsite

SHORT-TAILED WEASEL (*Mustela erminea*)

Body weight (kg)	0.028	Soil ingestion rate (kg/day)[a]	0.0001
Food ingestion rate (kg/day)[a]	0.011	Area use factor	1

Food Item	Percent of diet
Sitka mice	100

Chemical	Soil Concentration (mg/kg)[a]	Soil Exposure (mg/kg-day)	Sitka Mouse Concentration (mg/kg)[a]	Sitka Mouse Exposure (ng/kg-day)	Total Exposure (ng/kg-day)	TRV (ng/kg-day)	Hazard Quotient
PCDDs/Fs (expressed as TEC)	37	0.13	1.6	0.64	0.77	0.96	0.81

Note: PCDD/F - polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran

TEC - toxic equivalent concentration based on data for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin

TRV - toxicity reference value

[a] Soil values are expressed on a dry weight basis; Sitka mice values are expressed on a wet weight basis.

FIGURES

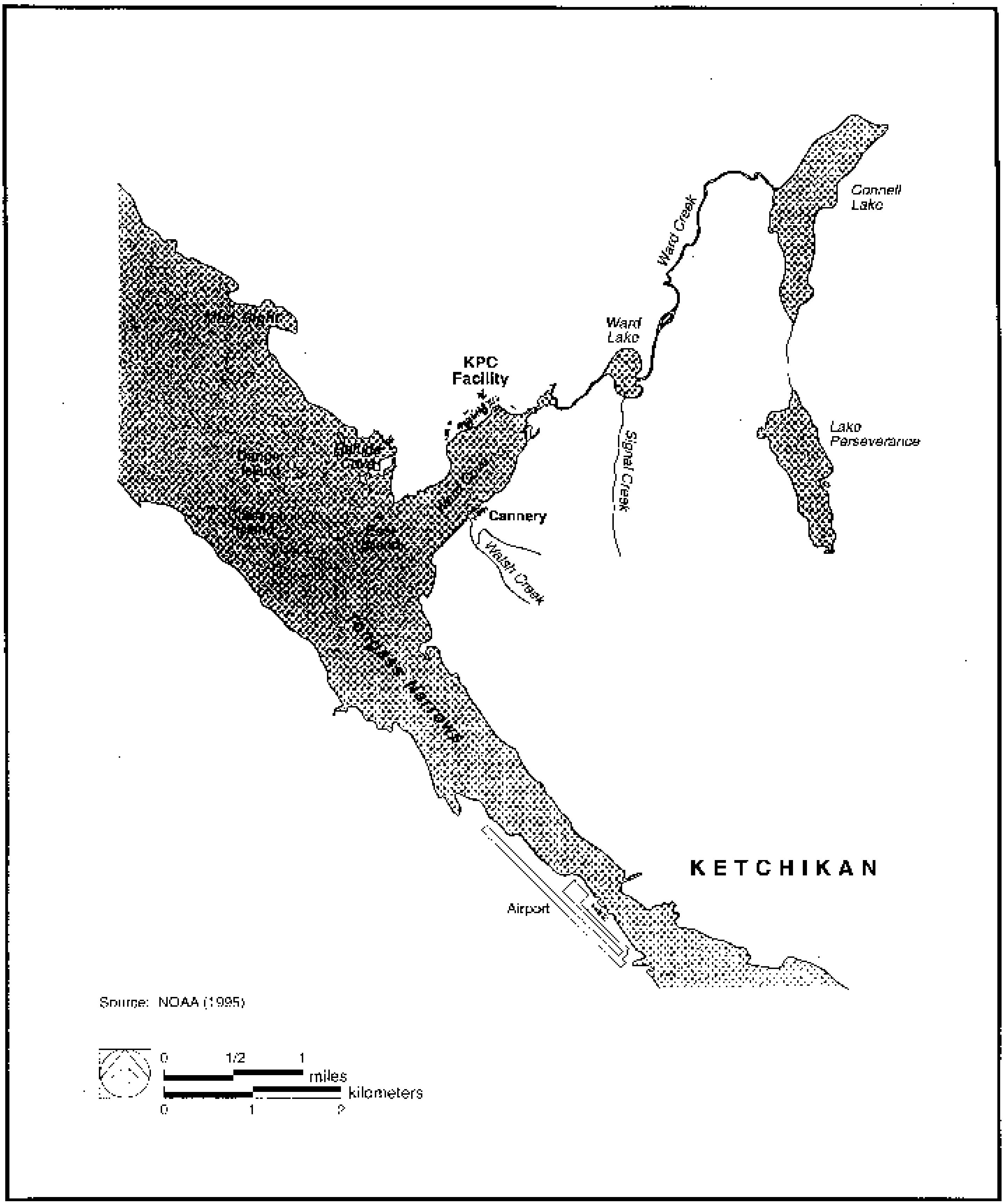


Figure 1. Location of Ward Cove and former KPC facility

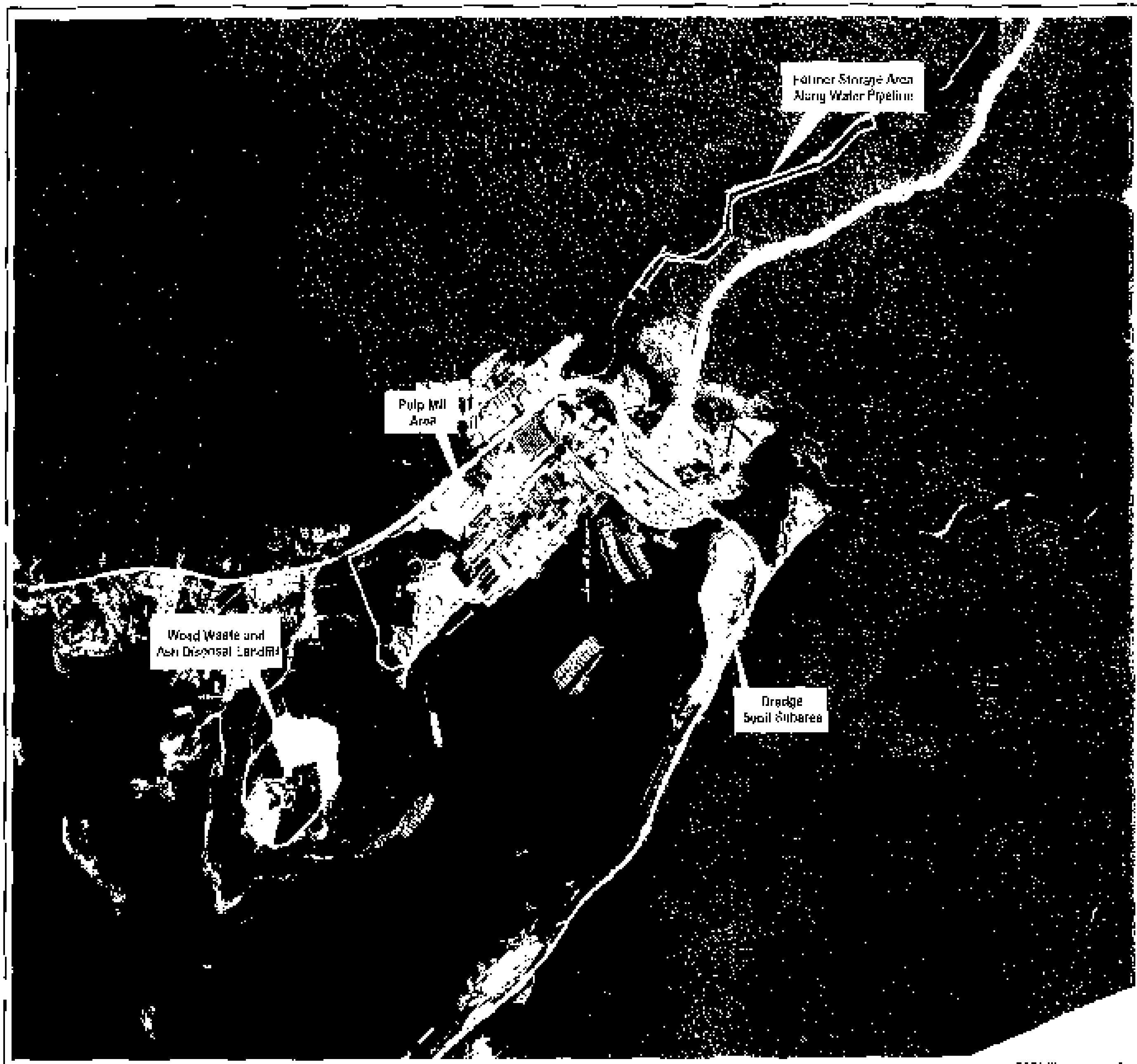


Figure [illegible]. Important features of the [illegible] operable unit

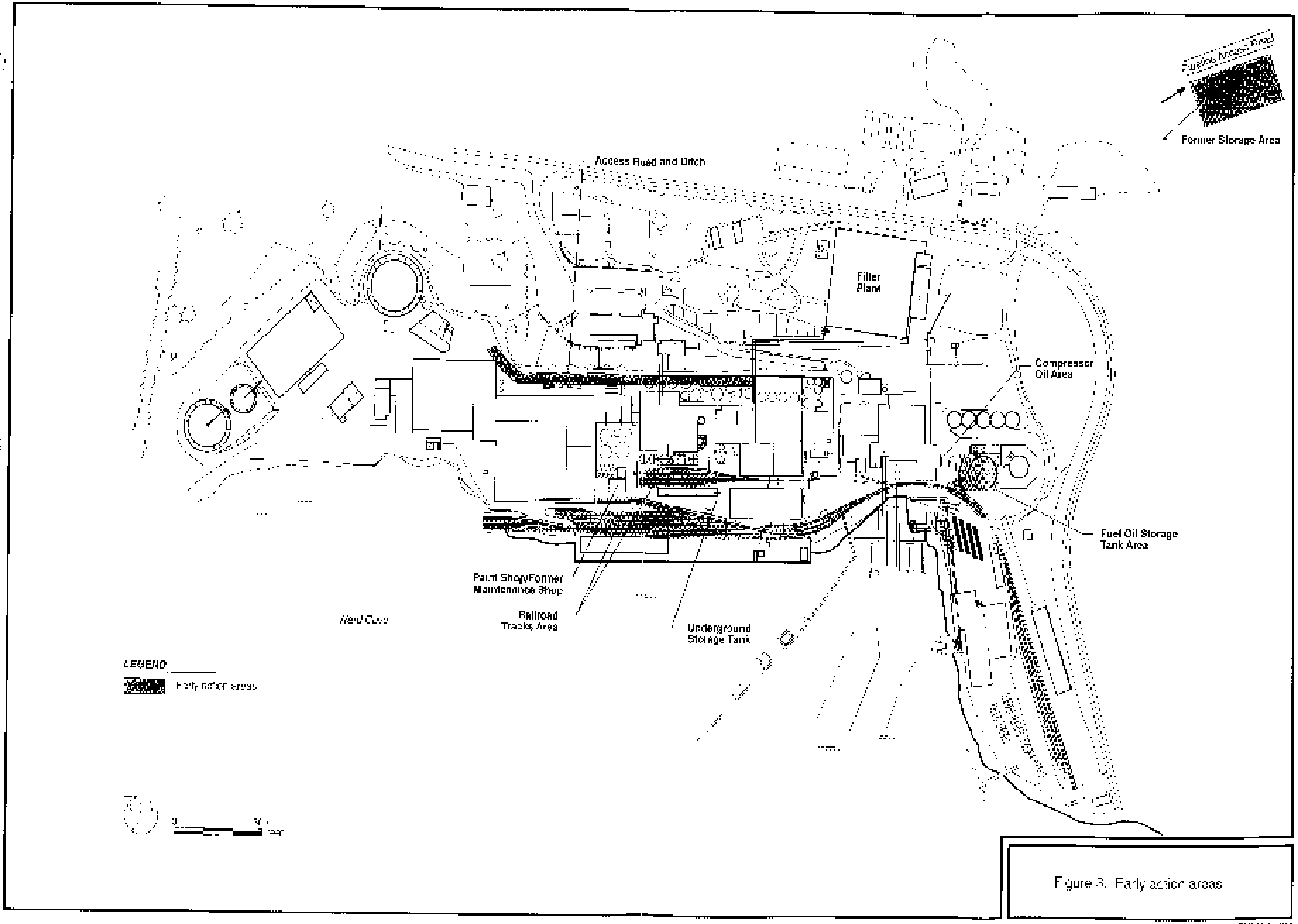


Figure 3. Early action areas

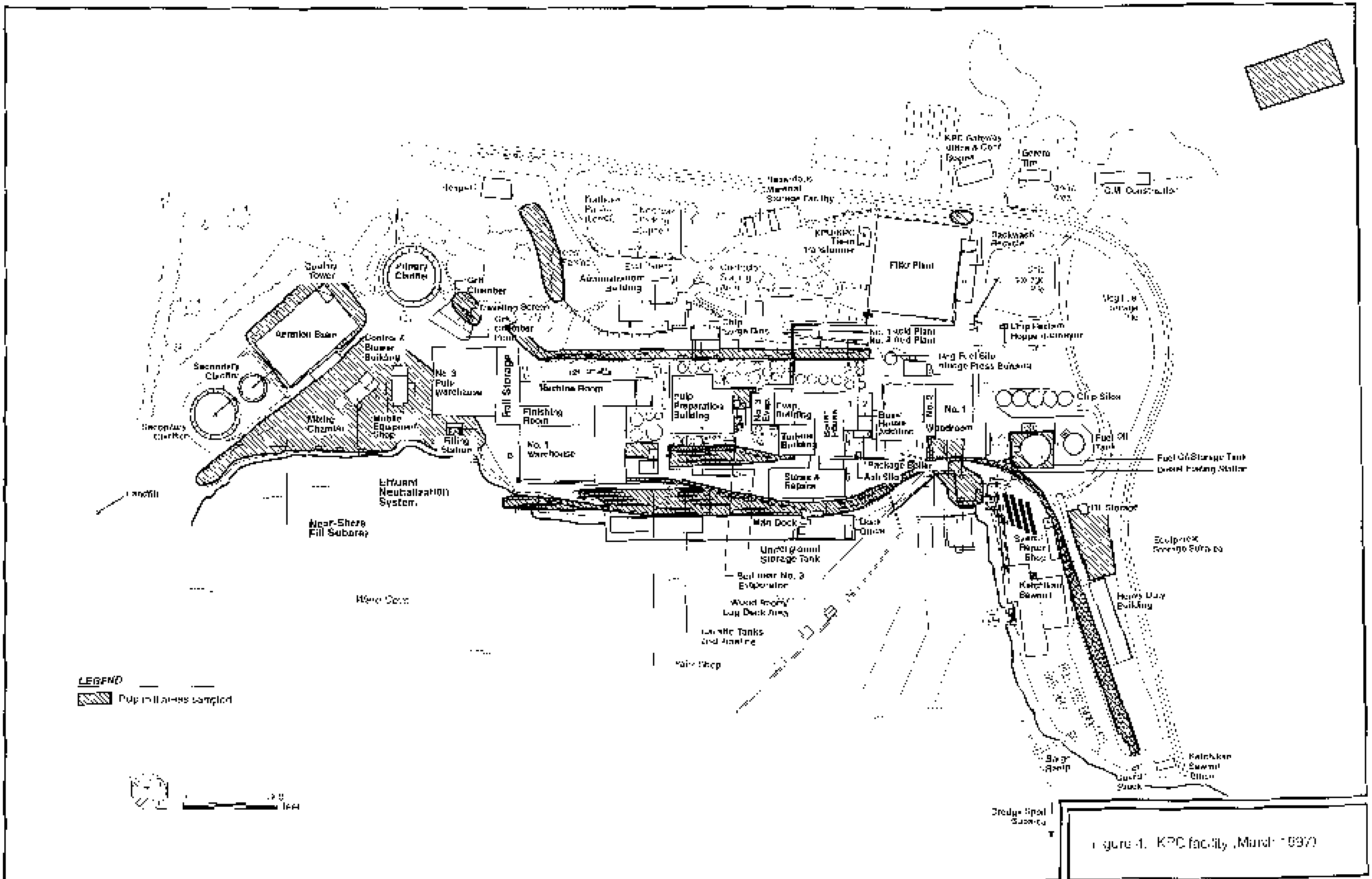


Figure 4. KPC facility (March 1997)

