

ALASKA LEGISLATURE COMMITTEES 1971-1972 00/2

9269 HOUSE LABOR & COMMERCE

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Wastewater Discharge and Treatment Processes

The Red Dog Mine is the largest operating lead/zinc mine in the western world, shipping approximately 750,000 tons of concentrate annually. Developed and operated by Cominco Alaska Inc., the mine is located on Red Dog Creek. The mill complex includes water treatment facilities, a power plant, fuel storage and distribution facilities, maintenance and warehouse facilities, including a concentrate storage facility, and worker housing accommodations, as well as the facilities integral to the milling process. (Figure 2 - Red Dog Mine Layout)

The project involves a selective flotation milling process to concentrate valuable minerals. The process includes three major steps: size reduction, selective mineral concentration and moisture reduction of the concentrates. During the milling process, zinc, lead and other minerals are separated as metal sulfide concentrates, while the residual tailings slurry containing waste rock is directed to the tailings impoundment. Following separation of the ore minerals from the waste rock, the metal concentrates are dewatered by filtration. Concentrates are trucked to the port facilities where they are stored in a concentrate storage building until shipped to smelters outside Alaska.³⁰

Excess water from the mill process, other wastewater sources, and site runoff accumulate in the tailings impoundment. By federal law, only water from precipitation in excess of evaporation can be discharged, and it must meet federal water quality criteria for metals. All discharged water is drawn from the tailings impoundment and passed through a chemical treatment process and sand filters to reduce metals and other contaminants.¹ The treated wastewater is then discharged to Red Dog Creek.

Mine Water Management System⁷

Overburden removal from the Red Dog ore body began during the summer of 1989. In late fall, 1989 and again in the spring of 1990, the ADEC received reports of orange staining in Red Dog and Ikalukrok Creeks. The source was determined to be seeps into Red Dog Creek at the base of the ore body. These seeps involved both surface water runoff and ground water flow into the creek. Drill holes into the ore body showed evidence of permafrost degradation.

Water samples taken during 1990 showed metals concentrations far in excess of those recorded during the years before the ore body was opened in 1989.⁷ In August, 1990, the ADEC and Cominco signed a Compliance Order by Consent for violations of the Alaska Water Quality Standards resulting from mining development and operation at the Red Dog Mine.

In order to assure that water quality in the Wulik River drainage returned to pre-mining conditions, the order required that water quality and fish tissue monitoring studies be done during the ensuing winter, that Cominco take the immediate remedial action of pumping the seeps along Red Dog Creek to the wastewater treatment facility, and that Cominco implement an approved plan to halt and prevent the introduction of additional metals into the Creek which exceed historic naturally occurring concentrations.

Mine Water Management System (cont.)

This plan, called the Mine Water Management System, was implemented in 1991. It consists of a lined conduit, in Middle Fork Red Dog Creek, to move waters uncontaminated by metals around the Red Dog ore body, and a parallel collection ditch with a dam/sump system to collect surface and groundwater mine drainage contaminated with heavy metals. The contaminated water which collects in the sump upstream of the dam is pumped to the tailings impoundment for subsequent treatment at the wastewater treatment facility.

Water quality monitoring reports since spring 1992 appear to show that the metals concentrations in Red Dog Creek, Ikalukrok Creek and the Wulik River have returned to levels observed prior to opening the ore body.⁷

Since 1991, ADEC has been working with resource agencies, local organizations, and Cominco to ensure that the protected water uses of the Wulik watershed are maintained. In 1995, ADEC issued a Water Quality Certification¹ for the Red Dog Mine treated wastewater discharge. Although this certification was rescinded in 1996 (the USEPA is in the process of developing its new National Pollution Discharge Elimination System (NPDES) permit), the intensive monitoring program, including effluent and receiving water sampling and analysis on a regular basis, continues. Annually the ADEC verifies Cominco's water quality data by taking samples alongside Cominco staff. The ADF&G publishes an annual report describing the health of the fishery, based on field and laboratory observations.^{25,26,27 & 34}

Approach to Draft Use Attainability Analysis - Document Development

Cominco originally submitted its reclassification request to ADEC in December, 1994.¹⁰ The ADEC was able to begin processing this request in September, 1995. Since November, 1995, the ADEC, the ADF&G, and Cominco have met regularly to discuss existing data, data needs and issues related to reclassification. The USEPA has participated in some of these meetings in an advisory capacity, in order to help interpret the federal regulations and requirements.

These meetings resulted in a phased approach to addressing Cominco's original reclassification request, which was agreed to by all parties in March, 1996. The use removals requested, creek sections and phases are shown in Table 1 and Figure 3.

Phase One, for which this UAA has been developed, addresses only those original reclassification requests for which there are adequate scientific data available for the State of Alaska to make a decision. All water quality data referenced in this document are pre-mining; that is, prior to 1989 when ore body mining disturbance began. An exception is the 1995 and 1996 data collected at tributaries to Middle Fork Red Dog Creek: Rachael, Hilltop, Shelly, Connie and Sulfur Creeks. These data are appropriate to include in the reclassification discussion because these tributaries have not been affected by mining activities. A summary of these data can be found in Tables 2 and 3. A complete compilation of these water quality data is found in the ADF&G Aquatic Life Component.³⁵ ADEC believes that the water quality, based on data collected in the early 1980's, is essentially equivalent to water quality conditions that

Approach to Draft Use Attainability Analysis - Document Development (cont.)

existed as of November 28, 1975. Support for this assumption is found in Charlotte MacCay's letter to Joyce Beelman, March 3, 1996. (Appendix C)

Phase Two includes those original reclassification requests for which additional environmental information is needed. Before ADEC begins Phase Two, additional water quality and biological information will be collected and analyzed, according to a study plan developed by ADEC, ADF&G and Cominco, and approved by ADEC (Appendix D).

Since November, 1995, the resource agencies and Cominco have been examining the possibility of a site specific criterion for total dissolved solids (TDS), which Cominco requested in its letter to ADEC dated April 19, 1995. TDS as calcium sulfate or gypsum(lime), is one of the components of the mine's treated waste water discharge. Cominco must add lime to the wastewater treatment process to remove metals prior to wastewater discharge. This exchange results in higher than natural TDS as calcium sulfate or gypsum in the discharge. The resource agencies and Cominco determined that inadequate information exists at this time to determine if this TDS causes any adverse affects on aquatic life downstream. Additional information is needed, particularly regarding affects on fish eggs, aquatic invertebrates and plants. Studies will be performed during 1996, according to a study plan agreed to by ADEC, ADF&G, USEPA and Cominco. Although the site specific criterion request will not be formally addressed by ADEC in 1996, it is considered an important upcoming issue and was discussed at the Phase One reclassification public workshops and meetings in Kivalina, Noatak, Kotzebue and Juneau, in April and May, 1996.

The following matrix, identifies the reclassification requests being addressed at this time (Phase One), as well as those to be addressed after additional water quality and biological information is available (Phase Two). Cominco and ADEC agreed to this phased approach on March 7, 1996.

TABLE 1

RED DOG & IKALUKROK CREEKS RECLASSIFICATION REQUEST MATRIX
18 AAC 70.20 PROTECTED WATER USE CLASSES

CREEK	WATER SUPPLY (a)(1)(A)				WATER RECREATION (a)(1)(B)		
	(i)	(ii)	(iii)	(iv)	(i)	(ii)	AQUATIC LIFE (a)(1)(C)
	DRINKING WATER	AGRICULTURE	AQUACULTURE	INDUSTRIAL	CONTACT RECREATION	SECONDARY RECREATION	
<u>PHASE ONE</u>							
<i>RDC = Red Dog Creek</i>							
MIDDLE FORK RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
SULFUR CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
SHELLY CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
CONNIE CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	Retain
RACHAEL CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
HILLTOP CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
MAIN STEM RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	Retain
IKALUKROK -							
RDC to Sta.73	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
Sta.73 to Sta.7	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
Sta 7 to confl.w/WulikR.	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
<u>PHASE TWO</u>							
NORTH FORK RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
IKALUKROK (Above confl.w Red Dog Creek)	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain

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Discussion of Uses

A. 18 AAC 70.020(a)(1)(A)(i), Water Supply, drinking, culinary and food processing -

Note: A federal Use Attainability Analysis is required to remove "fishable, swimmable" uses, but is not required to remove Water Supply uses. However, the Department is addressing Cominco's request through the UAA format in order to justify its recommendations to retain or remove these uses in state regulation.

1. **Cominco's Request:** Cominco requests removal of the Water Supply (drinking water, culinary, and food processing) from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Connie, Shelly and Sulfur Creeks, Main Stem Red Dog Creek, and Ikalukrok Creeks from its confluence with Red Dog Creek to its confluence with the Wulik River.

2. Is Water Supply for drinking, culinary and food processing an existing or probable use in the future ?

Water Supply is defined in 18 AAC 70.990 (60), DEFINITIONS as " ...any of the waters of the state that are designated in this chapter to be protected for fresh water or marine water uses, including waters used for drinking, culinary, food processing, agricultural, aquacultural, seafood processing and industrial purposes; "water supply" does not mean that a water body, protected as a supply for the uses listed in this paragraph, is safe to drink in its natural state. " ²

State regulations separate public drinking water supply systems into Class A (serving 25 or more residents at least 6 months...), Class B (serving at least 25 persons for 60 days per year...), or Class C (neither a Class A or B public water system, nor a private water system).³ There are no Class A, B or C public drinking water systems on Red Dog or Ikalukrok Creeks.¹⁵

a. **Water Supply for drinking water, culinary and food processing is not an existing use.**

The first documented drinking water use¹⁷ is downstream on the Wulik River, at Driver's Camp, downstream of Station 2. (Figure 3) The next downstream documented drinking water use¹⁷ is at the village of Kivalina, on the Wulik River, 54 miles downstream from the ore body outcrop. The village of Kivalina receives its drinking water supply from the Wulik River by infiltration gallery and fills its water supply tank once a year in late June or early July, when river water quality and flows are still high following spring breakup. Because of the timing of filling this tank, water quality samples taken from the water tank have always shown that this water is safe to drink and meets all drinking water requirements. The ADEC recommends that Kivalina's water supply be tested each year for metals to ensure that the village water supply continues to meet drinking water standards.

Discussions of Uses (cont.)

b. Water Supply for drinking water, culinary and food processing is not a probable use in the future.

Residential Use-

The nearest downstream village, Kivalina, at the mouth of the Wulik River on the Chukchi Sea, is approximately 54 miles away. Due to the remoteness of the Red Dog and Ikalukrok Creek areas under consideration for reclassification, the high mineralization of these waters and the poor fishing, it is unlikely that large residential settlements will occur on or near these waterbodies.

Industrial Use-

Mining exploration continues in the area adjacent to Red Dog and Ikalukrok Creeks. In 1994, a new discovery which doubles the projected ore reserves, was made on the east side of Red Dog Creek between Connie and Shelly Creeks. Exploration activities also occurred in 1996 near Ikalukrok Creek above its confluence with Red Dog Creek.

New mining activities which would require additional Water Supply sources, would not use highly mineralized water bodies, because it is cost-prohibitive to remove metals.^{20,21} Instead, non-mineralized waters which can be treated using conventional methods would be used. For example, the present Red Dog Mine gets its drinking water from nearby Bons Creek, a non-mineralized stream.

c. What about individual use of these water bodies for drinking water, culinary and food processing?

Cominco Alaska Inc. has posted the Red Dog Mine and Creek area to alert individuals that they are entering a hazardous industrial mining area.²⁸

During the public process, villagers from Kivalina and Noatak indicated that they do not use Red Dog or Ikalukrok Creeks during open water conditions, because access is impossible due to low water at the mouth of Ikalukrok Creek, and because villagers fish in summer close to their villages. In winter, villagers who hunt caribou, sheep, wolverine and grizzly bear in these drainages, either melt ice or snow for their drinking water.

At the public meetings, government representatives advised local hunters to continue to use ice or snow during winter months for drinking water, rather than any open water in Red Dog or Ikalukrok Creeks, which are high in metals. These waters are unsafe for human consumption. Red Dog Creek exceeds the USEPA cadmium health advisory for short-term use (10 days) for a child. Both Red Dog and Ikalukrok Creeks exceed the long-term use (7 year) health advisory for this toxic metal. The acute oral cadmium toxicity includes nausea, vomiting, diarrhea,

Discussions of Uses (cont.)

muscular cramps, salivation, sensory disturbances, liver injury, convulsions, shock and/or renal failure and cardiac, pulmonary depression. Long-term oral exposure to high levels of cadmium may result in damage to kidney, liver, bones and blood.^{29,32} ADEC does not recommend Red Dog or Ikalukrok Creeks for either short-term or long-term drinking water, culinary or food processing uses.

3. Is there a Water Quality problem?

These water bodies are naturally highly mineralized, containing high concentrations of cadmium, copper, lead, zinc and other metals, because they pass over and through the exposed ore body containing these metals. These waters exceed the Maximum Contaminant Levels (MCLs) for public drinking water supply for several metals. Cadmium is of particular concern because of its toxicity to humans. Cadmium concentrations in Red Dog Creek at the ore body naturally exceed the USEPA lifetime health advisory and the state drinking water Maximum Contaminant Level (MCL) of 0.005 mg/L by 37 times (median concentration) and 200 times (maximum recorded concentration). Metals concentrations decrease downstream of the Red Dog ore body, as non-mineralized or less-mineralized waters dilute the naturally mineralized water from Red Dog Creek. However, metals concentrations such as cadmium are not diluted sufficiently in Red Dog or Ikalukrok Creeks to serve as public drinking water supply. (Table 2 and Graphs, Sets 1 and 2)

Note: A Maximum Contaminant Level is defined in 18 AAC 80.990 DRINKING WATER, as "the maximum permissible level of a contaminant in water that is delivered to any user of a public water system." A public water system is defined as "intake works, collection system, treatment works, storage facility, or distribution system, including a vehicle or vessel used to distribute water, from which water is available for human consumption; and includes a system providing water to more than one residential dwelling unit, including a duplex, or to a factory, office building, restaurant, school, or similar facility, but does not include a system serving only one single-family residence."

A public water supply system must meet Maximum Contaminant Levels (primary MCL) to protect human health. A secondary MCL or MCLG (Maximum Contaminant Level Goal) is a goal and usually refers to an aesthetic condition such as taste, rather than to a human health concern.¹ Red Dog and Ikalukrok Creeks exceed both the MCL and MCLG for metals (Tables 2 & 3, Graphs, Sets 1 & 2)

4. Is Water Supply for drinking, culinary and food processing an attainable use?

The metals toxicity of these waters is due to natural conditions. Barring expensive treatment processes, there is no way for this Water Supply use to become attainable in the future. The best available technology to treat raw water so that it is suitable to meet public drinking supply standards includes coagulation, sedimentation, filtration and disinfection. These conventional methods would not remove dissolved metals, such as cadmium, from these natural highly mineralized water bodies. The cost of removal, by other means such as ion exchange or reverse osmosis, would be excessive.^{20,21}

Discussion of Uses (cont.)

Because the cost to treat mineralized water is excessive, development projects in the area would logically use non-mineralized water bodies to meet drinking water and other water supply needs. The Red Dog Mine, for example, uses non-mineralized Bons Creek for its Water Supply needs.¹⁷ Bons Creek flows through a non-mineralized area and its waters have very low to non-existent natural mineralization.¹² (Figure 3)

B. 18 AAC 70.020(a)(1)(A) Water Supply (ii) agriculture including irrigation and stock-watering, and (iii) aquaculture.

1. Cominco Requests: Cominco requests removal of Water Supply, agriculture including irrigation and stock-watering, and aquaculture from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Shelly, Connie and Sulfur Creeks, Main Fork Red Dog Creek, and Ikalukrok Creek from its confluence with Red Dog Creek to its confluence with the Wulik River.

2. Is Water Supply for agriculture and aquaculture an existing use or a probable future use?

There are no agricultural nor aquacultural activities at Red Dog and Ikalukrok Creeks. At the public hearings, Kivalina and Noatak residents indicated that they have not and would not use Red Dog Creek or Ikalukrok Creeks for agricultural or aquacultural activities. Existing, federal, state and native land management plans for this area do not list agriculture or aquaculture as existing or potential uses.

Land owners and managers of the area, including NANA Corporation, the Bureau of Land Management and the State of Alaska, describe mining as the primary or co-primary use of the area. NANA Regional Corporation is the landowner of the Red Dog Mine and land adjacent to Red Dog Creek, and some sections of upper Ikalukrok Creek.

Oct. 1915
The NANA Region Coastal Management Plan²⁴ identifies the Red Dog Mine area as a Mining Use Area, and the Ikalukrok Creek area as an Intensive Resource Use area, which includes moose overwintering, caribou migration, grizzly bear habitat, fish overwintering, spawning and rearing. The designated uses for the lands adjacent to Red Dog and Ikalukrok Creeks are Mining and Resource Management. Neither agriculture nor aquaculture are listed as existing or future uses in this plan.

Feb 1989
The Northwest Area Plan for State Lands⁴ designates Minerals, and Habitat and Harvest Uplands as the co-primary uses for State lands adjacent to NANA lands. Habitat and Harvest Uplands are to be used for multiple purposes, such as mining, wildlife and subsistence. Agriculture and aquaculture are not identified uses on State lands in the area.

Discussion of Uses (cont.)

During the public process, the USEPA requested clarification on whether wildlife populations (moose, caribou, grizzly bear, etc.) are included in the definition of "agriculture". The State does not consider wildlife, hunted by local subsistence hunters, to be "livestock" or "stock", since these terms imply domestication. (Appendix F)

The USEPA also asked whether "aquaculture" could occur on Red Dog or Ikalukrok Creeks, since fish are present although stressed by high mineralization of these waters. Mr. Don Bee, ADF&G, Clear Air Force Base Hatchery, indicated that a decision to locate a fish hatchery would include an evaluation of water quality.⁵ It would be unlikely that a highly mineralized water body would be chosen for a new hatchery where the natural fish populations exhibit metals' stress.²² (Appendix F)

During the public process, the Sierra Club Legal Defense Fund (SCLDF) raised the question of whether reindeer herding would include "stock watering" activities. The president of the Reindeer Herders' Association, Mr. Charles Davis of Nome, was consulted regarding this concern. Mr. Davis stated that stock watering is not an activity associated with reindeer herding. Reindeer are corralled twice a year and are kept confined less than 24 hours. Longer confinement results in undue stress to the animals. They are not given water while they are confined.¹³ (Appendix F)

3. Is there a Water Quality problem?

These waters are naturally highly mineralized and are toxic to humans, fish and wildlife.^{29,32} The aquaculture and aquatic life criteria for some metals such as cadmium and zinc, are often exceeded many times over at the water quality monitoring stations, Station 30 and 140, adjacent to the Red Dog Mine (Table 2, Graphs, Sets 1, 2, & 3). Aluminum, which is particularly toxic to fish, is found at levels in Red Dog Creek often much greater than concentrations known to be detrimental to fish. Fish analyzed from this area show signs of stress from high metals concentrations.²² Fish kills have been reported in Red Dog Creek.¹⁴

Although metals concentrations decrease downstream because of dilution by fresh, non-mineralized or less-mineralized water sources, cadmium and zinc concentrations are still often 2 times the aquaculture and aquatic life criteria at Station 6, at the confluence of Ikalukrok Creek with the Wulik River (Table 2).

4. Is Water Supply (agriculture and aquaculture) an attainable use?

Climate in this area, many miles north of the Arctic Circle, is extreme. Snow and ice cover the land and water bodies for much of the year. Agricultural uses are inappropriate at Red Dog and Ikalukrok Creeks because the adjacent land is rugged terrain, with continuously frozen permafrost, and the growing season is too short to grow crops on the wet, tundra active layer. Irrigation by waters contaminated with metals, would not be an appropriate use.

Discussion of Uses (cont.)