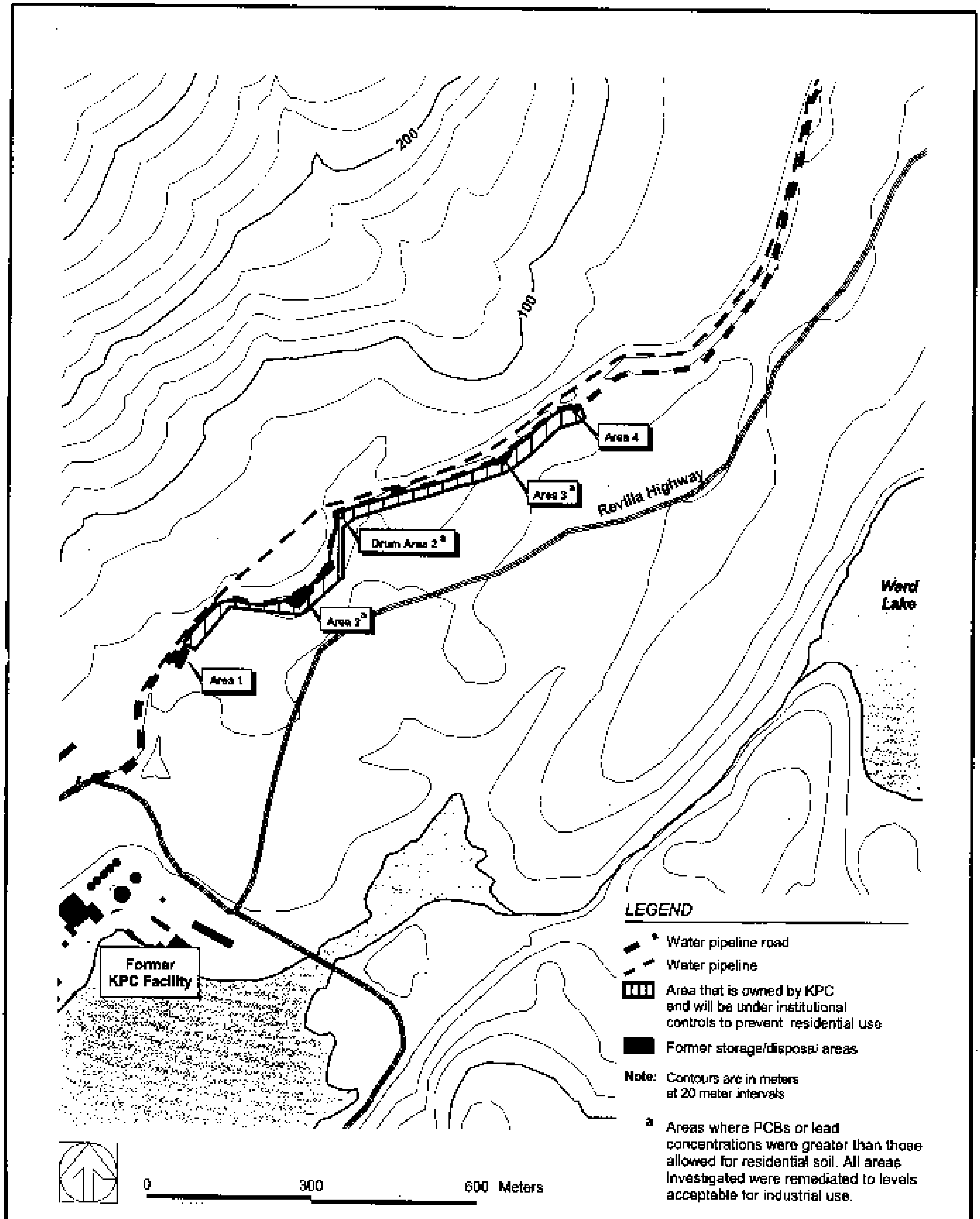


Figure 5. Water pipeline access road

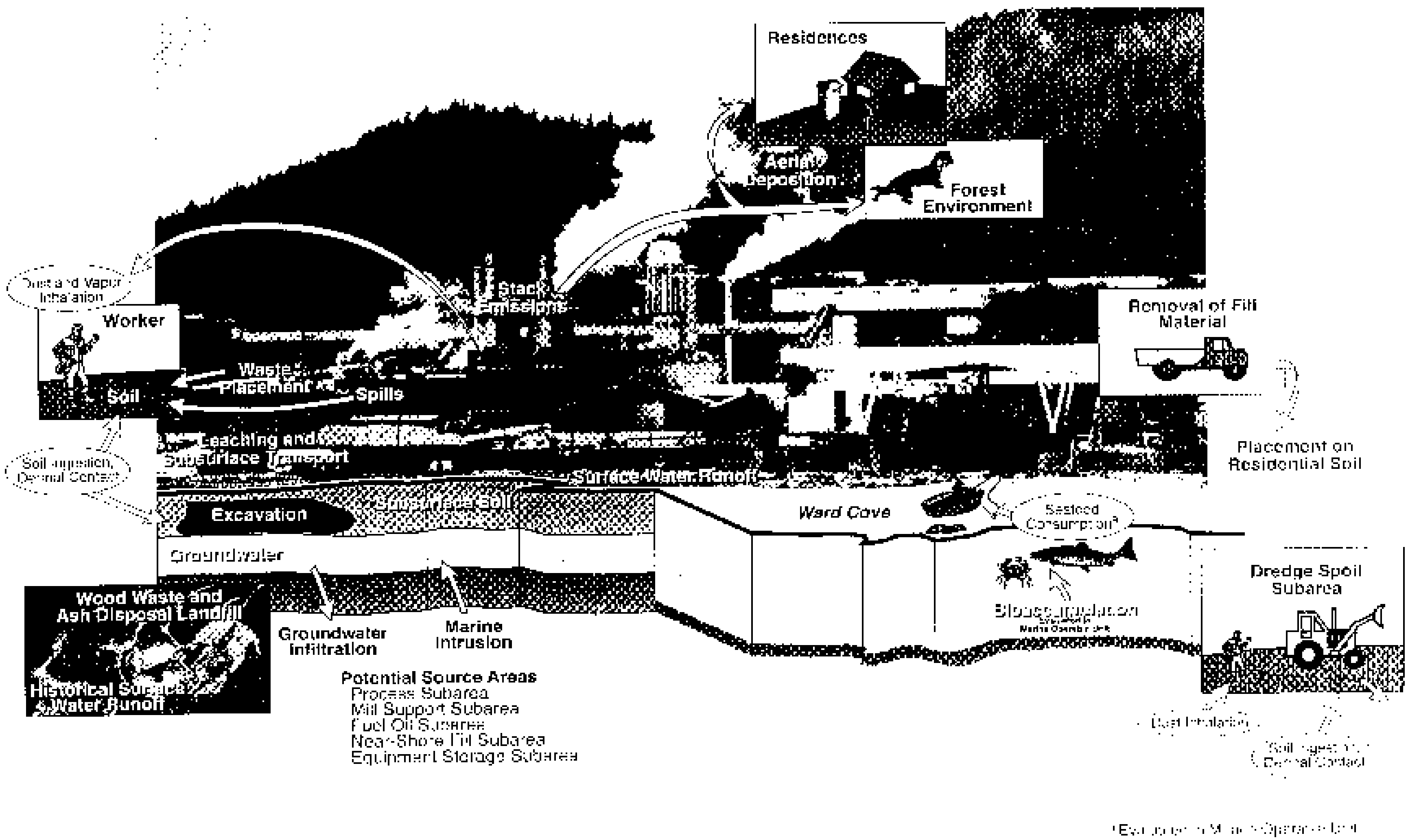


Figure 6. Overview of potential receptors and exposure pathways

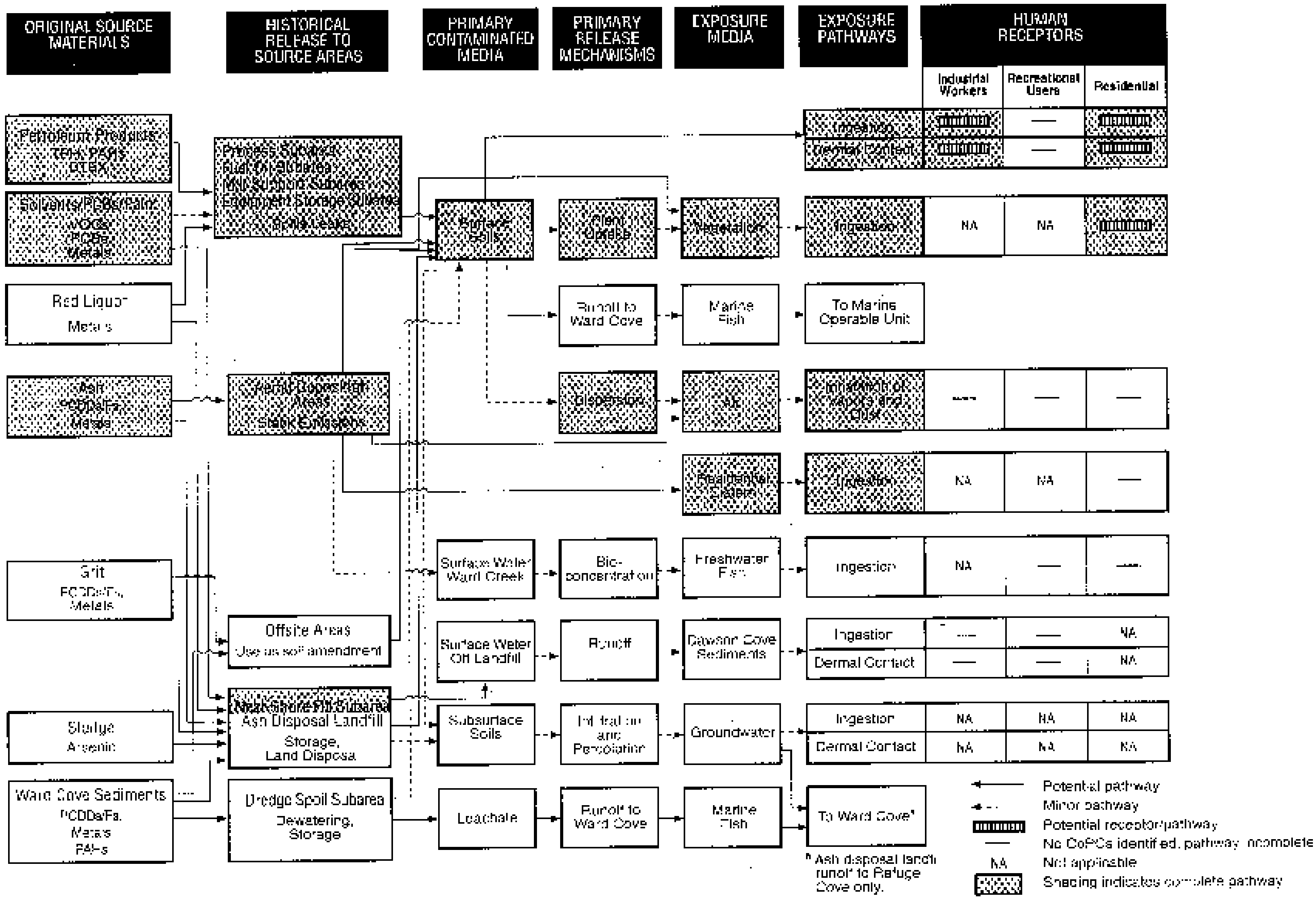