The draft UAA listed reindeer herding as a possible "stock watering" activity. During the public process, however, ADEC was informed by local villagers that this activity, which occurred along the foothills of the DeLong Mountains during the 1940's and 50's, would not be a potential future activity. Mr. Charles Davis, President of the Reindeer Herders Association, in Nome, where some reindeer herding presently occurs, stated that there is no stock-watering associated with reindeer.¹³ Reindeer herding involves herding and corralling the animals twice a year for slaughter or antler removal and must be accomplished in less than 24 hours to avoid undue stress to the animals. No stock-watering occurs. (Appendix F)

The natural metals toxicity of Red Dog and Ikalukrok Creeks would preclude aquaculture at these water bodies. According to ADF&G, a minimum water quality to assure healthy stocks would be required to locate a fish hatchery.⁵ (Appendix F).

C. 18 AAC 70.020(a)(1)(B) Water Recreation (i) Contact Recreation

1. Cominco Requests: Cominco requests that Contact (primary) Recreation uses be removed from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Connie, Shelly and Sulfur Creeks, Main Stem Red Dog Creek, and Ikalukrok Creeks below its confluence with Red Dog Creek.

Contact Recreation, 18 AAC 70.990 (14) means activities in which there is direct and intimate contact with water; examples include wading, swimming, diving, water skiing, and any intimate contact with water directly related to shoreline activities.

2. Is Contact Recreation an existing use or a probable use in the future?

According to public testimony, no local Contact Recreation activities have ever taken place, nor are likely to occur in Red Dog or Ikalukrok Creeks (Appendix E). Villagers say the entrance to Ikalukrok Creek at the Wulik River is too shallow in summer to enter. While mining activities occur, all creek recreational activities are prohibited at the Red Dog Mine, which is located on Red Dog Creek at the other end of the drainage under consideration. It is unlikely that native populations will ever use these water bodies for Contact Recreation.

For 6-9 months of each year, Red Dog and Ikalukrok Creeks are frozen. During open water conditions, the Contact Recreation protected uses: swimming, diving and water skiing, are not possible, either due to swift mountain stream velocities or to the shallowness of the water. Wading is the only possible Contact Recreation use in some sections of Red Dog and Ikalukrok Creeks during low water conditions.

Discussion of Uses (cont.)

In its comment letter to ADEC, the USEPA requested clarification of the meaning of the state's Contact Recreation definition which includes "intimate contact with water directly related to shoreline activities", particularly asking about fishing activities (Appendix F).

During the public process, local residents stated that they do not use Ikalukrok or Red Dog Creeks during open water conditions, preferring to fish close to home instead. Even in winter, Red Dog and Ikalukrok Creeks are not visited for ice fishing activities, which occur instead in the Wulik River. If fishing activities were to occur in Red Dog or Ikalukrok Creeks, fishing could only take place in Ikalukrok and Main Stem Red Dog Creeks. There are no fish in Middle Fork Red Dog Creek or its tributaries, due to the high natural mineralization of these waters.

The USEPA also requested a clarification of how the acute aquatic life criteria for metals are a factor in Contact Recreation; and how the "gulp" concept adversely affects human health. The draft UAA stated that "the primary concern regarding this protected use is whether human health might be adversely affected by ingestion of these waters during Contact Recreation activities". ADEC clarifies this statement in this final UAA by noting that swimming does not and cannot occur due to hydrologic conditions. Since it is not possible to swim, no ingestion (gulping) would occur.

In the Water Quality Standards Handbook³¹, the USEPA recommends that Secondary Recreation activities include activities in which there is incidental contact with water. The USEPA includes "wading" as an example of a Secondary Recreation activity. However, the State has chosen to include "wading" as a Contact Recreation activity in the Alaska Water Quality Standards². Contact Recreation is defined as "direct and intimate" contact with water. The State may want to consider bringing its definition of Contact Recreation into line with the federal definition during the next triennial review of the Alaska Water Quality Standard regulations.²

In summary, no Contact Recreation activities occur in the drainages under consideration, and it is unlikely that these waters will ever be used for Contact Recreation, because of their remoteness from population centers, access difficulties, mining activities, poor fishing, and hydrologic conditions.¹²

3. Is there a Water Quality problem?

Red Dog Creek, its tributaries and Ikalukrok Creek have natural high metals concentrations because Red Dog Creek moves through highly mineralized lands. Red Dog Creek is intermittent, flowing only during open water conditions (May through October). Tributaries of the Middle Fork Red Dog Creek, Hilltop Creek and Sulfur Creeks are also intermittent in summer. Sulfur Creek only carries water at spring breakup or during rainy conditions. Hilltop Creek, near the ore body, is a surface water seep, draining through unconsolidated rock rubble. It is highly mineralized and less than ankle deep.

Discussion of Uses (cont.)

4. Is Contact Recreation an attainable use?

Contact Recreation, except for wading in some sections, is not an attainable use. These cold, mountain streams are intermittent, almost completely frozen at least 6 months each year.

Swimming, diving and water skiing activities are not possible in any of the proposed areas under consideration. It is possible to wade in some of these stream sections during open water low flow conditions. Wading might be associated with fishing activities, where fish are present in Ikalukrok Creek and Main Stem Red Dog Creek. No fish exist in Middle Fork Red Dog Creek or its tributaries.

The section of Middle Fork Red Dog Creek above the Mine Water Management System is a disturbed creek bed. The Mine Water Management System consists of a lined conduit for non-mineralized water and the "dirty water" ditch collection system.⁷ Not even wading activities are possible in Middle Fork Red Dog Creek above the terminus of the Mine Water Management System. This instream construction was and is necessary to assure that metals released from the ore body as it is developed, do not go downstream; i.e., do not increase metals above pre-mining concentrations.⁷

Hilltop Creek is also unsuitable for wading. It is a steep ravine, which drains the ore body and is highly mineralized (Table 3). Intermittent water flows through unconsolidated rock rubble and is less than ankle-deep.

Table 4 outlines the possible Contact Recreation uses in each stream section.

D. 18 AAC 70.020(a)(1)(B) (ii) Secondary Recreation.

1. Cominco Requests: Cominco requests removal of secondary recreation uses from Middle Fork Red Dog Creek, its tributaries Hilltop, Rachael, Connie, Shelly and Sulfur Creeks, and Main Stem Red Dog Creek.

Secondary Recreation, 18 AAC 70. 990 (43), means recreation activities in which water use is incidental, accidental, or sensory; it includes fishing, boating, camping, hunting, hiking, and vacationing.

2. Does Secondary Recreation exist or is it a probable use in the future?

The State defines Secondary Recreation uses as fishing, boating, camping, hunting, hiking and vacationing. Villagers from Kivalina and Noatak indicate that they do not fish in Main Stem Red Dog or Ikalukrok Creeks during open water conditions, preferring to fish close to home. (Fish do not exist in Middle Fork Red Dog Creek or its tributaries.) Boating is not a possible use in Ikalukrok and Red Dog Creeks because of access

Discussion of Uses (cont.)

problems and the shallow depth. No local people indicated they hike or vacation near these drainages (Appendix E).

Noatak villagers indicate they do camp and hunt for caribou, wolverine, grizzly and sheep along the base of the mountains and in the vicinity of Ikalukrok Creek and Red Dog Creek (below the Red Dog Mine) during the winter months. There are winter trails from Noatak to Point Hope, which cross these drainages. Kivalina residents have winter fish camps along the Wulik River, both above and below its confluence with Ikalukrok Creek, but do not have winter fish camps at Red Dog or Ikalukrok Creeks.

Because of the noise of blasting and other mining activities, villagers indicated that they do not use Middle Fork Red Dog Creek (near the Red Dog Mine) or its tributaries Hilltop, Rachael, Connie, Shelly and Sulfur Creeks, for any Secondary Recreation activities. (Figure 3). Villagers indicated that hunting might resume in this area once mining activities cease (Appendix E).

In summary, the only existing Secondary Recreation activity is hunting, and possibly hiking and camping associated with hunting. Attainable Secondary Recreation uses, although unlikely, would also include fishing and vacationing. Hunting activities might expand into Middle Fork Red Dog Creek and its tributaries, should mining activities cease (Appendix E). Fishing is not possible in Middle Fork Red Dog Creek or its tributaries, because there are no fish. Boating is not possible in Red Dog Creek because of its shallowness.

3. Is there a Water Quality problem?

These waters are naturally highly mineralized and are toxic to fish. Fish do not exist in the Middle Fork Red Dog Creek and its tributaries. Although fish are present in Main Stem Red Dog Creek, a recent histological report by Beth MacConnell, United States Fish and Wildlife Service to the ADF&G²², states the following results from juvenile Dolly Varden from Main Stem Red Dog Creek and Evaingiknuk Creek (a non-mineralized stream in the same area):

"Dolly Varden - Red Dog Creek (7 fish examined)

Summary: No severe lesions were found in the fish examined. The cellular changes seen in kidney and liver tissue are non-specific but reported in fish exposed to heavy metals. Glycogen vacuolation and cellular degeneration in liver, kidney, GI, gill and muscle suggests these fish are in poor health."

Dolly Varden - Evaingiknuk Creek (7 fish examined)

Summary: Overall these fish appear to be in good health. Kidney and liver normal. No significant lesions except in gill tissue. Gill changes suggest chronic exposure to a non-infectious irritant such as organics, sediments, particulates in the water."

Discussion of Uses (cont.)**4. Is Secondary Recreation an attainable use in Red Dog Creek?**

Fishing is not an attainable use in Middle Fork Red Dog Creek or its tributaries. No fish exist in these waters because of their natural metals toxicity^{12,30} (Table 3). Fish are present in Main Stem Red Dog Creek, but exhibit stress caused by metals.²²

Boating is not an attainable use in Red Dog or Ikalukrok Creek, because of its shallow depth.¹²

The existing Secondary Recreation uses, winter camping and hunting at Ikalukrok Creek and Red Dog Creek below the Mine Water Management System⁷, would continue. Winter camping and hunting activities are not attainable Secondary Recreation uses in disturbed creek section of Middle Fork Red Dog Creek, above the terminus of the Mine Water Management System. Although no villagers presently use Middle Fork Red Dog Creek or its tributaries, they indicated that winter camping and hunting might resume once mining activities cease (Appendix E).

Although no local people indicated that they hike, except incidental to hunting, both hiking and vacationing are attainable uses, albeit unlikely because of the remoteness of this area.

Table 5 delineates attainable Secondary Recreation uses.

E. 18 AAC 70.020 (a)(1)(C) Growth and propagation of fish, shellfish, other aquatic life, and wildlife.

1. Cominco originally requested removal of the Aquatic Life use from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Shelly, and Sulfur Creeks. Connie Creek was not included in this request because aquatic invertebrates and periphyton were found during the Aquatic Survey performed by ADF&G in 1995.³⁵

On November 27, 1996, Cominco withdrew its request to remove aquatic life protected uses from Rachael, Shelly and Sulfur Creeks (Appendix G). The following discussion will only address the appropriateness of removing the Aquatic Life protected use at Middle Fork Red Dog Creek and its tributary, Hilltop Creek.

Discussion of Uses (cont.)

2. Is Aquatic Life an existing or probable use in the future?

Aquatic Life, which includes fish, macrophytes and periphyton (plants), and macro-invertebrates and micro-invertebrates, does not exist in Middle Fork Red Dog Creek or its tributary, Hilltop Creek.^{12,14,35} It appears that aquatic life cannot survive in these naturally toxic waters. (Tables 2, 3, and 6)

The Alaska Department of Fish and Game's 1995 report "Red Dog Use Attainability Analysis, Aquatic Life Component", which is an addendum to this UAA, addresses the appropriateness of the Aquatic Life classification for Middle Fork Red Dog Creek and its tributaries.³⁵ The ADF&G conducted aquatic surveys of Middle Fork Red Dog Creek, Main Stem Red Dog Creek, North Fork Red Dog Creek and the Ikalukrok Creek from its confluence with Red Dog Creek to Station 8. This ADF&G study provides information on the abundance and relative diversity of aquatic taxa to fulfill the Aquatic Life use analysis required in a Use Attainability Analysis.

The ADF&G study compared its aquatic survey results with baseline information available from the 1980's.^{12,14,30} Baseline information shows no aquatic life in Middle Fork Red Dog Creek. High metals concentrations in Middle Fork Red Dog Creek were a result of direct contact with the exposed ore body mineralization.¹² No mining activities contributed to this natural poor water quality. (Appendix C)

The 1995 ADF&G study compared water quality in Red Dog and Ikalukrok Creeks with metals concentrations reported to cause acute or chronic toxicity to species of salmonid fish. Ninety-seven to 100% of baseline water quality samples had toxic concentrations of cadmium and zinc; 100% of these water quality samples exceeded maximum allowable concentrations.³⁵ Extensive sampling by the ADF&G in 1995 and 1996 found no fish, no plants and no micro-invertebrates, in Middle Fork Red Dog Creek. The ADF&G's conclusion is that metals concentrations, especially cadmium and zinc, are sufficiently high to preclude use by fish, aquatic plants, and aquatic invertebrates.

Hilltop Creek, which drains the southeast portion of the ore body (on the west side of Middle Fork Red Dog Creek), has high metals concentrations, low pH and is frozen in winter and intermittent in summer (Table 3). Flows are always less than 1 foot deep, due to the porous nature of the rubble rock drainage. High metals concentrations exclude all aquatic life in Hilltop Creek.

3. Is there a Water Quality problem?

These waters drain a natural, highly mineralized area. Direct contact with the ore body results in natural, high concentrations in water of cadmium, zinc, lead, aluminum and other metals.

Discussion of Uses (cont.)**4. Is Aquatic Life an attainable use?**

Aquatic Life is not an attainable use for Middle Fork Red Dog Creek and its tributary Hilltop Creek in this highly mineralized area. These waters have high naturally occurring metals concentrations toxic to all aquatic life. Low pH also diminishes the quality of habitat for Aquatic Life.

Cominco Alaska Inc. is the only industrial wastewater discharger in this area. Cominco, as is required in permit, has been meeting low metals concentrations in the effluent discharged. Even if the Red Dog Mine were not located in this area, aquatic life would not exist in Middle Fork Red Dog Creek or its tributary, Hilltop Creek.

ADEC Determinations**A. Water Supply (drinking, culinary and food processing)**

ADEC agrees with Cominco that it is appropriate to remove the Water Supply (drinking water, culinary, and food processing) use from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Connie, Shelly and Sulfur Creeks, Main Stem Red Dog Creek, and Ikalukrok Creeks from its confluence with Red Dog Creek to its confluence with the Wulik River (Table 7).

Comments received during the public process either supported or did not object to the removal of this use. Water Supply (drinking water, culinary and food processing) is neither an existing, probable, nor an attainable use. These waters are naturally contaminated with toxic metals, from the mineralized Red Dog ore body and other mineralized areas in the drainage, such as Rachael Creek (Table 3). Drinking water maximum contaminant levels (MCLs) for metals such as cadmium, which is toxic to humans, are greatly exceeded adjacent to the mine, and continue to be exceeded in the downstream drainage, even with dilution (Tables 2 and 3, Graphs, Set 1 & 2).

These waters meet the use attainability requirements of 40 C.F.R.131.10 (g)(1) to remove a protected use: naturally occurring pollutant concentrations prevent the attainment of the use.

B. Water Supply (agriculture and aquaculture)

ADEC agrees with Cominco that it is appropriate to remove the Water Supply (agriculture including irrigation and stock-watering, and aquaculture) uses from Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Shelly, Connie and Sulfur Creeks, Main Fork Red Dog Creek and Ikalukrok Creek from its confluence with Red Dog Creek to its confluence with the Wulik River (Table 7). Neither agricultural nor aquacultural uses exist, are probable in the future, and neither use is attainable.

ADEC Determinations (cont.)

Removal of these uses is supported by 40 C.F.R. 131.10 (g) (1) and (2). Factors 1 and 2 are described on page 2 of this document. In brief, these require that naturally occurring pollutant concentrations prevent the attainment of the use and that natural, ephemeral, intermittent, or low-flow conditions prevent the attainment of the use.

C. Contact Recreation

ADEC agrees in part with Cominco's request regarding removal of Contact Recreation uses, finding it appropriate to remove Contact Recreation from Middle Fork Red Dog Creek to the terminus of the Mine Water Management System⁷, and its tributary, Hilltop Creek.

ADEC's decision to remove Contact Recreation from Middle Fork Red Dog Creek above the terminus of the Mine's Water Management System, is supported by 40 C.F.R.131.10 (g), Factor 4, which states "... dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original conditions or to operate such modification in a way that would result in the attainment of the use."

Hilltop Creek is an intermittent, low flow ore body seep, and as such meets the requirements of Factor 2, which states that "natural, ephemeral, intermittent or low-flow conditons prevent the attainments of the use."

All the waterbodies considered for reclassification are highly mineralized. The State's primary concern in protecting a water body for Contact Recreation uses, is the health of the individuals who might ingest these waters. Since wading is the only possible Contact Recreation activity in the remaining drainages under consideration: Middle Fork tributaries Connie, Shelly, Sulfur and Rachael Creeks, Middle Fork Red Dog Creek below the terminus of the Mine's Water Management System, Main Stem Red Dog Creek and Ikalukrok Creek below its confluence with Red Dog Creek, ADEC is not concerned about water ingestion.

Swimming, diving, and water skiing activities do not occur in any of the drainages under consideration, because of hydrologic limitations. Wading is the only activity which is possible during low water conditions. Because wading is the only Contact Recreation possible in Middle Fork Red Dog Creek, below the terminus of the Mine Water Management System, in Middle Fork tributaries: Connie, Shelly, Sulfur and Rachael Creeks; in Main Stem Red Dog Creek, and in Ikalukrok Creek, from its confluence with Red Dog Creek to its confluence with the Wulik River, ADEC's decision is to remove all Contact Recreation uses, except wading, from these stream segments (Table 7).

ADEC Determinations (cont.)

D. Secondary Recreation

ADEC agrees with Cominco that it is appropriate to remove Secondary Recreation from Middle Fork Red Dog Creek above the terminus of the Mine Water Management System⁷. This section of Middle Fork Red Dog Creek has been disturbed by the construction of the clean water conduit and dirty water ditch system. No Secondary Recreation activity is possible. As such, this stream section meets the requirements of Factor 4, which states "...dams, diversions, or other types of hydrologic modification preclude the attainment of the use and it is not feasible to restore the water body to its original condition or operate such modification in a way that would result in the attainment of the use."

Because there are no fish in Middle Fork Red Dog Creek below the terminus of the Mine Water Management System, or in its tributaries Rachael, Connie, Hilltop, Shelly and Sulfur Creeks, ADEC's decision is to remove the Secondary Recreation "fishing" use from these streams (Table 7).

ADEC cannot remove Secondary Recreation as a protected use for any of the other Red Dog and Ikalukrok Creeks segments under consideration. DEC notes that although fish exist in Main Stem Red Dog Creek, these fish are stressed by high metals concentrations.

E. Aquatic Life

ADEC and ADF&G agree with Cominco's revised request and find it appropriate to remove Aquatic Life as a protected use from all of Middle Fork Red Dog Creek (above the confluence with North Fork Red Dog Creek) and from Middle Fork tributary, Hilltop Creek (Appendix G).

Removal of this use is supported by pre-mining water quality data, and by pre-mining and post-mining aquatic life surveys.^{12,14,35} These waters have always been highly mineralized and are toxic to fish. There never has been, nor will there be, aquatic life in these water bodies due to the natural high toxicity caused by this mineralization. Data strongly support application of 40 CFR 131.10(g)(1), which requires that naturally occurring pollutant concentrations prevent the attainment of the use (Tables 2 and 3, Graphs, Sets 1, 2 and 3).