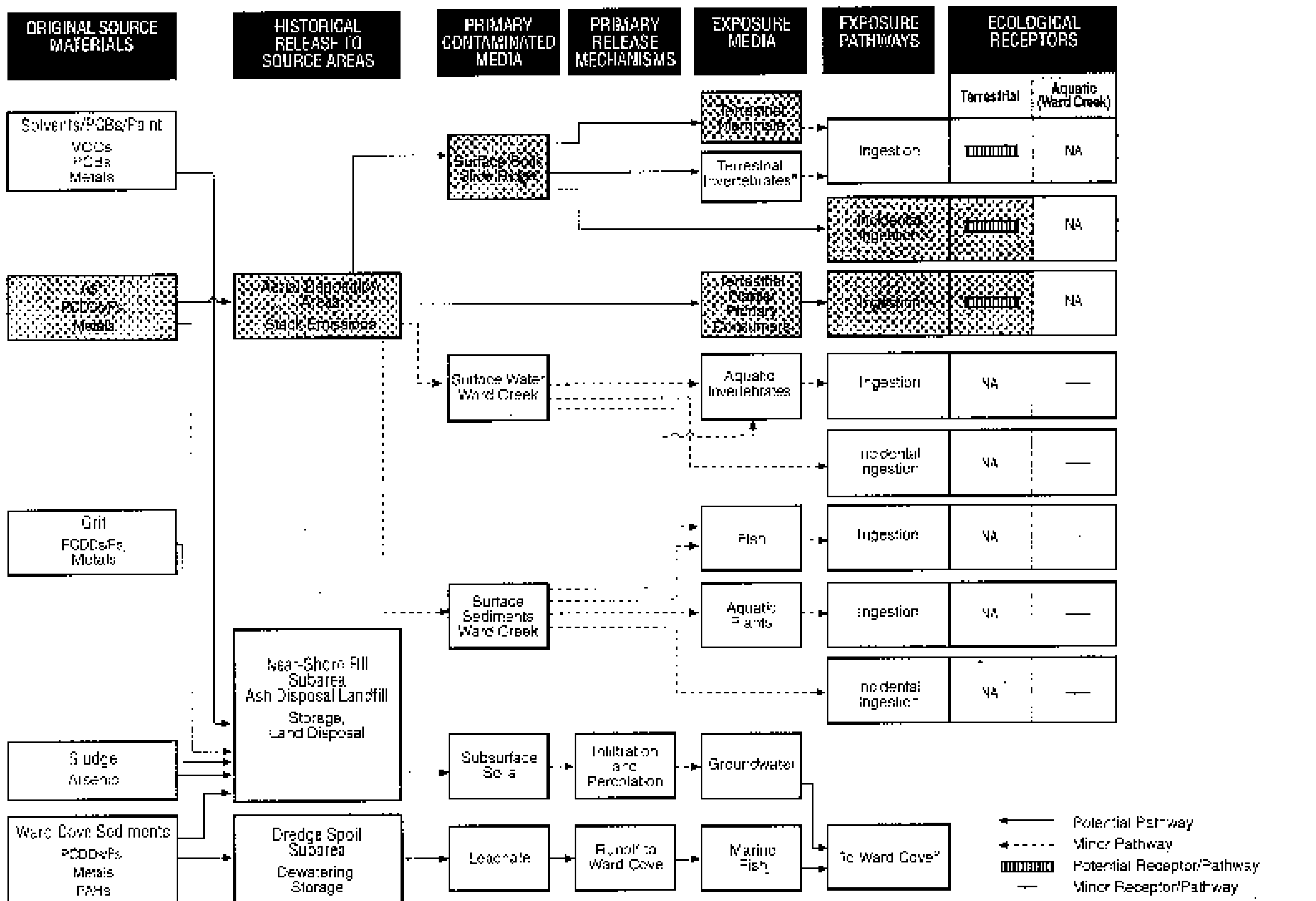


Figure 7. Conceptual model: human health



[a] No terrestrial macro invertebrates were identified during the sampling of Slide Ridge or in background forest soils conducted in 1997

[b] Ash disposal landfill runoff is primarily to Refuge Cove only

Figure 8. Conceptual model: ecological receptors

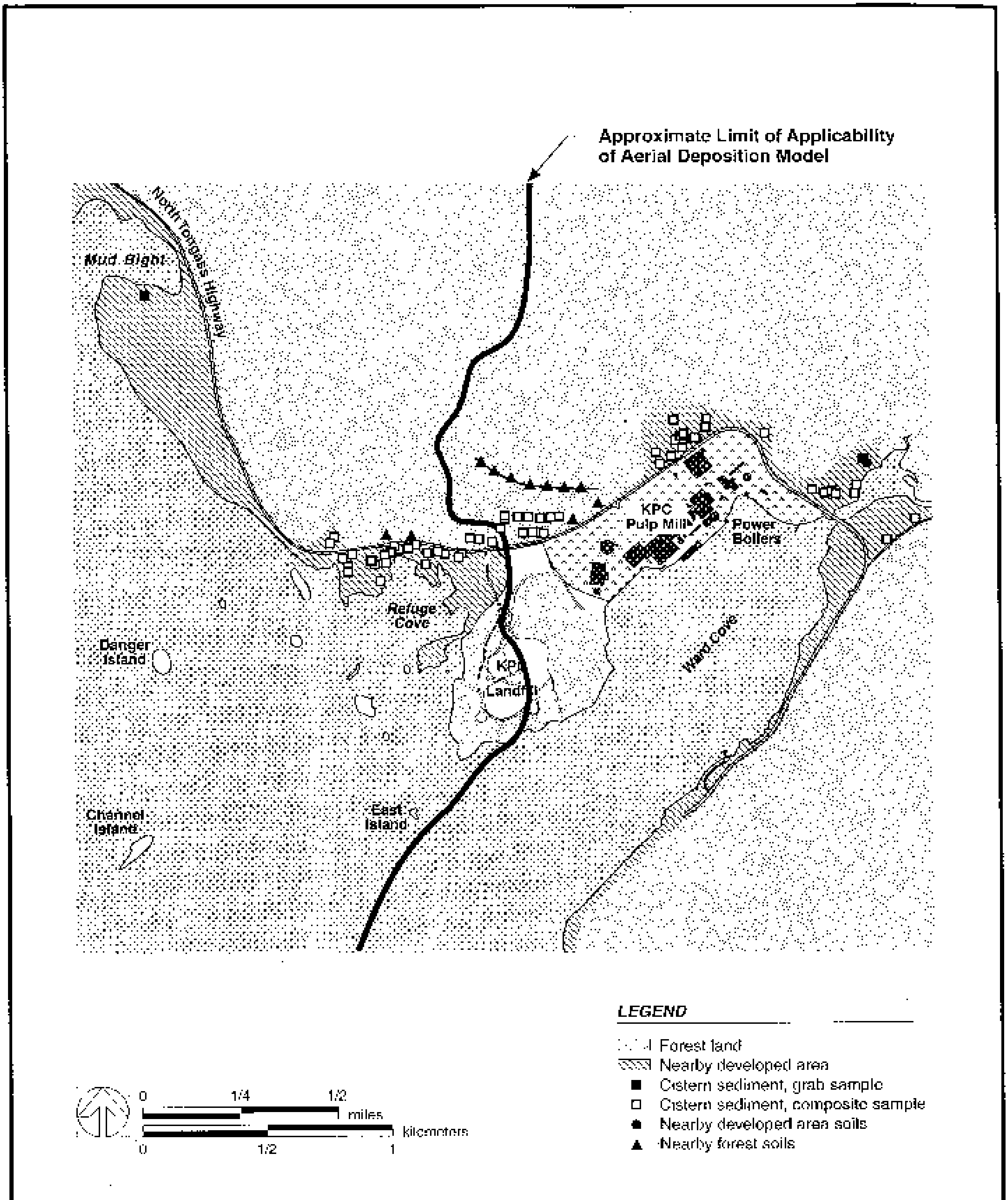
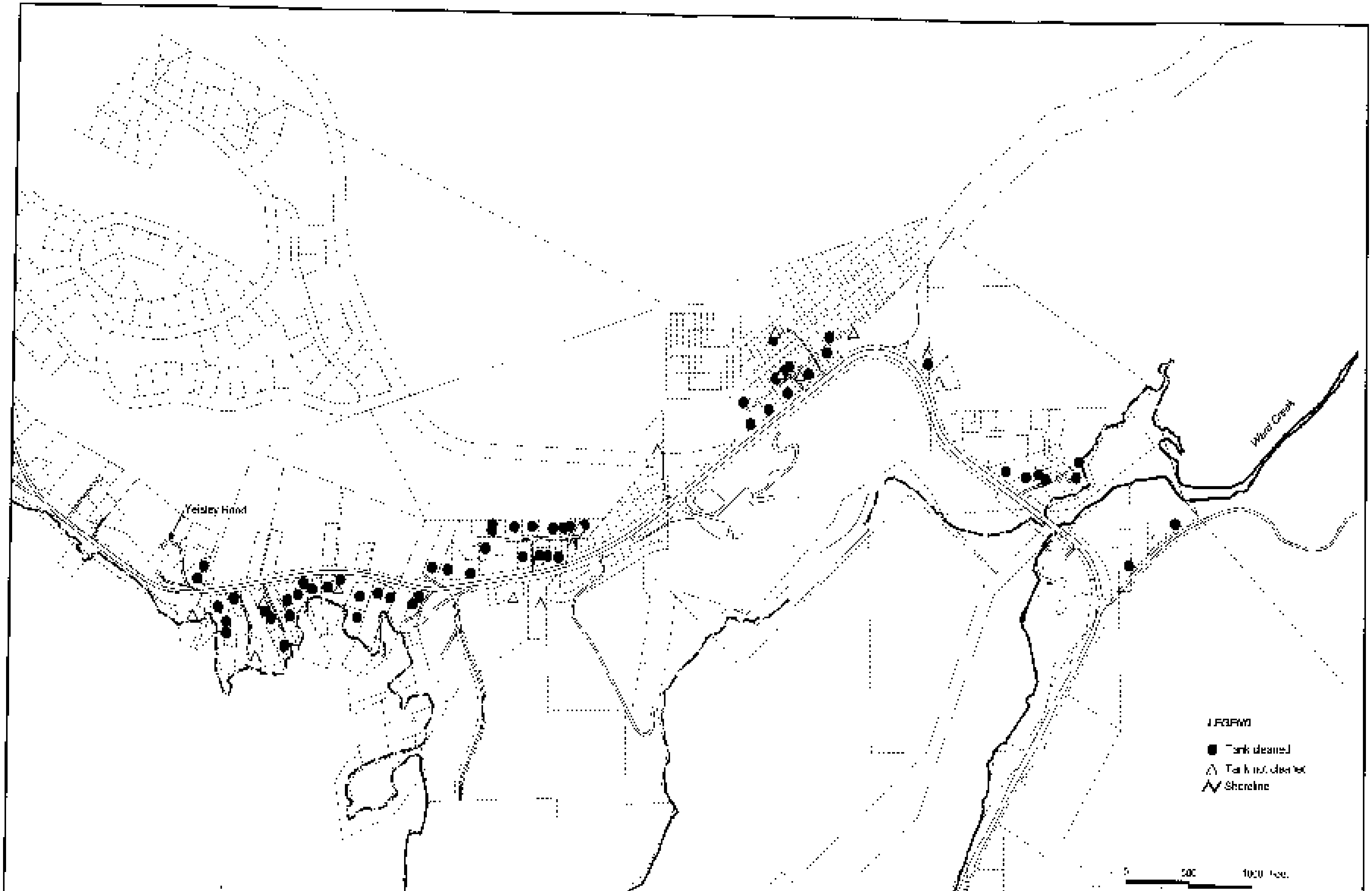


Figure 9. Cistern and soil sampling locations



Sources: Data on actions taken (Philip 1998)
Parcel, roads, and building footprint
data (City of Ketchikan 199_)

Figure 10. Location of residential and commercial cisterns near the former KPC facility

APPENDIX A

APPENDIX B

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ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS

(1) This Environmental Protection Easement and Declaration of Restrictive Covenants ("Easement and Covenant") is made this 28 day of Oct., 1999 by and between Ketchikan Pulp Company ("Grantor"), having an address of P.O. Box 6600, Ketchikan, Alaska, 99901, and the State of Alaska Department of Natural Resources ("Grantee") having an address of 3601 "C" Street, Suite 960, Anchorage, Alaska 99503, for use by the State of Alaska Department of Environmental Conservation (DEC), as represented by its State of Alaska Department of Law.

WITNESSETH:

(2) WHEREAS, Grantor is the owner of a parcel of land and tide and submerged lands located in the Ketchikan Gateway Borough, State of Alaska, more particularly described on **Exhibit A** attached hereto and made a part hereof ("the Property"); and

(3) WHEREAS, the U.S. Environmental Protection Agency (EPA) and the State of Alaska Department of Environmental Conservation (DEC) intend to select response actions for the Property in Records of Decision pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 *et seq*., AS 46.03.822, and/or pursuant to a consent decree dated September 19, 1995, filed under US. v. Ketchikan Pulp Company, No. A92-587-CV (D. Alaska);

(4) WHEREAS, the parties hereto agree (a) to grant a permanent right of access over the Property to the Grantee for purposes of implementing, facilitating and monitoring the response actions; and (b) to impose on the Property use restrictions as covenants that will run with the land for the purpose of protecting human health and the environment; and

(5) WHEREAS, Grantor wishes to cooperate fully with the Grantee and EPA in the implementation of all response actions at the Property;

NOW, THEREFORE:

(6) Grant: Grantor, for good and sufficient consideration received, does hereby covenant and declare that the Property shall be subject to the restrictions on use set forth below, and does give, grant and convey to the Grantee, and its assigns, (a) a right to enforce said use restrictions for the duration of this Easement and Covenant as established in Paragraph (9) below, and (b) an environmental protection easement of the nature and character, and for the purposes hereinafter set forth, with respect to the Property.