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Appendix A: Tables, Figures and Graphs

Station	Date	Source of Data	Analyzed As:	Al mg/L	Cd mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Zn mg/L	pH
mid-Hilltop	7/31/95	Cominco	TR	17.10	10.1		20.6	2.64	2130	3.55
mid-Hilltop	8/1/95	Cominco	TR	27.60	10.5		22	2.33	2000	3.5
end Hilltop	7/31/95	Cominco	TR	7.87	6.2		3.45	4.69	1510	4.25
end Hilltop	8/1/95	Cominco	TR	12.20	6.9		4.11	4.55	1600	4.1
beg. Hilltop	7/31/95	Cominco	TR	15.40	3.78		85.5	1.63	530	2.71
beg. Hilltop	8/1/95	Cominco	TR	12.20	6.9		4.11	4.55	1600	4.1
Hilltop	8/16/95	Cominco	TR	9.39	7.8		3.68	4.12	1580	4.2
Hilltop	8/21/95	Cominco	TR	8.19	7.6		1.96	4.22	1550	4.8
Hilltop	8/25/95	Cominco	TR	9.59	7		3.08	3.90	147	4.2
Hilltop	8/29/95	Cominco	TR	8.47	5		2.39	3.78	1430	4.6
Hilltop	9/3/95	Cominco	TR	7.75	6.7		2.17	3.49	1460	5
Hilltop	9/6/95	Cominco	TR	4.09	6.5		0.37	3.39	1260	
Hilltop	9/13/95	Cominco	TR	3.65	7		0.21	0.39	1380	5.7
Hilltop	9/21/95	Cominco	TR	2.97	6.9		0.11	3.94	1250	5.7
Hilltop	9/28/95	Cominco	TR	8.29	6.8		0.8	3.09	1250	5
Hilltop	10/6/95	Cominco	TR	3.05	6.2		0.16	3.35	1150	5.8
Hilltop	10/17/95	Cominco	TR	0.26	3.2		0.03	3.75	710	6.1
Hilltop	5/13/96	Cominco	TR	0.69	0.341	0.07	0.547	1.68	33.8	
Hilltop	5/23/96	Cominco	TR	0.61	0.54	0.12	1.01	4.11	92.3	
Hilltop	6/18/96	Cominco	TR	4.05	0.678	0.513	25.4	10.80	173	
Hilltop	6/1/96	Cominco	TR	2.06	0.455	0.286	7.52	24.50	61.9	
Hilltop	6/6/96	Cominco	TR	2.48	0.59	0.35	5.67	15.40	108	
Hilltop	6/9/96	Cominco	TR	3.03	1.21	0.432	4.89	14.70	150	
Hilltop	6/25/96	Cominco	TR	4.03	1.79	1.19	4.84	7.02	511	
Hilltop	6/30/96	Cominco	TR	4.00	2.65	1.53	3.96	5.38	906	
Hilltop	7/7/96	Cominco	TR	4.18	4.6	2.09	2.65	4.25	1560	
Hilltop	7/16/96	Cominco	TR	7.68	7.66	2.96	3.8	3.60	2240	
Hilltop	7/25/96	Cominco	TR	18.90	2.94	1.81	231	68.60	701	
Hilltop	7/30/96	Cominco	TR	4.48	3.3	1.77	7.37	2.27	699	
Hilltop	8/13/96	Cominco	TR	5.91	3.02	1.9	17.8	5.20	696	
Hilltop	8/20/96	Cominco	TR	5.39	3.4	1.98	19.9	1.92	642	
Hilltop	8/30/96	Cominco	TR	5.10	3.07	1.61	13.3	1.79	688	
Hilltop	9/12/96	Cominco	TR	1.47	4.58	1.56	0.356	2.68	1070	
	9/15/98	Cominco	TR	1.24			0.355	3.43	1060	

Table 3. Water Quality Data - 1995 (Red Dog Creek Tributaries at Red Dog Mine)

Station	Date	Reference	Hard	TDS	SO4	TSS	matrix	Al	Cd	Cu	Fo	Hg	Pb	AG	Zn	CnTot	pH
			mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
Sulfur Cr	5/12/95	Cominco					TR	5.97	0.009	0.02	20.1		2.12		1.24		6.5
Sulfur Cr	5/31/95	Cominco	87.3				TR	< 0.05	0.004	< 0.01	0.153		0.193		0.494		7
Sulfur Cr	6/26/95	Cominco	130				TR	< 0.05	0.012	0.0022	0.036		0.0937		1.9		7
Sulfur Cr	7/4/95	Cominco	133				TR	0.053	0.005	0.0012	0.059		0.0888		0.701		7.4
Sulfur Cr.	7/12/95	ADEC						0.061	0.003	< 0.01			0.069	0.399			
Sulfur Cr.	7/24/95	Cominco	140					< 0.05	0.01	0.0028	0.052		0.0658	1.68			
Sulfur Cr.	August		no flow														
Shelly Cr	5/12/95	Cominco					TR	0.238	0.005	< 0.01	0.397		0.154		0.292		6.4
Shelly Cr	5/31/95	Cominco	33.1				TR	0.077	< 0.003	< 0.01	0.27		0.011		0.398		6.8
Shelly Cr	6/7/95	Cominco					TR	0.175	0.004	0.0033	0.403		0.0276		0.467		6.7
Shelly Cr	6/7/95	Cominco					TR	0.108	6E-04	0.0016	0.194		0.0052		0.088		6.7
Shelly Cr	6/26/95	Cominco	61.9				TR	0.125	0.01	0.0058	0.198		0.0179		1.35		7.1
Shelly Cr	7/4/95	Cominco	61.1				TR	0.137	0.01	0.0057	0.19		0.0198		1.28		7.3
Shelly Cr.	7/12/95	ADEC						0.304	0.017	0.014			0.049	1.89			
Shelly Cr.	7/24/95	Cominco	102					0.436	0.024	0.0145	0.55 ^e		0.0502	3.23			
Shelly Cr.	7/29/94	Cominco						< 0.1	0.01		0.3		0.04	0.86			
Shelly Cr.	7/31/95	Cominco	116					0.549	0.032	0.021	0.816		0.0708	4.2			
Shelly Cr.	8/15/95	Cominco						0.461	0.032	0.0185	0.704		0.0651	3.59			
Shelly Cr.	9/3/95	Cominco						0.472	0.03	0.0201	0.887		0.604	3.55			
Shelly Cr.	9/21/95	Cominco						0.504	0.045	0.0235	1.06		0.083	5.1			
Shelly Cr.	10/7/95	Cominco						0.511	0.037	0.0208	1.22		0.079	4.13			
Connie Cr	5/12/95	Cominco					TR	0.372	0.005	< 0.01	1.22		0.196		0.615		6.6
Connie Cr	5/31/95	Cominco	51.2				TR	0.105	< 0.003	< 0.01	0.168		0.016		0.088		6.7
Connie Cr	6/7/95	Cominco					TR	0.174	3E-04	0.0023	0.12		0.002		0.0059		7
Connie Cr	6/8/95	Cominco					TR	0.09	4E-04	0.0021	0.122		0.0092		0.065		6.6
Connie Cr	6/26/95	Cominco	79.1				TR	0.082	7E-04	0.0021	0.048		0.0037		0.107		7.4
Connie Cr	7/4/95	Cominco	76.2				TR	0.087	6E-04	0.002	0.084		0.0127		0.097		7.3
Connie Cr.	7/24/95	Cominco	132				TR	< 0.05	0.001	0.0015	0.064		0.0347		0.155		
Connie Cr.	7/31/95	Cominco	148				TR	< 0.05	9E-04	0.0024	0.059		0.0047		0.137		
Connie Cr.	8/15/95	Cominco					TR	0.347	0.186	0.056			0.273		36.8		
Connie Cr.	9/3/95	Cominco					TR	0.073	8E-04	0.0025	0.092		0.0054		0.138		
Connie Cr.	9/21/95	Cominco					TR	0.05	7E-04	0.0015	0.061		0.0033		0.107		
Connie Cr.	10/7/95	Cominco					TR	0.101	0.001	0.0025	0.262		0.0137		0.174		
Rachel Cr	5/12/95	Cominco					TR	1.59	< 0.003	0.061	0.245		0.048		0.202		4.7
Rachel Cr	5/31/95	Cominco	164				TR	2.19	< 0.003	0.059	1.79		0.007		0.357		5.1
Rachel Cr	6/26/95	Cominco	256				TR	1.59	0.002	0.0512	1.67		0.0023		0.506		5.8
Rachel Cr	7/4/95	Cominco	252				TR	1.81	0.002	0.0643	1.61		0.0008		0.507		5.9
Rachel Cr.		ADEC					TR	1.99	< 0.003	0.084		<	0.001	0.615			
Rachael Cr.	7/19/95	Cominco	413				TR	1.57	0.003	0.0504	3.3		0.0005	0.707			
Rachael Cr.	7/31/95	Cominco	491				TR	1.17	0.003	0.0427	2.8		0.0002	0.778			
Rachael Cr.	8/15/95	Cominco					TR	1.53	0.004	0.0471	4.22		0.0008	0.838			
Rachael Cr.	9/3/95	Cominco					TR	1.97	0.003	0.0728	4.28		0.0003	0.802			
Rachael Cr.	9/21/95	Cominco					TR		0.004	0.0718			0.0004	0.828			
Rachael Cr.	10/7/95	Cominco					TR	3.27	0.003	0.073	3.77		0.0008	0.782			

TABLE 1

RED DOG & IKALUKROK CREEKS RECLASSIFICATION REQUEST MATRIX

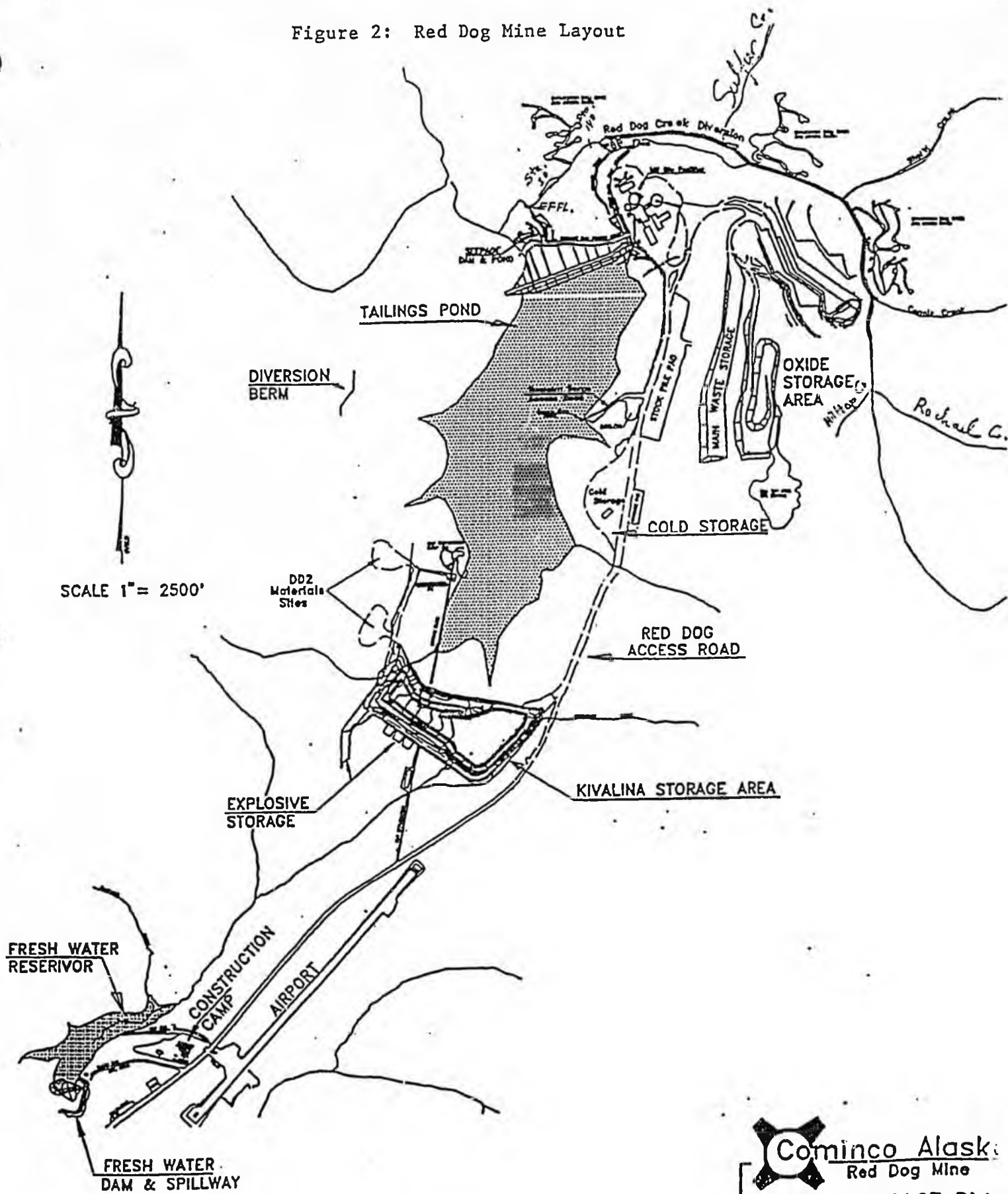
18 AAC 70.20 PROTECTED WATER USE CLASSES

CREEK	WATER SUPPLY (a)(1)(A)				WATER RECREATION (a)(1)(B)		
	(i) DRINKING WATER	(ii) AGRICULTURE	(iii) AQUACULTURE	(iv) INDUSTRIAL	(i) CONTACT RECREATION	(ii) SECONDARY RECREATION	AQUATIC LIFE (a)(1)(C)
<i>RDC = Red Dog Creek</i>	<u>PHASE ONE</u>						
MIDDLE FORK RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
SULFUR CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
SHELLY CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
CONNIE CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	Retain
RACHAEL CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
HILLTOP CREEK	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>
MAIN STEM RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	<u>Remove</u>	Retain
IKALUKROK - RDC to Sta.73	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
Sta.73 to Sta.7	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
Sta 7 to confl.w/WulikR.	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
	<u>PHASE TWO</u>						
NORTH FORK RDC	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain
IKALUKROK (Above confl.w Red Dog Creek)	<u>Remove</u>	<u>Remove</u>	<u>Remove</u>	Retain	<u>Remove</u>	Retain	Retain

Table 2 Water Quality Summary Pit-Mining																
Station	date	hard. mg/L	TDS mg/L	804	AJ mg/L	Cd mg/L	Cu mg/L	Pb mg/L	Zn mg/L	pH	Temp °C	D.O. mg/L	Conduct.	Flow cfs	Alkal. mg/L	
Station 140		89			0.725	0.115		0.33	18.7	8.4						
Station 140	max	155			2.31	0.21		1.11	28.5	8.7						
Station 140	min	67.5			0.15	0.071		0.08	9.06	5.8						
Station 140	count	10			20	20		20	20	10						
Station 30	median	92.1	216	174	0.666	0.1335	0.013	0.274	15.85	8.88	8.3	11.3	278	8.68	4.98	
Station 30	max	201	287	324	2.31	0.94	0.028	1.11	49.8	8.5	12.8	14.2	850	27	18	
Station 30	min	67.5	131	85	0.15	0.071	0.007	0.0026	9.06	6.3	0	10.4	83	1.3	1	
Station 30	count	12	4	6	24	32	4	32	32	8	7	8	7	8	8	
Station 20	median	93		108	0.325	0.078	0.009	0.11	9.865	6.8	5	11.6	265	13.5	23	
Station 20	max	145		149	0.91	0.14	0.025	0.36	18.5	6.8	14.3	14.2	825	76	44	
Station 20	min	58.5		66	0.05	0.02	0.005	0.0015	2.63	8.7	0	8.7	28	1.6	1.7	
Station 20	count	16		3	28	34	4	34	34	6	8	6	5	18	8	
Station 10	median	127	186.5	68.8	0.15	0.0275	0.0045	0.08	3.485		6.3	11.2	270	31	70	
Station 10	max	227	286	124	1.19	0.044	0.019	0.1	5.06		17.1	13.8	492	128	245	
Station 10	min	21	8.8	7.9	0.02	0.002	0.002	0.0008	0.567		0	9.2	120	3.2	8.2	
Station 10	count	21	10	10	41	46	18	46	46		12	8	12	30	8	
Station 08	median	145.5	149		0.035	0.01	0.003	0.0046	0.755	7.4	8.1	11.7	286	182.5	75	
Station 08	max	194	174		0.17	0.038	0.022	0.0276	4.2	7.7	14.7	13.7	499	310	388	
Station 08	min	28	124		0.02	0.0006	0.001	0.0001	0.17	6.1	0	10	179	15	12	
Station 08	count	8	2		10	17	10	17	17	8	7	8	7	14	10	
Station 73	median					0.0115		0.029	0.98							
Station 73	max					0.025		0.08	1.8							
Station 73	min					0.008		0.0003	0.349							
Station 73	count					12		12	12							
Station 7	median					0.009		0.001	0.58	7.7						
Station 7	max	179				0.012		0.004	3.48	7.9						
Station 7	min	96				<0.002		0.001	0.21	7.5						
Station 7	count	2				6		6	6	6						
Station 06	med	139	161.5	36.5	0.03	0.003	0.003	0.001	0.049	7.6	7.8	12	230	188		
Station 06	max	178	191	49.5	0.37	0.03	0.021	0.0069	0.14	7.9	15	13.4	310	885		
Station 06	min	43	56	9.3	0.02	0.0003	0.002	0.0001	0.023	8.6	0	10	76	48		
Station 06	count	9	8	9	6	9	9	9	9	9	9	9	9	9		
Alaska Drinking Water Maximum Contaminant Level (primary MCL)						0.005										
Alaska Drinking Water secondary MCL Goal						0.2		1	5							
Alaska Aquatic Life Chronic Criteria							0.0011*	0.012*	0.0032*	0.047						
U.S. Aquatic Criteria						0.087										
* hardness dependant																

Black border indicates Drinking Water or Aquatic Life Water Quality Standard Exceedance

Figure 2: Red Dog Mine Layout



SCALE 1" = 2500'

0 1/2 1 MILE

Cominco Alaska
Red Dog Mine
AREA WIDE PLOT PLAN
CURRENT LAND USAGE

DATE: 7/4/94
SCALE: 1" = 2500'

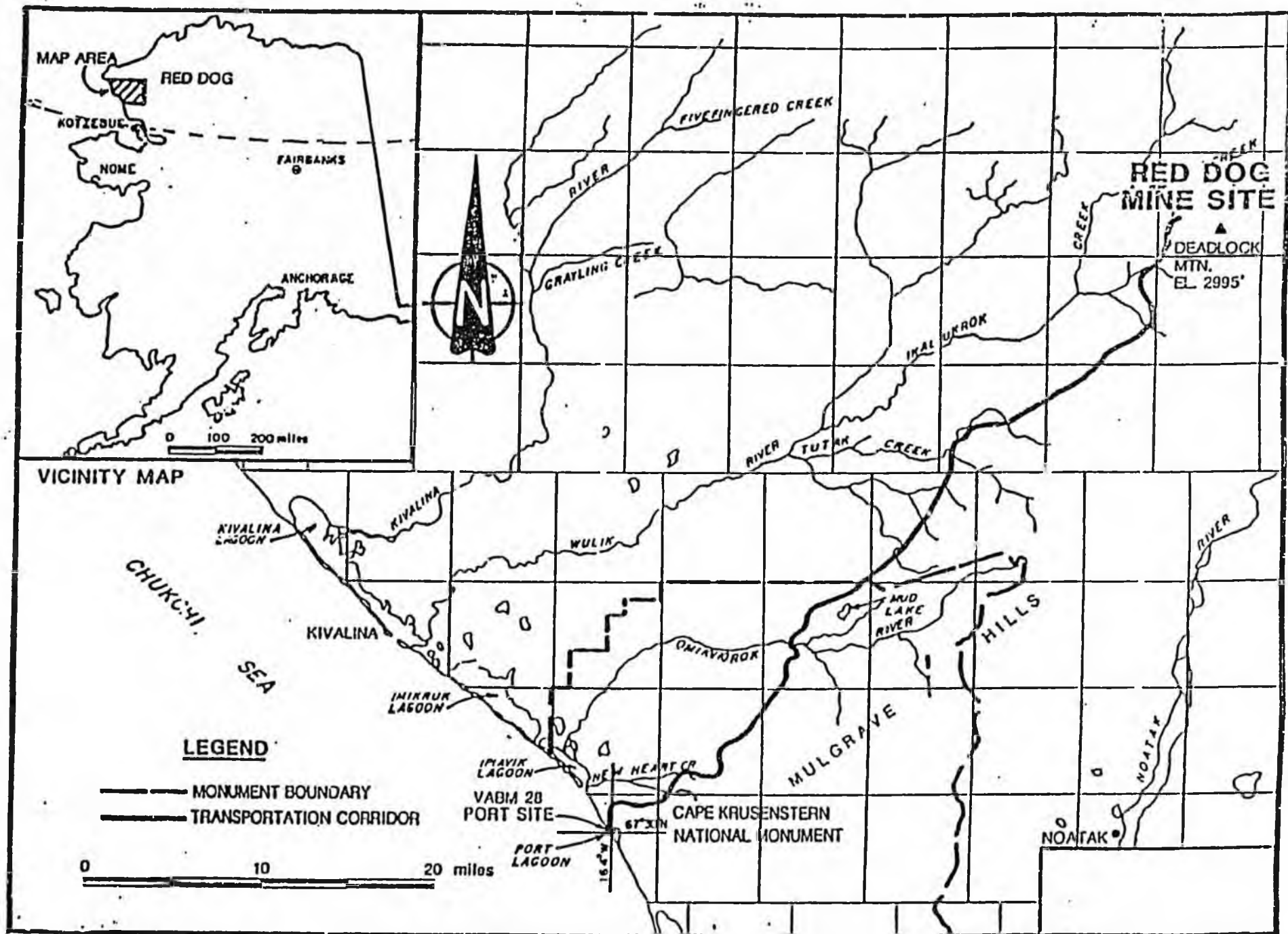


FIGURE 1: LOCATION MAP

Table 6

Attainability of Aquatic Life Use

Stream	Plants	Invertebrates	Fish	Comments
Hilltop Creek	No	No	No	High metals concentration, particularly zinc
Red Dog Creek (Middle Fork to terminus of the Mine's Water Management System)	No	No	No	Disturbed creek bed
Red Dog Creek (Middle Fork from terminus of the Mine's Water Management System to confluence with North Fork Red Dog Creek)	No	No	No	High metals loading from ore body

Table 7
Final Use Attainability Analysis Matrix

Creek Sections Requested for Reclassification	Designated Water Use[s]	Is this an existing use?	Is this use attainable?	Do any of the six factors apply? 40CFR§131.10 (g)(1-6)
Middle Fork Red Dog Creek and its tributaries Hilltop, Rachael, Connie, Shelly, and Sulfur Creeks; Main Stem Red Dog Creek; Ikalukrok Creek (confluence with Red Dog Creek to confluence with Wulik River).	Water Supply : Drinking Water, Agriculture, & Aquaculture.	No	No	1 and/or 2
Middle Fork Red Dog Creek, down to terminus of the Mine's Water Management System.	Water Recreation: Contact	No	No	4, instream hydrologic modifications - clean/dirty water ditches/sump
Hilltop, Creek	Water Recreation: Contact	No	No	2, ephemeral, low flow conditions
Middle Fork Red Dog Creek tributaries: Connie, Shelly, Sulfur and Rachael Creeks	Water Recreation: Contact	No	Yes, wading only	2
Middle Fork Red Dog Creek below terminus of the Mine's Water Management System down to confluence with North Fork Red Dog Creek	Water Recreation: Contact	No	Yes, wading only	2
Main Stem Red Dog Creek; Ikalukrok Creek (confluence with Red Dog Creek to confluence with Wulik River).	Water Recreation: Contact	No	Yes, wading only	2
Middle Fork Red Dog Creek to terminus of Mine's Water Management System.	Water Recreation: Secondary	No	No	4
Connie, Hilltop, Shelly, Sulfur and Rachael Creeks	Water Recreation: Secondary	No	Yes, except for fishing	1 prevents attainment of fishing use.
Middle Fork Red Dog Creek below Mine's Water Management System to confluence with North Fork Red Dog Creek	Water Recreation: Secondary	No	Yes, except for fishing.	1 prevents attainment of fishing use.
Main Stem Red Dog Creek.	Water Recreation: Secondary	No	Yes	Fish present but stressed
Middle Fork Red Dog Creek and Hilltop Creek, but not including other tributaries.	Growth and propagation of fish, shellfish, other aquatic life and wildlife	No	No	1

Table 4

Attainability of Contact Recreation Use (Direct and Intimate Contact)

Stream	Wading	Swimming	Diving	Skling	Comments
Connie Creek	Yes	No	No	No	Shallow
Rachael Creek	Yes	No	No	No	Shallow
Hilltop Creek	No	No	No	No	Intermittent, steep and shallow, drains ore body
Shelly Creek	Yes	No	No	No	Shallow
Sulfur Creek	Yes, when water present	No	No	No	Intermittent (flows only at breakup and high rain fall)
Red Dog Creek (Middle Fork to terminus of the Mine's Water Management System)	No	No	No	No	Disturbed creek bed
Red Dog Creek (Middle Fork from the terminus of Mine's Water Management System to North Fork Red Dog Creek)	Yes	No	No	No	Shallow
Red Dog Creek (Main Stem)	Yes	No	No	No	Shallow
Ikalukrok Creek (Confluence of Red Dog Creek to confluence with Wulik River)	Yes	No	No	No	Shallow and/or swift

Table 5

Attainability of Secondary Recreation Use (Water use incidental, accidental or sensory)

Stream	Fishing	Boating	Camping	Hunting	Hiking	Vacationing	Comments
Connie Creek	No	No	Yes	Yes	Yes	Yes	No fish
Rachael Creek	No	No	Yes	Yes	Yes	Yes	No fish
Hilltop Creek	No	No	Yes	Yes	Yes	Yes	No fish
Shelly Creek	No	No	Yes	Yes	Yes	Yes	No fish
Sulfur Creek	No	No	Yes	Yes	Yes	Yes	No fish
Red Dog Creek (Middle Fork to terminus of Mine's Water Management System)	No	No	No	No	No	No	Disturbed creek bed, No fish
Red Dog Creek (Middle Fork from terminus of the Mine's Water Management System to North Red Dog Creek)	No	No	Yes	Yes	Yes	Yes	No fish
Red Dog Creek (Main Stem)	Yes	No	Yes	Yes	Yes	Yes	Fish stressed from natural creek mineralization
Ikalukrok Creek (from confluence with Red Dog Creek to confluence with Wulik River)	Yes	Yes	Yes	Yes	Yes	Yes	

JATC LIFE
IXC

3215

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3213

3212

3211

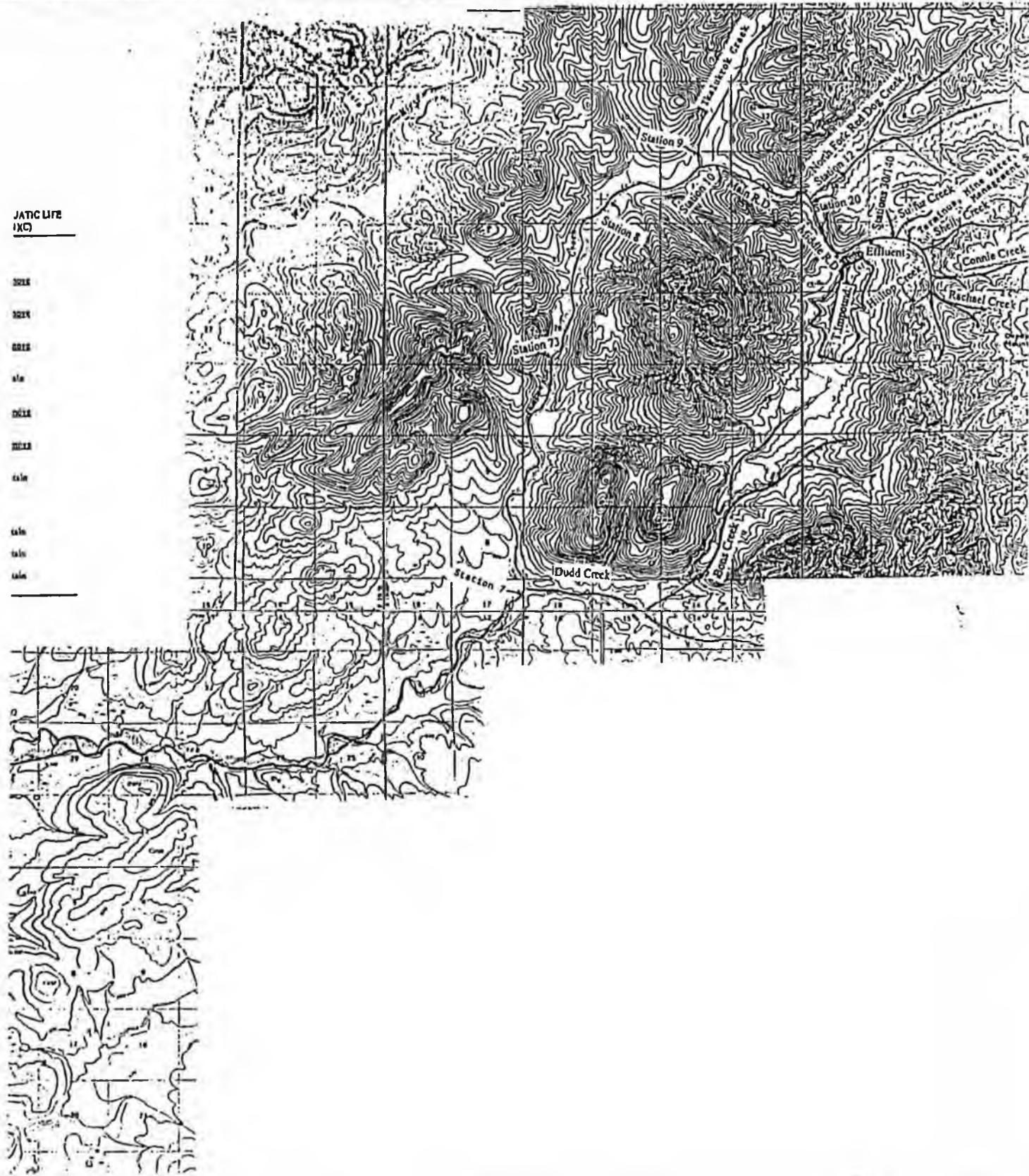
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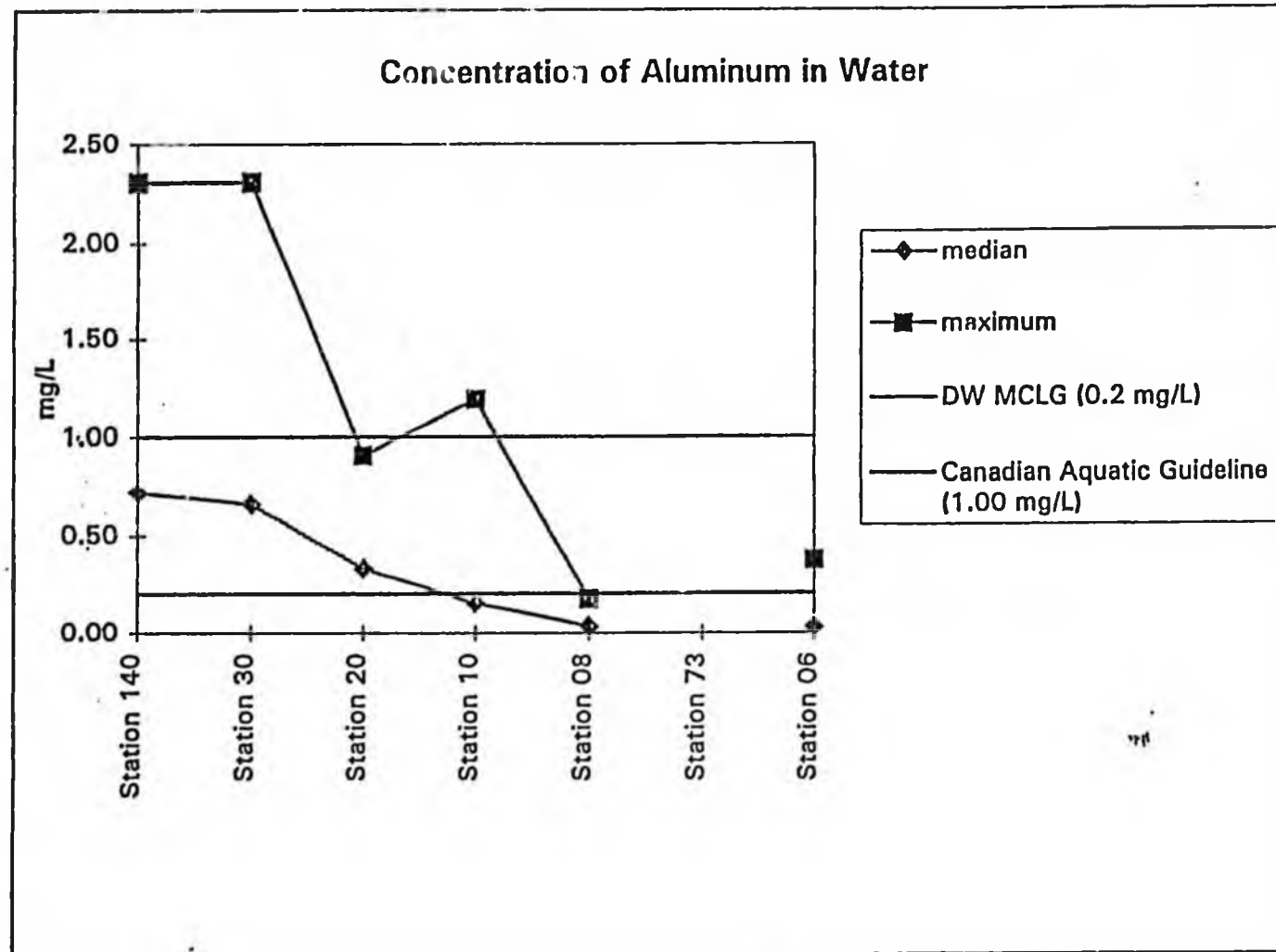
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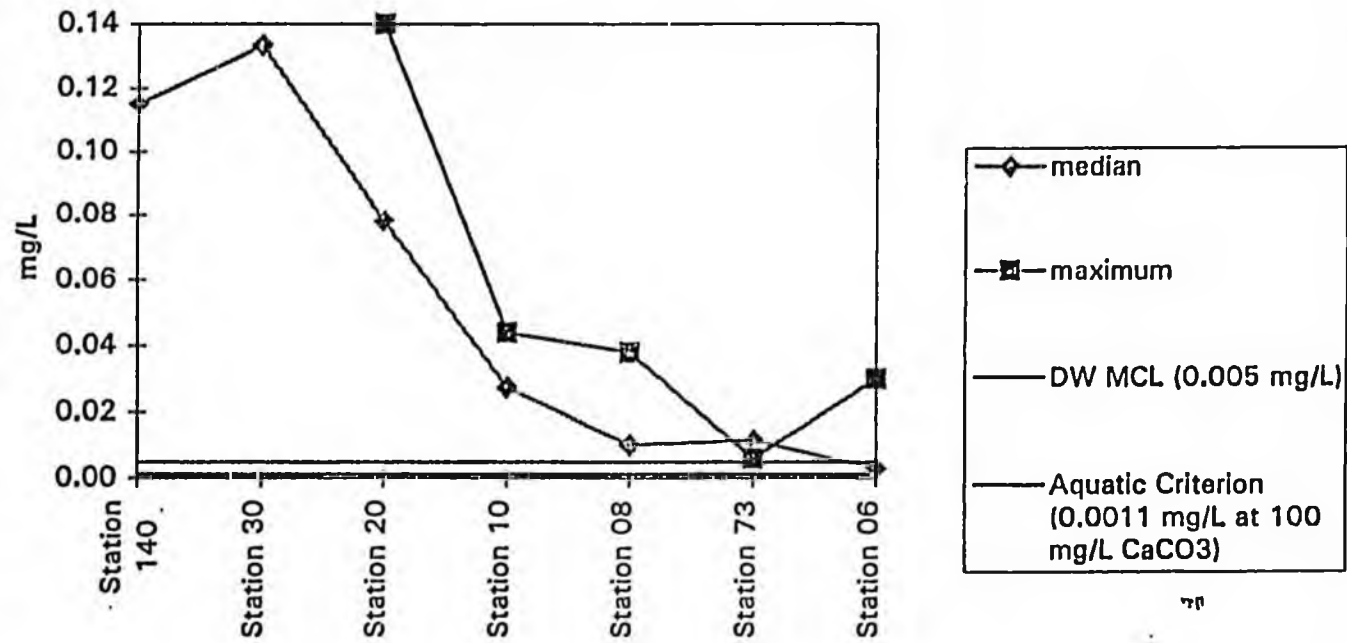
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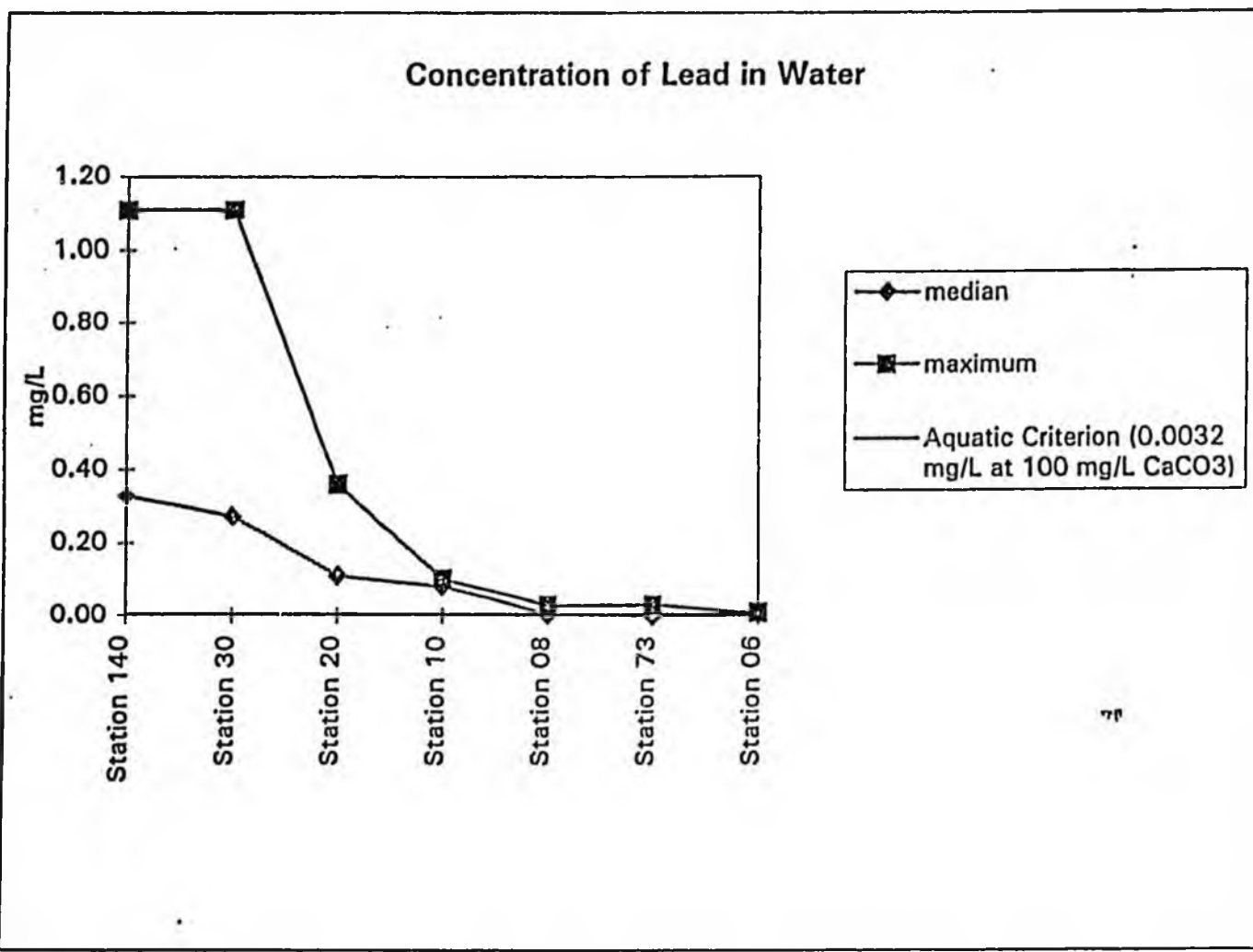