(7) Purpose: It is the purpose of this instrument to convey to the Grantee real property rights, which will run with the land, to facilitate tile remediation of past environmental contamination and to protect human health and the environment by reducing the risk of exposure to contaminants.

(8) Restrictions on use: The following covenants, conditions, and restrictions apply to the use of the Property, run with the land, and are binding on the Grantor:

(a) Uses of the Property are limited to commercial or industrial use.

(b) The Property shall not, at any time, be used, in whole or in part, for human habitation, schooling of children, hospital care, child care or any purpose necessitating around-the-clock residence by humans.

(c) Drilling of drinking water wells is prohibited.

(d) Use of ground water for drinking water is prohibited.

(e) Controls specified in the "Management Plan for Arsenic and Rock and Soil," prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock shall be complied with.

(f) Soils in the nearshore fill area or soils underneath paved areas or structures at the pulp mill site that are exposed in the future, e.g., as the result of excavation or demolition activities, shall be properly characterized and managed in accordance with applicable disposal requirements.

(g) Projects or activities that materially damage the cap applied to tide and submerged lands shall be required, at the direction of EPA, to redress such impacts, e.g., a dredging project that may erode or displace large portions of the cap will be required to repair or replace the cap.

(9) Modification of restrictions: The restrictions for the Property set forth in Paragraphs (8)(a) through (f) above shall exist until 2099, or until concentrations of the contaminants set forth in **Exhibit B** attached hereto no longer exceed site-specific, risk-based, residential cleanup levels, whichever comes first. The restriction set forth in

Paragraph (8)(g) above for tide and submerged lands shall exist until 2020 or until EPA determines that healthy benthic communities exist in the capped tide and submerged lands, whichever comes earlier. The above restrictions may be terminated in whole or in part, in writing, by the Grantee. If requested by the Grantor, such writing will be executed by Grantee in recordable form.

(10) Environmental Protection Easement: Grantor hereby grants to the Grantee an irrevocable and continuing right of access under the terms and conditions of this instrument at all reasonable times to the Property for purposes of implementing the following activities pursuant to CERCLA, AS 46.03.822, or the above-referenced consent decree. Grantee, in its sole discretion, may relinquish this easement for right of access. Grantee may designate EPA as its authorized representative for the following activities:

(a) Implementing response actions for the Property selected by EPA and/or DEC in Records of Decision.

(b) Verifying any data or information submitted to EPA or the Grantee by the Grantor.

(c) Verifying that no action is being taken on the Property in violation of the terms of this instrument, CERCLA, AS 46.03.822, or the above-referenced consent decree.

(d) Monitoring response actions on the Property including, without limitation, sampling of air, water, sediments, soils, and specifically, without limitation, obtaining split or duplicate samples.

(e) Conducting periodic reviews of any response action(s) selected by EPA and/or DEC, including but not limited to, reviews required by applicable statutes and/or regulations.

(f) Assessing the need for and implementing additional or now response actions authorized. under CERCLA, AS 46.03.822, or the above-referenced consent decree.

(11) Reserve rights of Grantor: Grantor hereby reserves unto itself, its successors, and assigns, all rights and privileges in and to the use of the Property which are not contrary to the restrictions, rights and casements granted herein.

(12) Other Authorities. Nothing in this document shall limit or otherwise affect the State of Alaska's or EPA's rights of entry and access or their authority to take response actions under CERCLA, the National Contingency Plan (NCP), or other federal or state law.

(13) No Public Access and Use: No right of access or use by the general public to any portion of the Property is conveyed or authorized by this instrument nor are any such existing rights affected by this instrument.

(14) Notice requirement: Grantor agrees to include in any instrument conveying any interest in any portion of the Property, including but not limited to deeds, leases and mortgages, a notice which is in substantially the following form:

NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS, DATED ______, 19__, RECORDED IN THE KETCHIKAN RECORDING DISTRICT, FIRST JUDICIAL DISTRICT, STATE OF ALASKA, ON ______, 19__, IN BOOK ___, PAGE ___ THAT IS IN FAVOR OF, AND ENFORCEABLE BY, THE STATE OF ALASKA.

Within thirty (30) days of the date any such instrument. of conveyance is executed, Grantor must provide Grantee with a certified true copy of said instrument and, if it has been recorded in the public land records, its recording reference.

(15) Administrative jurisdiction: The interests conveyed to the State of Alaska by this instrument are to its Department of Natural Resources, for administration by its Department of Environmental Conservation.

(16) Enforcement: The Grantee shall be entitled to enforce the terms of this instrument by resort to specific performance or legal process without regard to the existence or nonexistence of any dominant estate. Grantee or its authorized representative shall be entitled to enforce the rights of access set forth in Paragraph (10) above. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA and AS 46.03.822. Enforcement of the terms of this instrument shall be at the discretion of the Grantee; any forbearance, delay or omission to exercise its rights under this instrument in the event of a breach of any term of this instrument shall not be deemed to be a waiver by the Grantee of such term or of any subsequent breach of the same or any other term, or of any of the rights of the Grantee under this instrument.

(17) Damages: Grantee shall be entitled to recover damages for violations of the terms of this instrument,

(18) Waiver of certain defenses: Grantor hereby waives any defense of laches, estoppel, or prescription.

(19) Notices: Unless and until changed by Grantor or Grantee, any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Grantor:

Ketchikan Pulp Company
Attn: President and General Manager
c/o Louisiana-Pacific Corp.
111 SW 5th Avenue
Portland, Oregon 97204

To Grantee:

State of Alaska
Department of Natural Resources
Division of Mining, Land and Water
Realty Services Section
3601 "C" Street, Suite 960
Anchorage, Alaska 99503

AND

State of Alaska
Department of Environmental Conservation
Spill Prevention & Response
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

(20) General provisions:

(a) Controlling law: The interpretation and performance of this instrument shall be governed by the laws of the United States and the State of Alaska,

(b) Liberal construction: Any general rule of construction to the contrary notwithstanding, this instrument shall be liberally construed in favor of the Grant of this instrument to effect the purpose of this instrument and policy and purpose of CERCLA, the above-referenced consent decree, and applicable state law. If any provision of this instrument is found to be ambiguous, an interpretation consistent with the purpose of this instrument that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability: If any provision of this instrument or the application of it to any person or circumstance, is found to be invalid, the remainder of the provisions of this instrument, or the application of such provisions to persons or circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

(d) Entire Agreement: This instrument sets forth the entire agreement of the parties with respect to rights and restrictions created hereby, and supersedes all prior discussions, negotiations, understandings, or agreements relating thereto, all of which are merged herein.