Concentration of Cadmium in Water

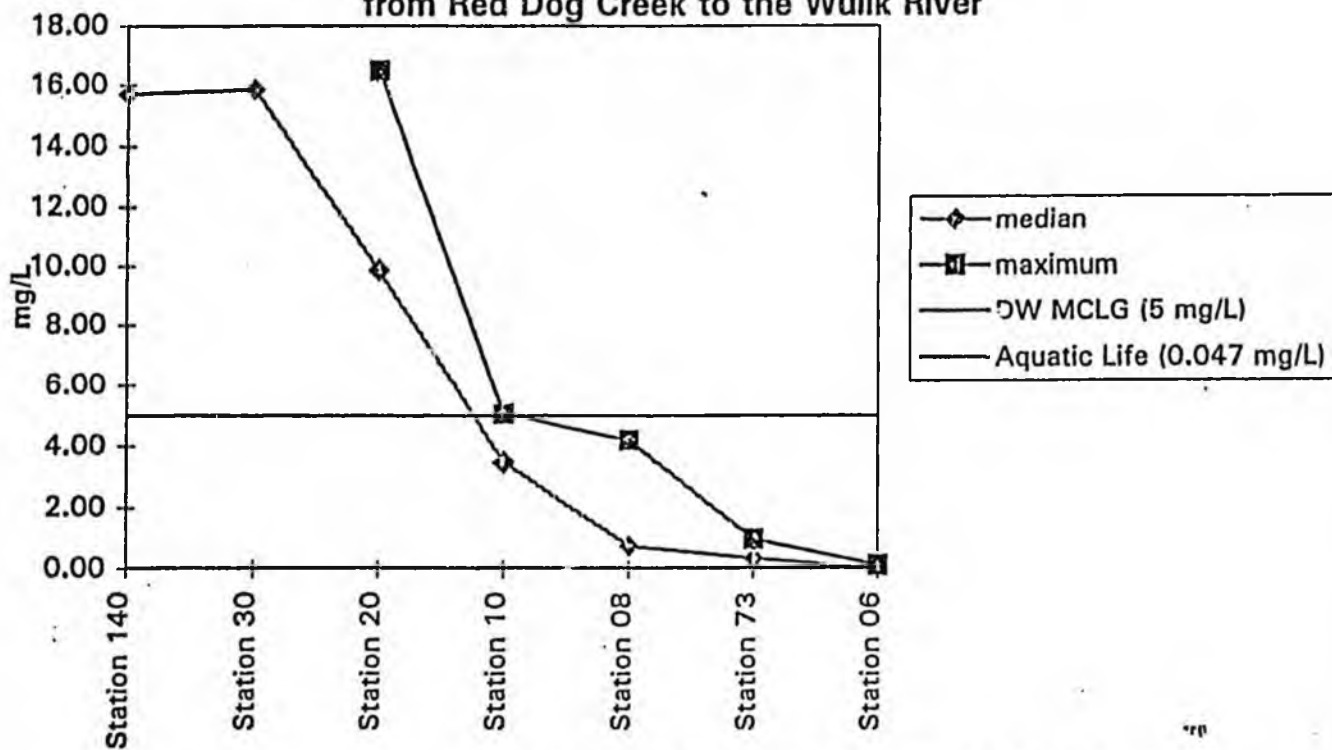


maximum at Station 140 = 0.21 mg/L
maximum at Station 30 = 0.94 mg/L

Concentration of Lead in Water

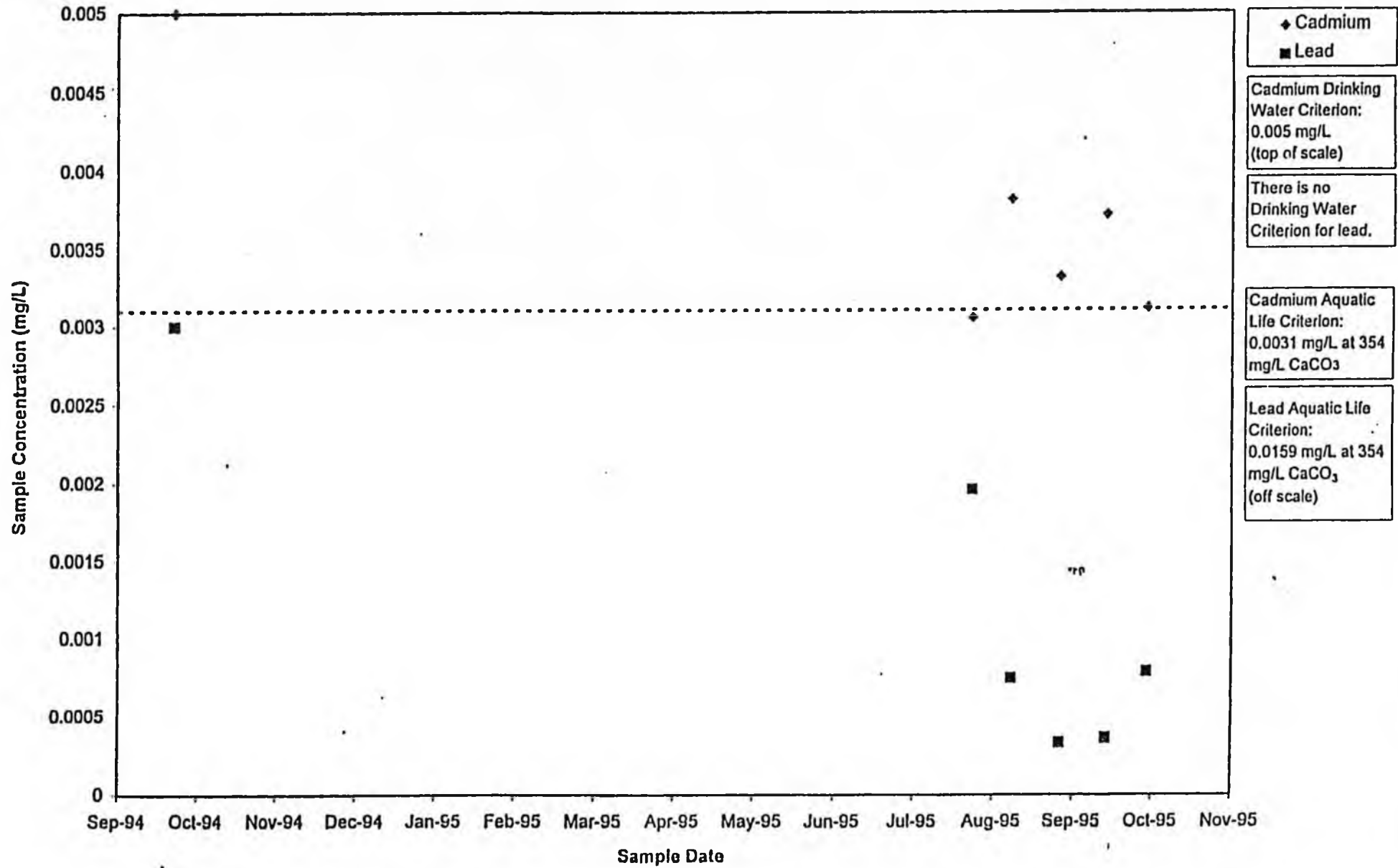


Concentration of Zinc in Water from Red Dog Creek to the Wulik River

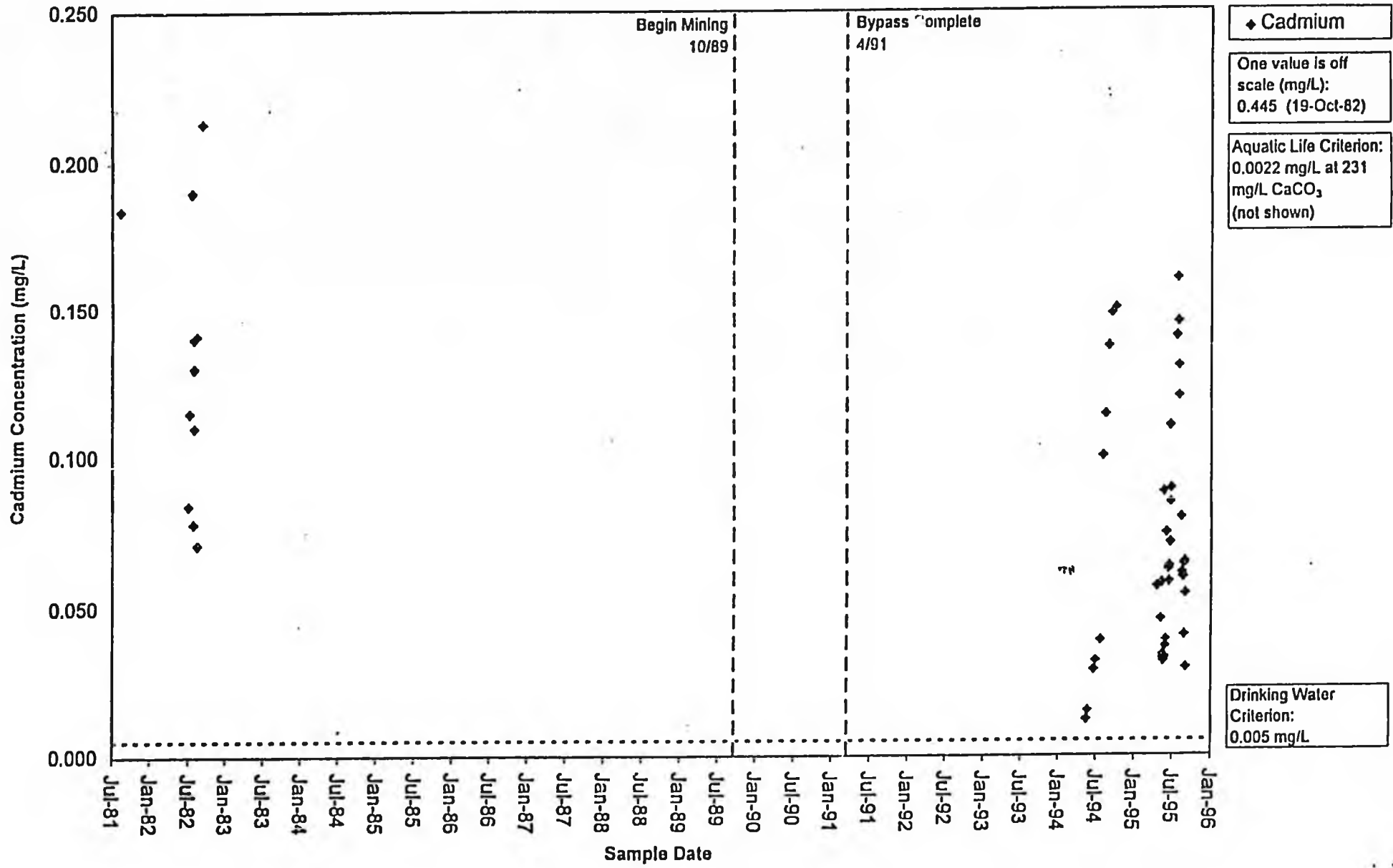


maximum at station 140 = 28.5mg/L
maximum at Station 30 = 49.8 mg/L

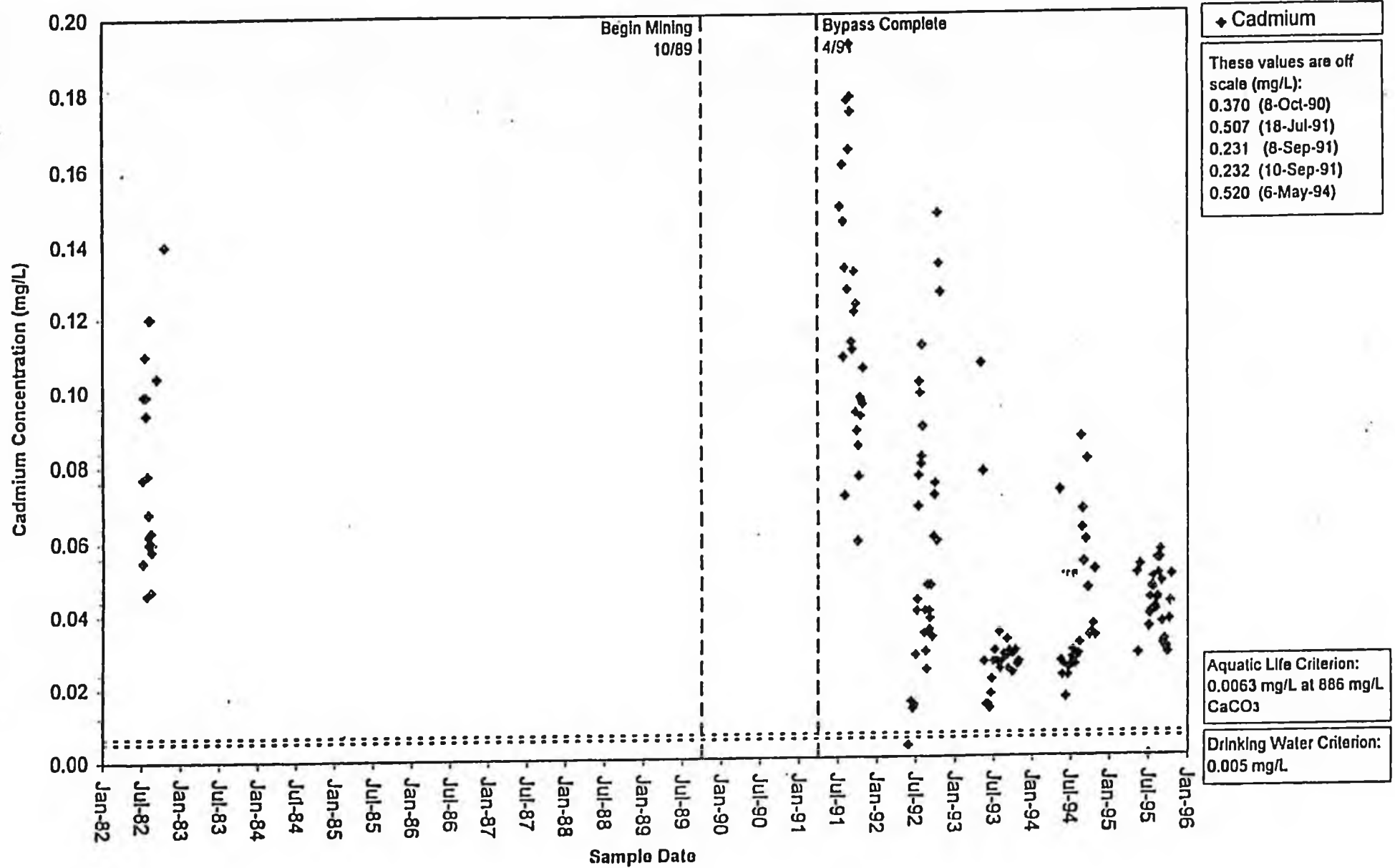
Cominco Alaska Red Dog Mine Rachael Creek Cadmium and Lead History



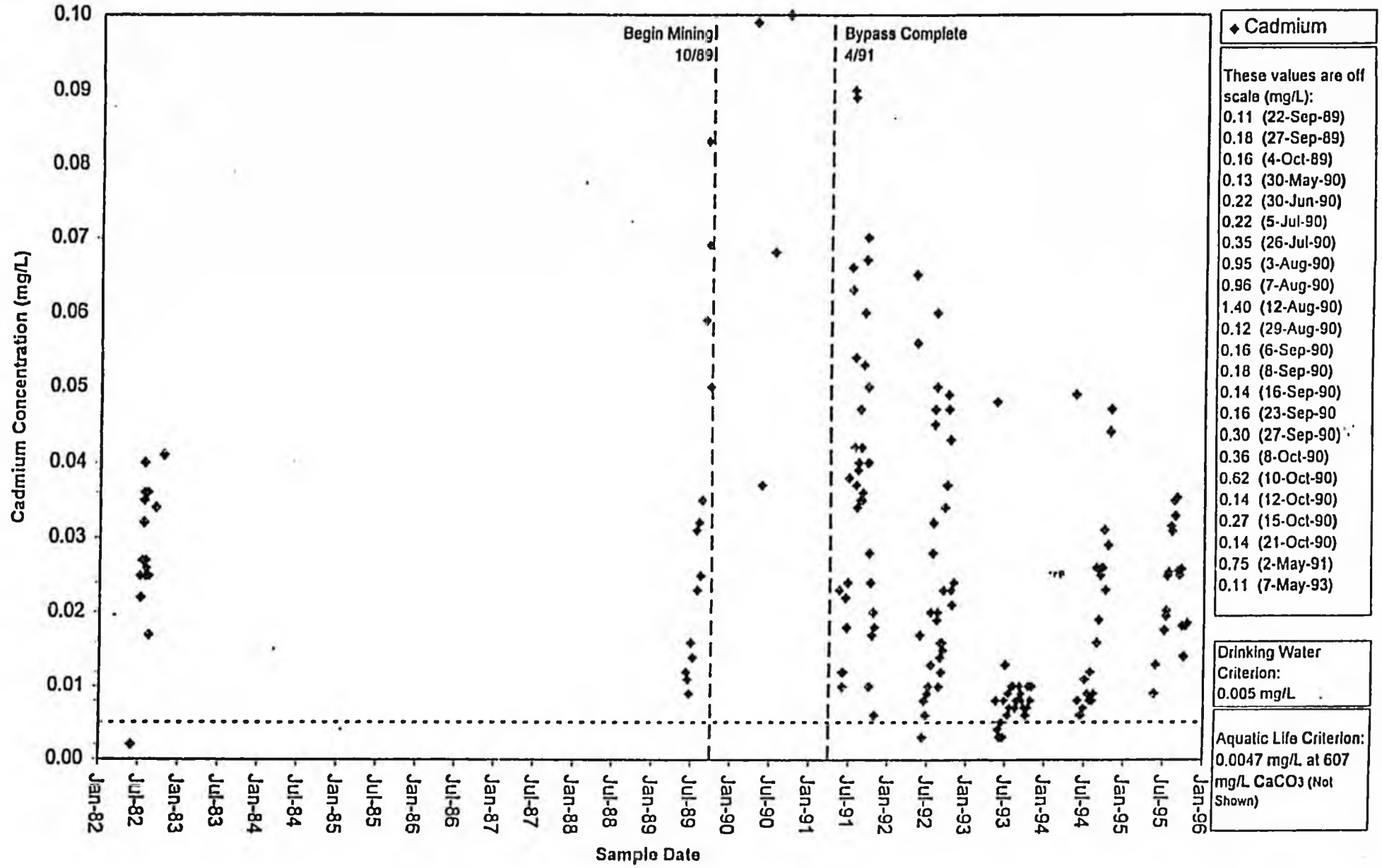
**Cominco Alaska Red Dog Mine
Station 140 Cadmium History**



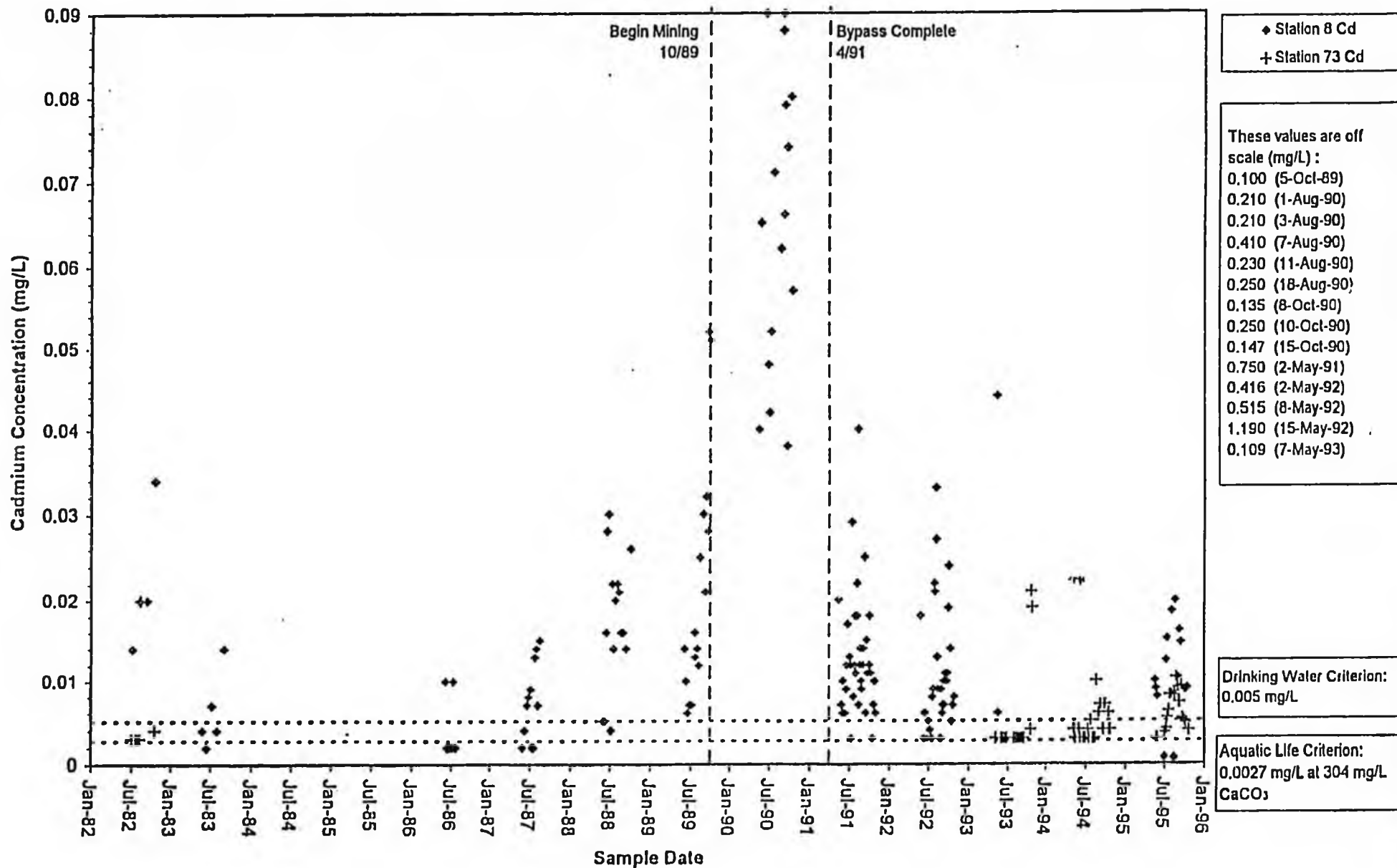
Cominco Alaska Red Dog Mine
Station 20 Cadmium History



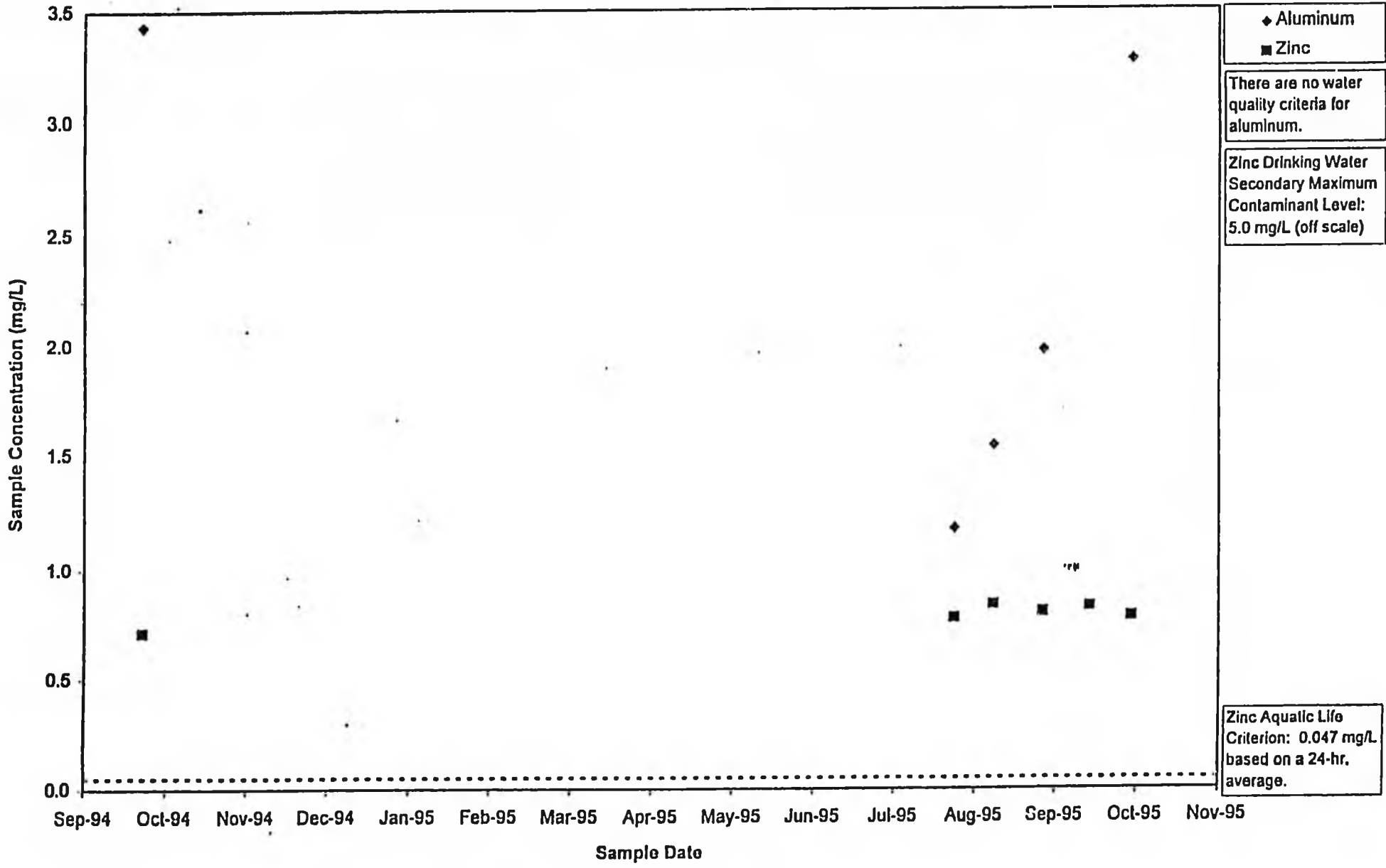
**Cominco Alaska Red Dog Mine
Station 10 Cadmium History**



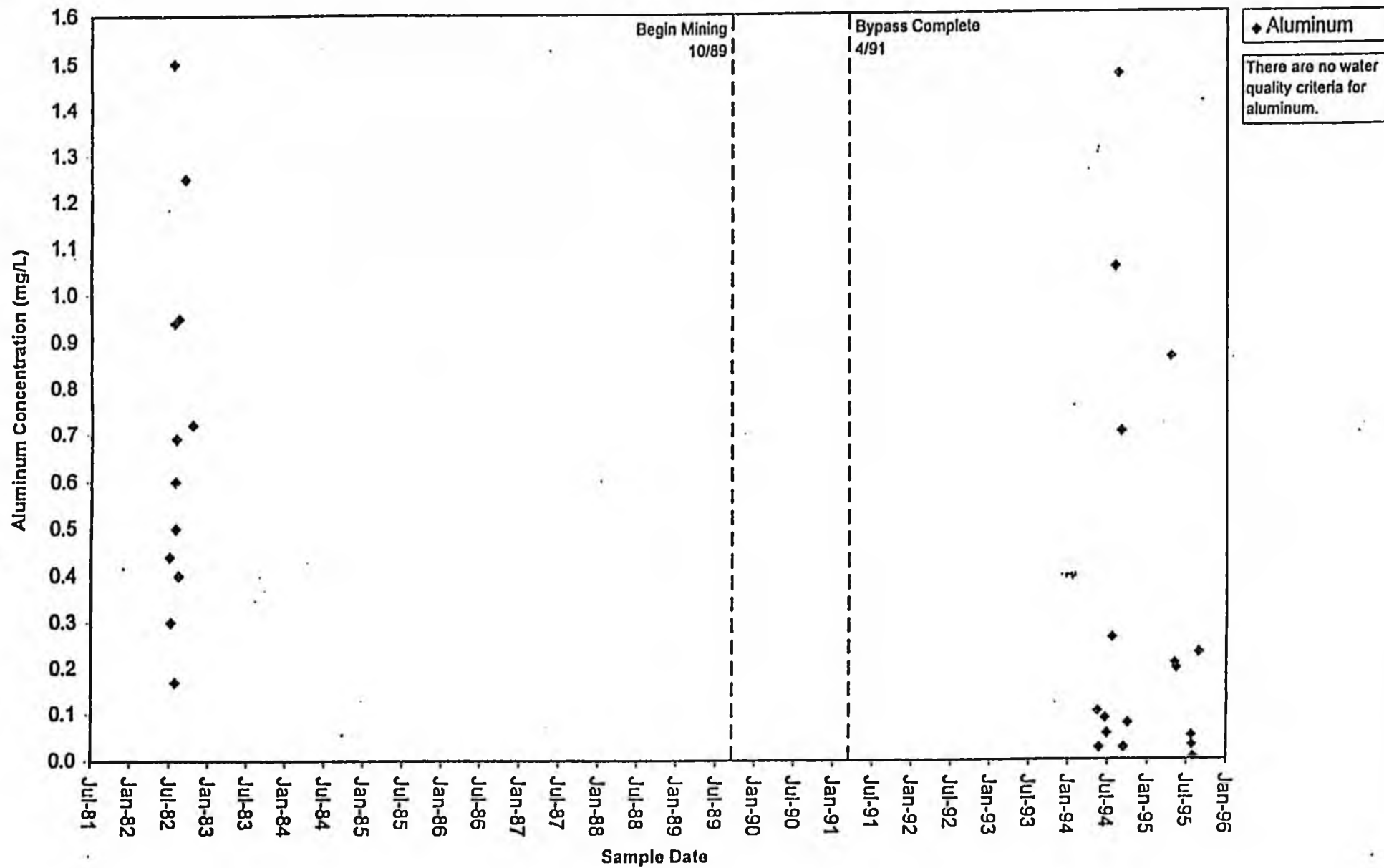
Cominco Alaska Red Dog Mine Stations 8 & 73 Cadmium History



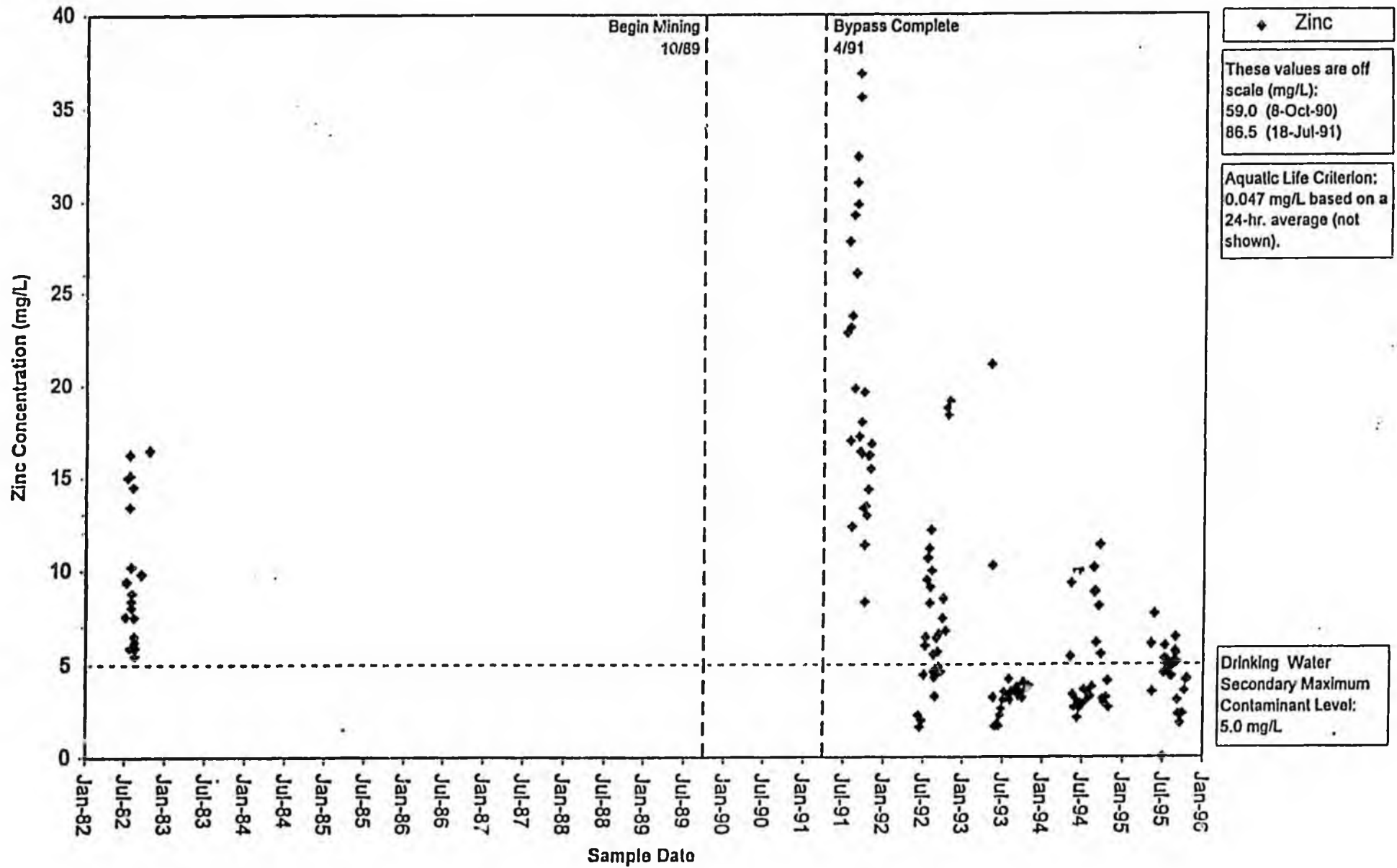
Cominco Alaska Red Dog Mine Rachael Creek Aluminum and Zinc History



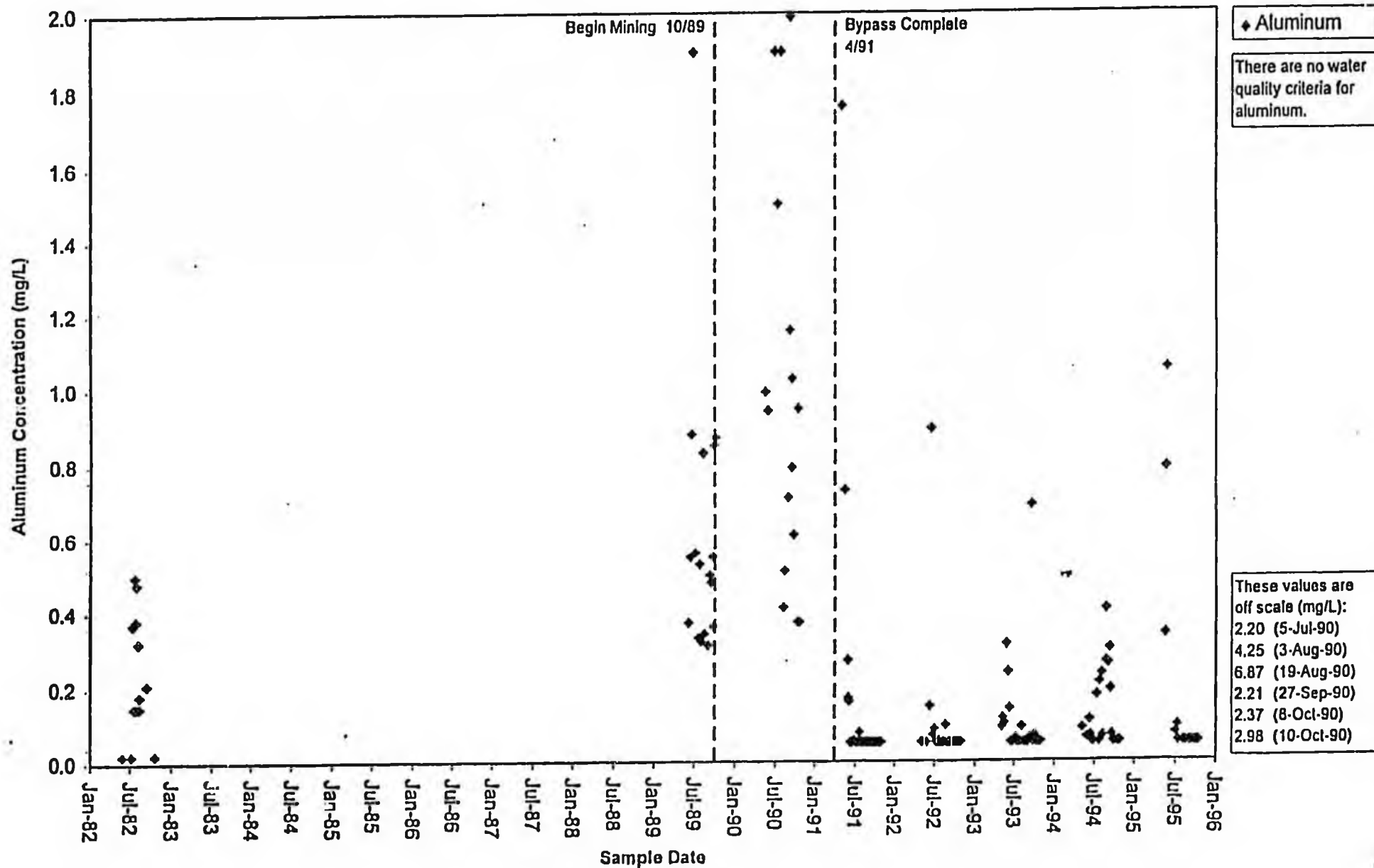
Cominco Alaska Red Dog Mine Station 140 Aluminum History



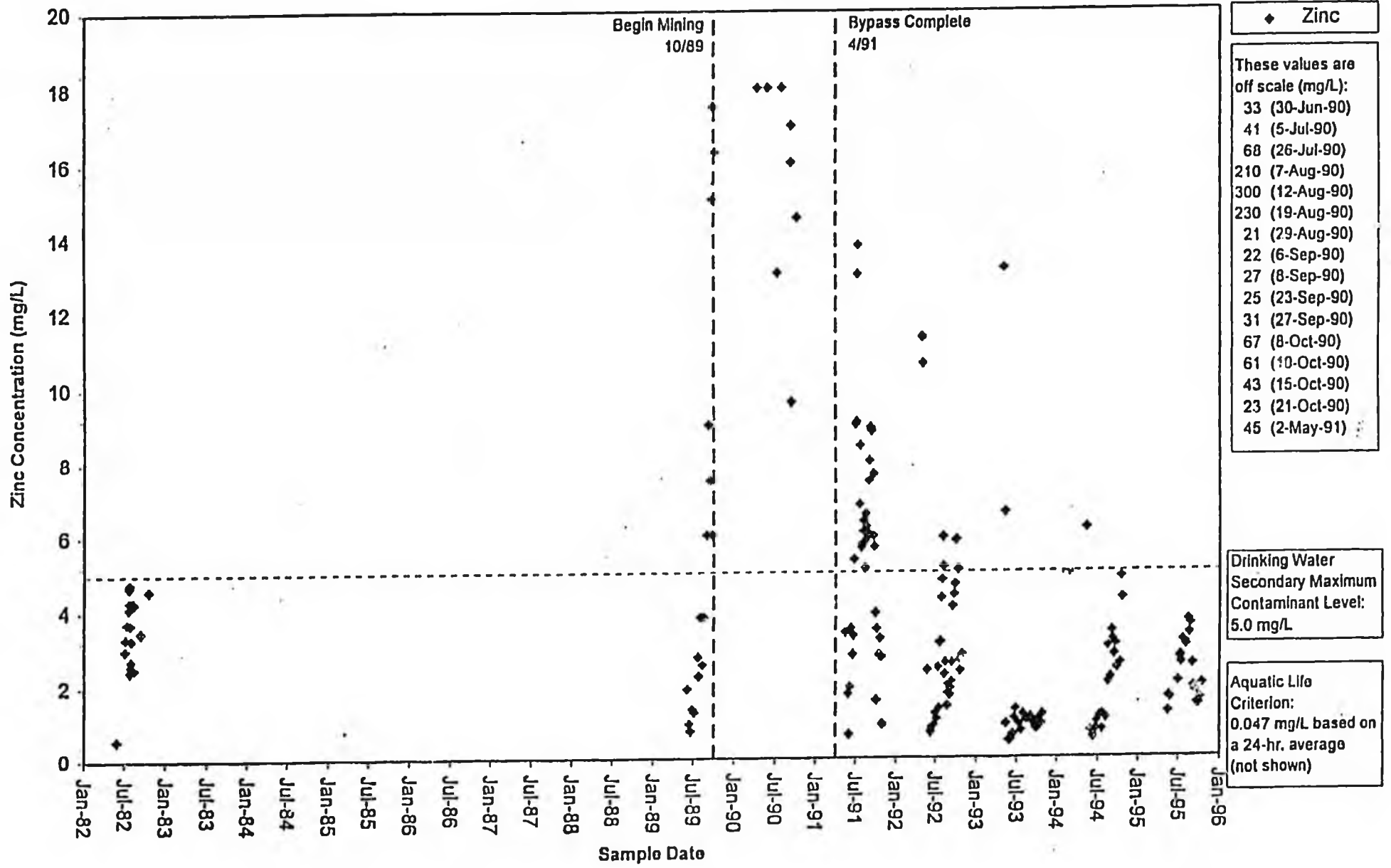
Cominco Alaska Red Dog Mine
Station 20 Zinc History