(e) No Forfeiture: Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors: The covenants, terms, conditions, and restrictions of this instrument shall be binding upon, and inure to the benefit of, the parties hereto and their respective personal representatives, heirs, successors, and assigns and shall continue as a servitude held by Grantee in gross without regard to the existence or absence of privity of estate with Grantor or its successors or assigns, and shall run with the Property for the duration of this Easement and Covenant as established in Paragraph (9) above. The term "Grantor", wherever used herein, and any pronouns used in place thereof, shall include the persons and/or entities named at the beginning of this document, identified as "Grantor" and their personal representatives heirs, successors, and assigns. The term "Grantee", wherever used herein, and any pronouns used in place thereof, shall include the persons and/or entities named at the beginning of this document identified as "Grantee" and their personal representatives, heirs, successors, and assigns. The rights of the Grantor under this instrument are freely assignable. The rights of the Grantee under this instrument are freely assignable to governmental bodies, subject to the notice provisions hereof. The term "EPA" shall include any successor agencies of EPA.

(g) Termination of Rights and Obligations: Grantor's rights and obligations under this instrument terminate upon transfer of the party's interest in the Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Captions: The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon construction or interpretation.

(i) Counterparts: The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling, TO HAVE AND TO HOLD unto the State of Alaska and its assigns

forever.

IN WITNESS WHEREOF, Grantor has caused this Agreement to be signed in its name.

Executed this 28 Day of Oct., 1999.

By: [signature]
Chris Paulson
Its: President & General Manager
Ketchikan Pulp Company

STATE OF ALASKA)
: ss
FIRST JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 28th day of Oct., 1999, at ~~Juneau~~ Ketchikan, Alaska, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared Chris Paulson, known to me and known to me to be the person he represents himself to be, and the same identical person who executed the above and foregoing document regarding an Environmental Protection Easement and Declaration of Restrictive Covenants, and who acknowledged to me that he executed the same freely and voluntarily for the purposes and uses herein mentioned.

WITNESS my hand and official seal the day, month and year in this certificate first written above.

NOTARY PUBLIC STATE OF ALASKA

[signature]
Notary Public, State of Alaska
My Commission Expires: 9-14-2002

This easement and declaration is accepted this 27 day of October, 19 99.

STATE OF ALASKA DEPARTMENT
OF NATURAL RESOURCES

By: [signature]

SE Regional Manager

STATE OF ALASKA)
:SS
FIRST JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 27 day of Oct, 1999, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn as such, personally appeared [signature], known to me and to me known to be the SE Regional Mgr, and he/she acknowledged to me that he/she signed as accepting the foregoing Environmental Protection Easement and Declaration of Restrictive Covenants, granting to the State of Alaska, those lands described therein, and he/she executed the foregoing instrument freely and voluntarily.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year first written above.

(SEAL) SHARON FREEMAN NOTARY PUBLIC STATE OF ALASKA

[signature]
Notary Public in and for the State of Alaska
My commission expires 5/24/03

AFTER RECORDING PLEASE RETURN ORIGINALS TO:

Carol Shobe, Chief
Realty Services Section
State of Alaska, Department of Natural Resources
Division of Mining, Land and Water
3601 "C" Street, Suite 960
Anchorage Alaska 99503

Location Index:
Sections 33 and 34, T. 74 S., R 90 E., CRM
Sections 3 and 4, T., 75 S., 90 E., CRM

STATE BUSINESS, NO CHARGE

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EXHIBIT A
To The Environmental Protection Easement
And Declaration of Restrictive Covenants

Description of "the Property"

PARCEL NO. l:

ALASKA TIDELANDS SURVEY NO. 1 (CR 74S 90E), according to the recorded plat thereof, (mistakenly recorded in the Juneau Recording District as Plat No. 292), Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: That portion thereof taken by the State of Alaska, Department of Transportation and Public Facilities by that certain Declaration of Taking (filed under Ketchikan Superior Court Case No. 1KE-87-444 CI) recorded May 28, 1987 in Book 149 at Page 625.

PARCEL NO. 2:

U.S. Survey 1056, accepted by the General Land Office, in Juneau, Alaska on January 24, 1919, and located within the Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: Those portions of U.S. Survey 1056 situated upland (North) of the north Right-of-way line of the North Tongass Highway;

Excepting therefrom: That certain portion thereof conveyed to Eugene Wacker and Lillian Wacker, his wife by Warranty Deed recorded January 27, 1950 in Volume "W" of Deeds at Page 614;

Also excepting therefrom: That certain portion conveyed to The United States of America by Right-of-way Deed recorded April 28, 1949 in Volume "W" of Deeds at Page 397.

PARCEL NO. 13:

Lots 1-7, inclusive, Block 1, Lots 1-6, inclusive, Block 2, Lots 1-4, inclusive, Block 3 and Lots 1-16, inclusive Block

4, and the Unsubdivided Remainder, according to the subdivision plat of U.S. Survey 1754 recorded March 8, 1956 in Volume 1 of Plats at Packet 20, Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: Those portions of U.S. Survey 1754 situated upland (North) of the North Tongass Highway.

PARCEL NO. 15:

That portion of U.S. Survey 1862, according to the plat of survey approved by the Department of the Interior, General Land office in Washington, D.C., on January 20, 1931 and located within the Ketchikan Recording District, First Judicial District, State of Alaska, more particularly described as follows: Beginning at U.S. Location Monument No. 2; thence North 32 degrees 27 minutes West a distance of 155.5 feet to Corner No. 1 of U.S. Survey 1862 and the true point of beginning of the portion herein described; thence North 0 degrees 25 minutes West a distance of 515 feet, more or less, to a point on the South Right of Way line of North Tongass Highway, which point is 50 feet from the center line of said highway and at right angles to Engineers Station 299+50; thence along that portion of a spiral curve to the left whose chord bears South 24 degrees 30 minutes East a distance of 114.65 feet; thence along the arc of a 527.46 foot radius curve the long chord of which bears South,36 degrees 35 minutes East a distance of 126.14 feet; thence along a spiral curve whose chord bears South 51 degrees 21 minutes East a distance of 210.05 feet; thence South 55 degrees 27 minutes East a distance of 316.97 feet; thence South 34 degrees 33 minutes West a distance of 50 feet; thence South 55 degrees 27 minutes East a distance of 137.00 feet; thence South 88 degrees 00 minutes West a distance of 535 feet more or less along Meander Line No. 11 of U.S. survey 1862; thence North 29 degrees 30 minutes West a distance of 155.5O feet along Meander Line No. 12 of U.S. Survey 1862 to Corner No. 1, which is the point of beginning;

ALSO: That portion of U.S. Survey 1862 lying with the North Tongass Highway Right of Way as created by a deed dated April 1, 1949 and recorded in Volume “W” of Deeds at Page 362, Ketchikan Recording District, First Judicial District, State of Alaska, and as conveyed to Ketchikan Pulp Company by Quitclaim Deed recorded July 27, 1988 in Book 158 at Page 588.

Excepting therefrom: Those portions of U.S. Survey 1862 situated upland (north) of the north Right-of-way line of the North Tongass Highway.

Exhibit B to Environmental Protection Easement
and Declaration of Restrictive Covenants

Contaminants of Concern

Arsenic
Dioxin
Lead
Petroleum
Polycyclic aromatic hydrocarbons (benz(a)anthracene, benzo(b)fluroanthene, benzo(a)pyrene, and dibenz(ah)anthracene)
Polychlorinated biphenyls