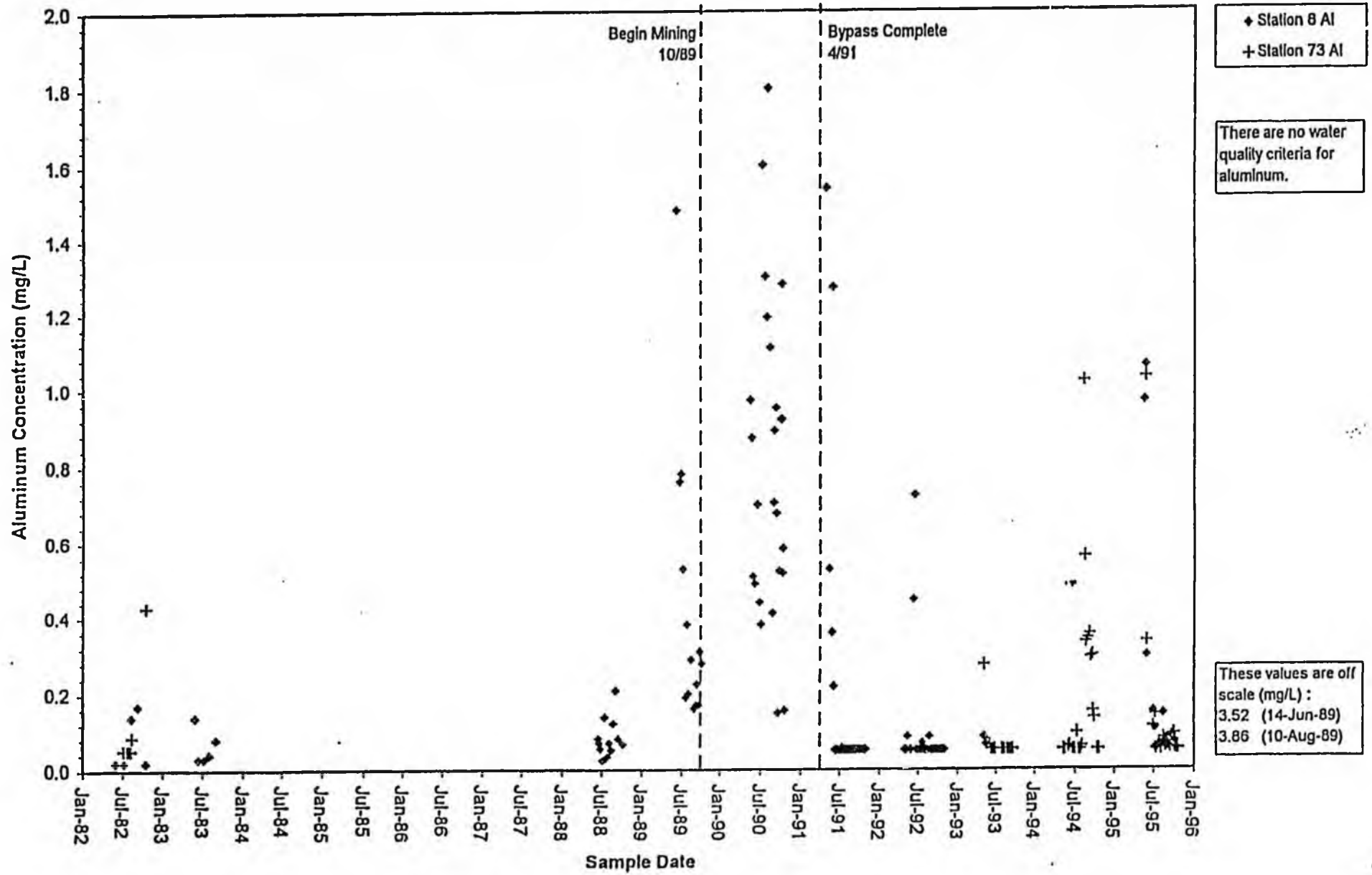
Cominco Alaska Red Dog Mine Station 10 Aluminum History



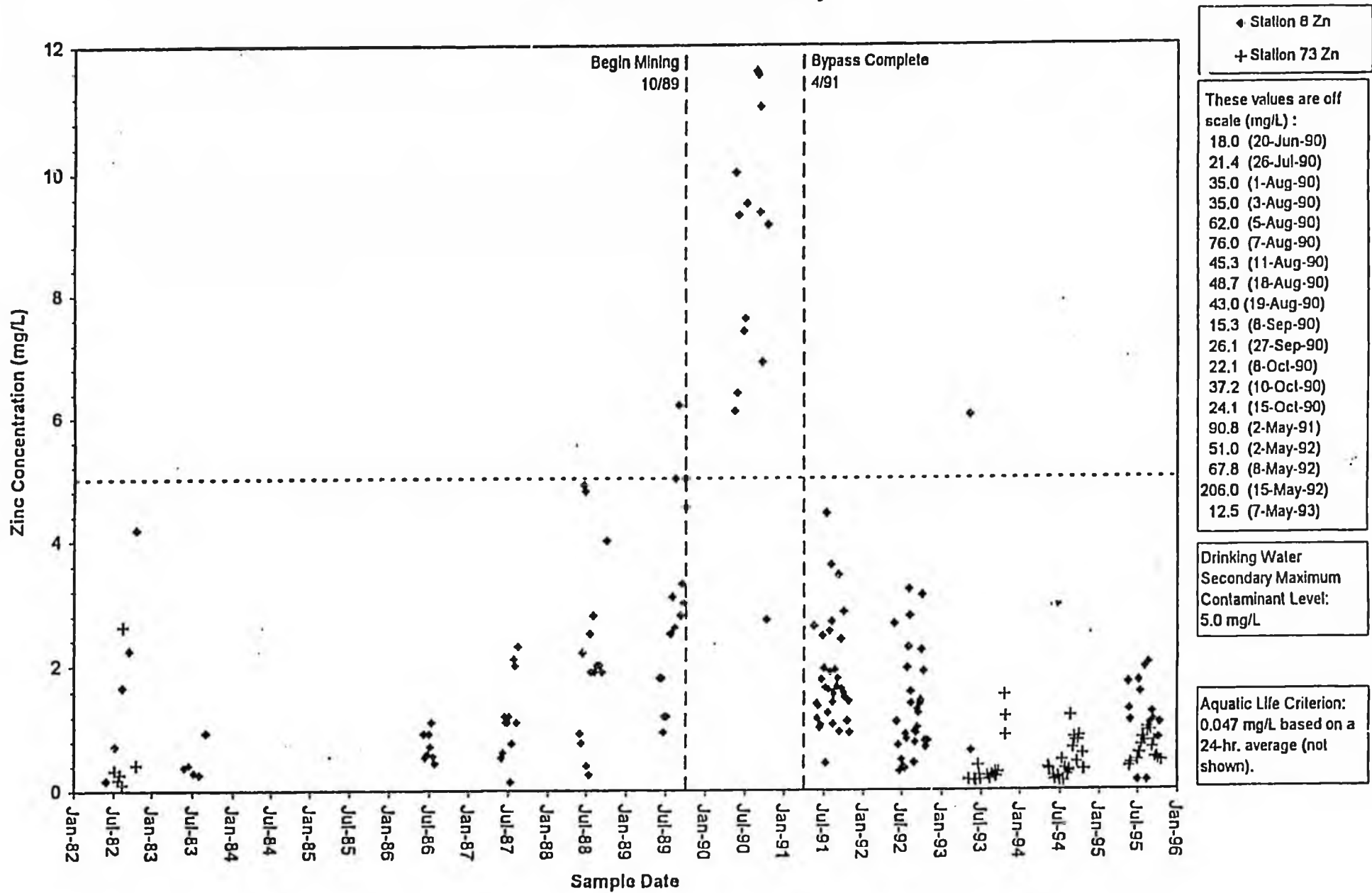
Cominco Alaska Red Dog Mine Station 10 Zinc History



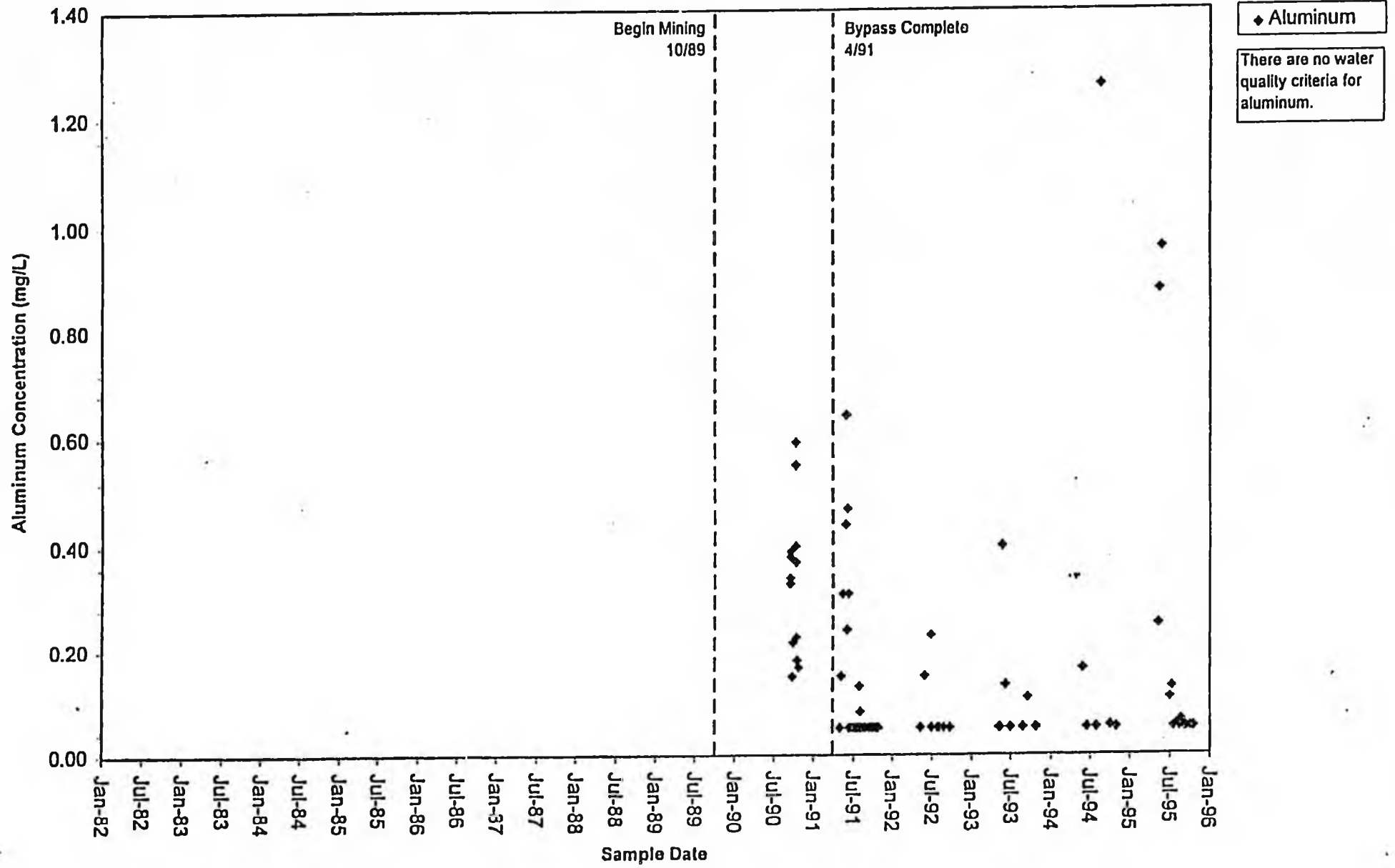
Cominco Alaska Red Dog Mine Stations 8 & 73 Aluminum History



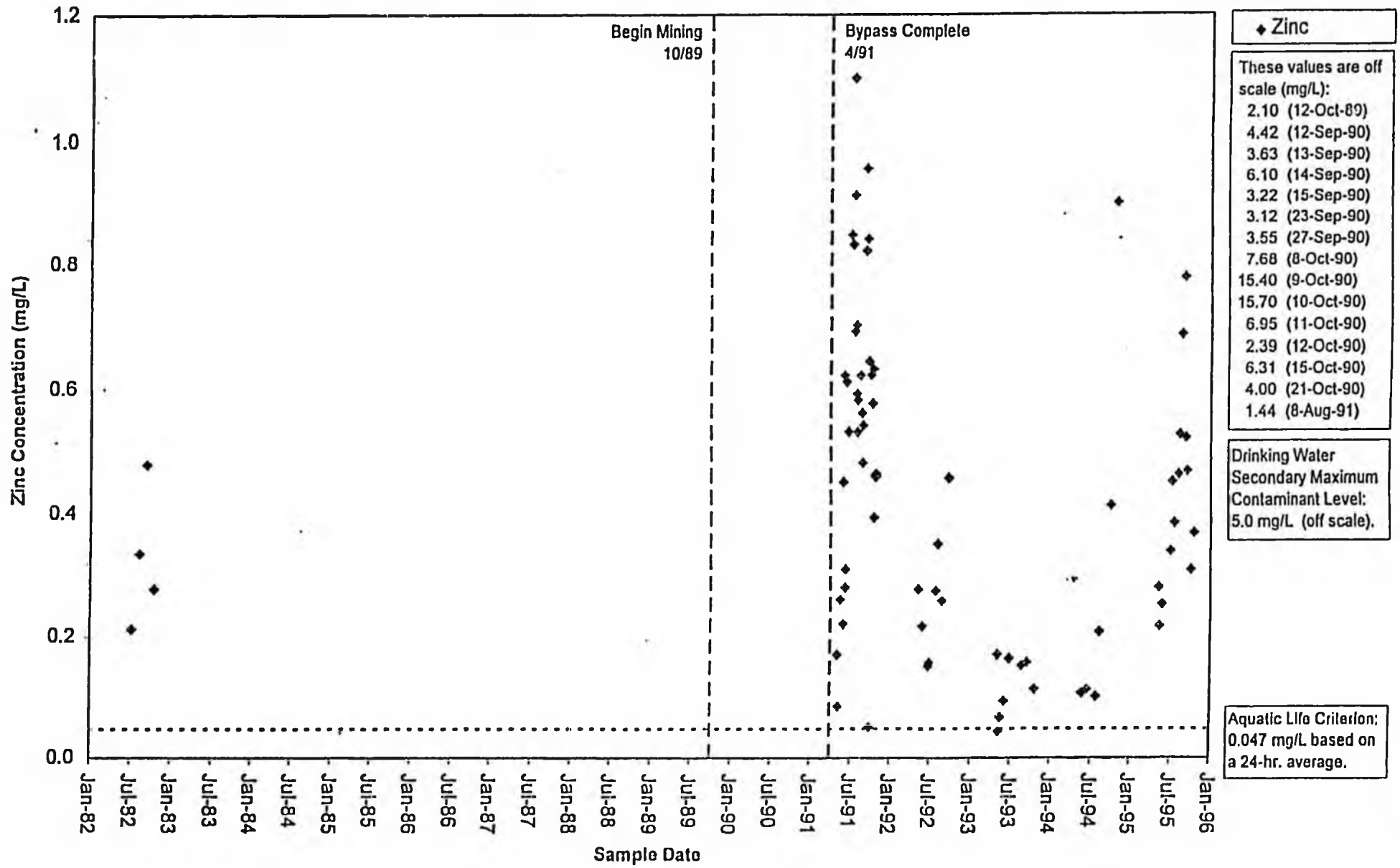
Cominco Alaska Red Dog Mine Stations 8 & 73 Zinc History



Cominco Alaska Red Dog Mine Station 7 Aluminum History



Cominco Alaska Red Dog Mine Station 7 Zinc History



STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

465-2600

BILL SHEFFIELD, GOVERNOR

POUCH D - JUNEAU 00017

May 10, 1983

Mr. Harry Noah
COMINCO Alaska
5660 "B" Street
Anchorage, Alaska 99502

Dear Mr. Noah:

Re: Red Dog Project, Preliminary
Water Quality Standards

This letter is for purpose of a discussion when you come to Juneau the week of May 16-20.

I am outlining below preliminary answers to questions posed in your April 20, 1983 letter. Since the natural water quality of Red Dog Creek is unusual, a different approach to establishing water quality standards is called for. I believe the approach outlined below protects downstream water quality, yet recognizes ambient conditions.

1. In lieu of asking for a mixing zone on Red Dog Creek, you should consider petitioning to reclassify Red Dog Creek to exclude all uses except industrial. Since background data show that natural contamination precludes some uses, reclassification may be a logical step. You should also note that mixing zone widths are limited to one third of the stream width. Water quality standards for reclassified waters, on the other hand, apply to the entire width.

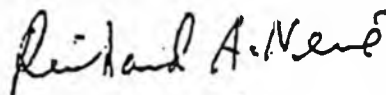
The department will be proposing changes to streamline the reclassification process by May 13, 1983. Such changes may make the process quite a bit faster, and may be worth waiting for.

2. The approach used in setting water quality standards for receiving waters in the Red Dog area was formed around the following points.
 - The quality of Ikalukrok Creek and, ultimately, the Wulik River are of primary concern.
 - COMINCO will not be asked to improve the quality of the receiving waters over natural conditions as measured during a specific time period.
 - Due to the high background levels of Cadmium, Aluminum, Lead, Zinc, and Iron, and the importance of downstream fisheries, no increase in concentrations

Mr. Harry Noah
Page 3
May 5, 1983

I invite you to comment on the approach, and the preliminary standards. You may also want to propose alternatives for consideration. I hope this information is helpful. Feel free to call if you have any questions.

Sincerely,



Richard A. Neve
Commissioner

cc: Ron Kreizenbeck
E.P.A. Alaska Operations Office
Dennis Ward, NRO
Dan Easton, WQM

CORRECTION

THE FOLLOWING DOCUMENT(S)
HAVE BEEN REFILMED TO
ASSURE LEGIBILITY OR PAGINATION



Rev. 6/98

Central Microfilm Services
Department of Education
State of Alaska

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

465-2600

BILL SHEFFIELD, GOVERNOR

POUCH 0 - JUREAU 2011

May 10, 1983

Mr. Harry Noah
COMINCO Alaska
5660 "B" Street
Anchorage, Alaska 99502

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Water Quality Standards

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The department will be proposing changes to streamline the reclassification process by May 13, 1983. Such changes may make the process quite a bit faster, and may be worth waiting for.
2. The approach used in setting water quality standards for receiving waters in the Red Dog area was formed around the following points.
 - The quality of Ikalukrok Creek and, ultimately, the Wulik River are of primary concern.
 - COMINCO will not be asked to improve the quality of the receiving waters over natural conditions as measured during a specific time period.
 - Due to the high background levels of Cadmium, Aluminum, Lead, Zinc, and Iron, and the importance of downstream fisheries, no increase in concentrations

Mr. Harry Noah
Page 2
May 5, 1983

- The results of the EPA Third Party EIS and the draft NPDES permit are not available.

Using this approach the following preliminary water quality standards for Ikalukrok Creek were derived.

<u>Substance</u> ¹	<u>Standard</u>
total hydrocarbons	15 ug/l ²
aromatic hydrocarbons	10 ug/l ²
oil and grease	no visible sheen
Zn, Cd, Al, Pb	no increase over ambient ³
pH	6.5 - 9.0
residual mill process reagents	to be developed as substances are identified

¹Other substances may be identified through the EIS or further research and added.

²The standards for hydrocarbons are maximums, and may be reduced to values of 0.01 x 96-hour LC₅₀ for resident species if such information is, or becomes available.

³Specific concentrations are not available at this time. A statistical approach may be necessary to predict natural variation. The department is examining this option.

3. COMINCO should expect to monitor water quality at, at least, the following three points:

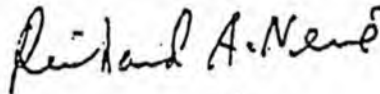
- On Ikalukrok Creek below Red Dog Creek to determine compliance with the water quality standards.
- On Red Dog Creek just upstream of Ikalukrok Creek, and on Ikalukrok Creek upstream of Red Dog Creek to determine relative pollutant loading to Ikalukrok Creek from both its headwaters and Red Dog Creek.

Monitoring frequencies cannot be projected at this time.

Mr. Harry Noah
Page 3
May 5, 1983

I invite you to comment on the approach, and the preliminary standards. You may also want to propose alternatives for consideration. I hope this information is helpful. Feel free to call if you have any questions.

Sincerely,



Richard A. Neve
Commissioner

cc: Ron Kreizenbeck
E.P.A. Alaska Operations Office
Dennis Ward, NRO
Dan Easton, WQM

March 3, 1996

Joyce Beelman
Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, Alaska 99709 - 3643



Cominco Alaska

A Subsidiary of Cominco American Incorporated

Dear Ms Beelman:

This letter is to provide support for the assumption that baseline data from the early 1980's is equivalent to existing/November 28, 1975 water quality conditions.

Development of the mine site primarily started in 1987. Prior to this time, activities were limited to exploration work and a temporary field camp. A small gravel airstrip to accommodate small aircraft was located at the mouth of Red Dog Creek, at the confluence with Ikalukrok Creek.

The following lists the chronological development around the Red Dog Mine:

- **1960's - 70's** BLM, as well as several private interested parties were doing geological surveys in this area. This primarily consisted of collecting surface rock samples and mapping the geologic types. Transportation around the area was based out of a small base camps. The base camp was helicopter or small plane accessed, with collection done on foot.
- **1980's up to mine development in 1988** Helicopter supported diamond drilling was done throughout the area to define the orebody. No heavy equipment or surface disruption occurred prior to 1988. There was a Cat train from the LIK airstrip to South Fork Red Dog Creek in 1981, but this was a low ground pressure vehicle traveling over snow overlying frozen ground and would not have created any impact. Personnel were housed in a small tent camp located along South Fork Red Dog Creek.
- **1983** The airstrip, located along Buddy Creek was first constructed.
- **1987** The airport, located along the Buddy Creek drainage was being expanded from a small strip to one large enough to accommodate cargo planes.
- **1987** Pads were being developed above Middle Fork Red Dog Creek for placement of the accommodations, mill, and service facilities.
- **1987** Diversion ditches were constructed along the west side of South Fork Red Dog Creek. These ditches were put in place to divert water away from this drainage and minimize flow into the future tailings impoundment. Necessary preparatory work to allow for tailing dam construction.

- 1987 The ground was being prepared for the Kivalina Waste Storage Site. This is located at the water break between the South Fork Red Dog Creek drainage and the Bons Creek drainage.
- 1988 Stripping of the overburden from the ore deposit (above Middle Fork Red Dog Creek) was initiated and overburden was stockpiled at the Kivalina Storage Site.
- 1988 Exploration started to involve surface disturbance and the use of heavy equipment.
- 1988 Construction was initiated on the tailing dam at the mouth of South Fork Red Dog Creek.
- 1989 The road from the port to the mine site was completed. This allowed for the modular facilities to be brought in and erected.
- 1989 In November the first ore was processed in the mill. Discharge from the waste water treatment facility was initiated.

A review of the data shows no indication of water quality impacts until 1989. This would be associated with the removal of the overburden and the thawing of the underlying permafrost. Numerous seeps were observed at this time and are thought to be groundwater liberated from the orebody due to the thawing activity.

Sincerely,

Charlotte L. MacCay

Charlotte L. MacCay
Senior Administrator, Environmental and Regulatory Affairs

cc: P. Milam EPA
S. Brough EPA
P. Weber ADF&G
C. Leonard Attn. Gen. Office
L Hartig Hartig, Rhodes
E. Ballard Ballard & Assoc.
JLK/file - RDG, file - Homer

DEPT. OF ENVIRONMENTAL CONSERVATION
Division of Air and Water Quality
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July 8, 1996

Charlotte L. MacCay
Senior Administrator, Environmental & Regulatory Affairs
Cominco Alaska Inc.
2137 Foraker Drive
Anchorage, Alaska, 99517

Dear Charlotte:

We are sending you a copy our recommendations for Reclassification for segments of Red Dog and Ikalukrok Creeks (Phase One), so that you may review them before we meet on July 9, 1996 in Juneau. Also enclosed is a copy of the amended Table 4, Use Attainability Analysis Matrix.

Recommended Additional Sampling for Phase Two Reclassification

As you will note in the final section, we recommend retention of aquatic life protection in Sulfur and Shelly Creeks. We agree with EPA that these simplified communities need further study to determine "biotic integrity". Biotic integrity is defined as "a balanced, integrated, adaptive community of organisms having species composition diversity and functional organization comparable to that of natural habitat of the region". This definition comes from a paper by Karr & Dudley "Ecological Prospective on Water Quality Goals" in Environmental Management, 1981. We recommend that additional aquatic life sampling be done at Connie, Shelly and Sulfur Creeks, as well as at some stream in the area known to have non-existent or low mineralization; e.g., Dudd Creek. The intent of this recommended sampling would be to determine what constitutes a self-sustaining or robust community, worthy of aquatic life protection under 18 AAC 70.020(a)(1)(C).

Regarding Reclassification of Ikalukrok Creek above its confluence with Red Dog Creek and the North Fork Red Dog Creek (Phase Two), we recommend that water quality samples be taken this field season on tributaries to these two larger water bodies, where you suspect mineralization. Water quality data at Ikalukrok Creek above its confluence with Red Dog Creek (Station 9) and North Fork Red Dog Creek (Station 12) show occasional high metals concentrations which may be due to one or more of the upstream tributaries. Based on the available baseline data at Station 9 and 12 alone, the Department would not consider reclassification of waters above these stations. However, water quality sampling on upstream tributaries may support reclassification on some of these tributaries where there is natural mineralization.

July 8, 1996

Since no aquatic life information is available above Stations 12 and 9, we also recommend that sampling be done on those tributaries where you suspect mineralization. We caution that in the case of both water quality and aquatic life sampling, one set of samples in 1996 may not be adequate to proceed with your reclassification request.

Recommended Aquatic Life Sampling for TDS Site Specific Criterion Determination

We appreciate your recent work with us on the proposed laboratory studies regarding Total Dissolved Solids (TDS). We hope that the results of these studies are positive and will enable us to determine that a site specific criterion is appropriate for this parameter. We recommend that aquatic life sampling be done at Station 6. Sampling at this station would identify any changes to the aquatic community due to TDS and determine if biotic integrity persists, even with TDS increases in water. A healthy community would certainly support a TDS SSC determination.

Sincerely,



Joyce Beelman
Red Dog Project Team Leader

JB/rg {K:\EQ\RDRCLS.LET}

enc. Reclassification Recommendations and Matrix

cc: Sally Brough, USEPA, Seattle
Phyllis Weber Scannell, ADF&G, Fairbanks
Cameron Leonard, Attorney General, Fairbanks
Pete McGee, ADEC, Fairbanks
Mike Conway, ADEC, Juneau
Len Verrelli, ADEC, Juneau

APPENDIX E

KIVALINA & NOATAK PUBLIC HEARINGS (May 13, 1996)
KOTZEBUE PUBLIC MEETING (May 14, 1996)
{NOTES FROM VIDEO}

Reclassification: Red Dog and Ikatukrok Creeks.

Presenters: Joyce Beelman, ADEC; Phyllis Weber-Scannell, ADF&G; Roland Booth, Translator

Note: ADEC used a topographical map of the area with overlays to show the proposed protected use reclassifications during the presentation. At each workshop which preceded the public hearing or meeting, the attached list of possible questions and answers was distributed).

Below is a summary of the public hearing comments, concerns and questions:

Kivalina, May 13, 1996 - Public Workshop and Hearing

*ADEC Question: Do you boat up or go up Ikalukrok Creek? In summer? In winter?
Do you use this creek in any way, at any time of year?

Local Responses: You can only get into the Ikalukrok when the water is high. Except for spring breakup, it's too low. Even in the rainy season, its too low. Jet boats or air boats might be able to get up into the Ik in summer. In January, it's dry, frozen. You could go up the Ik to look for game. The only time you would go up the Ik would be in the winter via snow machine. No one ever drinks water from the Ik, so we don't know of anyone getting sick from drinking it.

Bons Creek area was used for reindeer herding during WWII. There was calving in this area and a winter roundup. A shelter cabin was used and is still out there, water was used for drinking. Reindeer herding took place along the edge of the mountains in the Bons Creek and Dudd Creek areas, not Ikalukrok area. The reindeer were healthy. No one used the Ik for drinking water, since they weren't over there.

No one fishes in the Ik. In the summer fishing is at the mouth of the Wulik River, close to Kivalina. In winter there is traditional fishing up the Wulik. One winter site, Oren's camp, is a deep pool area in the Wulik River, at the base of a small mountain (the 2nd mountain upstream), some 3-4 miles above the fork (Wulik and Ikalukrok). The other site is a couple miles below this fork.

*ADEC Question: Any plans to farm or fish farm at Ikalukrok or Red Dog Creeks?
No affirmative response.

Summary:

Kivalina residents do not go up Ikalukrok Creek in summer; do not drink the water, do not fish there. Ikalukrok Creek would only be navigable using traditional boats at breakup, or jet/air boats during the rest of the open water season. Kivalina residents might use Ikalukrok Creek on snow machines to hunt game in winter.

Kivalina residents do not use Ikalukrok Creek or Red Dog Creek for fishing in the winter. Instead they use the Wulik River for traditional winter fishing.

Reindeer herding did not occur near the Ikalukrok and Red Dog Creek drainages. Instead it occurred where there is good water quality near the Bons and Dudd Creek drainages.

Kivalina villagers confirm that Ikalukrok Creek and Red Dog Creek were not used, and no one anticipates using these drainages for the following state protected water quality uses: Water Supply: drinking water, agricultural, aquacultural, and Contact Recreation in summer or winter (water frozen).

Kivalina villagers indicated the following regarding Secondary recreation uses: No summer use; possible winter use (game hunting via snow machine.)

**Miscellaneous questions/comments from villagers:*

Villagers said they melt ice for drinking water in winter when they are outside the village. The state commented that this is good because free water under ice has metals. One villager commented that there is a spring at a bend in the Wulik River, northwest of the Red Dog Mine, which has a sulfur smell.

One villager noted that old-timers commented on the mineralization of the area, and that they joked that the fish might be skinny or fat because of the mineralization.

**Does DEC have water quality results from pre-mining days?*

Response: Yes, it appears that water quality (metals) was the same or a little better now than pre-mining days.

**Frank Stein suggested the following language, "protected to a lower standard" rather than "is no longer protected for..."*

Response: DEC agreed and will make that distinction in future discussions. For example, if a use is removed from a creek section, as a result of this public process, ADEC will clarify that this creek section is protected to a lower standard, but still protected for other uses.

**Has Bons Creek water quality been tested?*

Response: Yes, it is tested regularly because it is the drinking water source for Red Dog Mine.

**Is water quality checked in the Wulik River at the tank several miles below Driver's camp?*

Response: Yes, this is Station 2 and is regularly tested during open-water conditions, as is required in the Red Dog Mine permit.

**Do you test sediment during the winter?*

Response: No, because Red Dog Mine does not discharge in winter.

**If DEC reclassifies these creeks, will we no longer be allowed up there?*

Response: Traditional uses, such as winter hunting, would continue and would not be prohibited. To remove a use, it cannot have existed in the past.

*If ADEC reclassifies Ikalukrok Creek and Red Dog Creek, will water quality monitoring stop? Will there be monitoring in the Wulik?

Response: As long as the Red Dog Mine discharges wastewater, water quality monitoring will continue. This is required in Cominco's permits. Sampling stations are set up in Red Dog Creek, Ikalukrok Creek and the Wulik River.

*Fishermen asked about fish health. They observed that fish coming into fresh water from the ocean were healthy, but fish leaving the fresh water system had tape worms. Some of these were sent to ADF&G, Fairbanks. What causes tapeworms in fish? Can these tapeworms live in humans?

Response: Phyllis Weber Scannell explained that the tape worm is a fresh water parasite and that there are normal fluctuations in its population. She would find out if this species can live in humans.

*How are the fish?

Response: Dr. Weber Scannell explained that there is some slight metals increases in lead and cadmium in the fish that ADF&G samples in the summer, but that they are safe to eat. She eats them.

Noatak, Public Workshop and Hearing

The same topographical map with overlays was used. Charlotte MacCay, Cominco Alaska Inc. and Cameron Leonard, Attorney for the State of Alaska joined the previously listed presenters. After the workshop presentation, were the following public hearing comments, concerns and questions.

*ADEC Questions: How do you use Red Dog and Ikalukrok Creeks? Do you use them for fishing, hunting?

Local Responses: In Winter for Arctic Char fishing through the ice in the Wulik only. (One fisherman had gone 3 times to Wulik this past winter.)

We just use the Wulik for fishing in winter; hunting too in winter (Ikalukrok and Wulik)

No fishing in Red Dog Creek or the Ikalukrok. Locals have seen lots of color in cooking pots, metals coming out.

Hunting occurs near Red Dog Mine, snow machine use. Wildlife include wolf, wolverine, sheep, caribou. There is a shelter cabin at the mountains; we hunt all along the mountains. We travel from village of Noatak in northwest direction towards Point Hope. Winter trails cross over Red Dog Creek, Ikalukrok Creek and Wulik River.

There's lots of caribou hunting occurs between Noatak village and Wulik River along mine haul road during winter.

*What do you use for drinking water?

Response: When its more than a day trip, we chip ice for water. If no ice, then we melt snow.

*Do you hunt in the Red Dog drainage now?

Response: No, it's prohibited and too much traffic. Before, yes hunting did occur.

*Have you ever waded in Red Dog or Ikalukrok Creeks? Swimming? Any contact recreation activities? No.

*Any farming? No.

-Summary-

Noatak villagers do not use Red Dog or Ikalukrok Creeks for any type of Water Supply: drinking water, agriculture or aquaculture. Red Dog and Ikalukrok Creeks are not used for any Contact Recreational activities. There are no Secondary Recreational activities in summer, but in winter Noatak villagers hunt and camp near these creeks in the winter. Winter trails cross over Red Dog and Ikalukrok Creeks for hunting, and also to reach Wulik River fishing sites.

-Miscellaneous comments/questions from locals and responses:

About Reclassification-

*Questions: What are the present standards and what would reclassification changes mean? Will reclassification change the water quality?

Responses: The present standards protect all uses. The river is protected to a standard that it does not meet naturally, that is, to a standard higher than the river really has. The original classification was wrong. Water quality would not change because of reclassification. The river is already polluted naturally. The intent of the reclassification process is to match the real protected uses of the stream/s with the regulations.

* Does the reclassification lower standards ; e.g., lead in the water, in the discharge? The mining company would not be allowed to increase the metals in the creek above historical concentrations. In fact, the permit requirements are getting more stringent.

*How would this reclassification affect other areas? It wouldn't. New mining areas would need new permits for wastewater discharges. An Environmental Impact Statement is necessary and the public would get the opportunity to review it.

*Question: Will this reclassification set a precedent for other mining streams?

Response: It may; if other streams are protected for uses which do not actually exist, there may be requests to correct the regulations to match the real situation.

-About health of fish-

*Comment: After the mine opened, I saw a healthy looking fish die. It looked healthy. The fish was sent to ADF&G. Was it tested?

Response: Dr. Phyllis Weber Scannell said the fish was tested and it was eatable. Dr. Weber Scannell stated that she eats fish in this drainage.

-About health of caribou-

*Questions: What about the caribou? What kind of sickness do animals get from the ore body, the dust with metals? Metals toxic? Some caribou hunted had liver which didn't look normal. If

people eat caribou that are sick, do people get that sickness?

Response: Phyllis Weber Scannell said that caribou don't stay in the same area all the time. All animals concentrate metals over the years (lead in the liver, cadmium in the kidney). Caribou don't graze on ore because there are not plants. It would be hard to say that caribou are sick because of the ore body.

*Question: What were the results of the recent tests for metals and radioactivity?

Response: The North Slope Borough and ADF&G took (sacrificed) 15 caribou. One of the local people, Mr. Gillespie, participated in this hunt. He was told that results would not be available for about six months.

-About mining activities-

*Questions about the tailings impoundment: Has it changed in size since mine startup?

Now that the mine is expanding, will the dam overflow? Is the bottom of dam toxic?

Responses from Charlotte MacCay, Cominco: The size of the tailings impoundment has not changed, but tailings increase each year. The bottom of the dam is toxic, as was expected to be. It is the tailings of the mining activity.

*Is the tailings impoundment leaking?

Cominco Response: There was an event 3-4 years ago, when the seepage pond below the tailings impoundment overtopped because the alarm was broken. Now this alarm system is fixed and mining personnel visit the site twice a shift to check water levels.

*What about the tailings impoundment when mining done? What plans are there to make sure that the children and grandchildren of local people are not affected? Will there be compensations to villages, because of risk?

Cominco Response: There is a Reclamation plan which calls for freezing these tailings and cover them with non-toxic cover. This plan is reviewed every 3 years. There is no plan for compensation to the villages. Cominco will monitor the water, etc. until it is sure that no everything is frozen and safe.

ADEC promised a copy of the present ADNR Reclamations Plan, to the appropriate village leader.

*As Cominco expands to the new area, will the tailings impoundment fill up and overtop?

Response by Charlotte MacCay: No decisions have been made about the new area. When there are design plans for the new area, there will be a public process to discuss them.

*Question: If there are new mining areas (like upper Ikalukrok), is there public process for comments regarding development?

Response: Yes, an Environmental Impact Statement would be required at all new mining areas where a new wastewater discharge is requested.

-Air Quality Questions-

*Question: Is mining dust hurting the caribou? The village of Noatak? Metals dust poisoning?

Response by Charlotte MacCay: There have been 15 spills from trucks along the road. Cominco is checking these sites to make sure they are cleaned up.

*Frank Onalik Question: What about blasting? Wind picks up the blasted material. The creek it might get into (Evang.) drains to the village of Noatak.

Charlotte MacCay Response: The air regulations require air modeling to make sure that the mining activities meet air standards when crossing the property boundaries. Blasting is obvious but studies show that more dust occurs at other locations. Company improvements include: dust suppressants on road, truck covers, scoop up snow where spills occurred, summer studies; improved loading at mine and port sites.

*Mr. Moos Comment: Mr. Moos said that the contractor who built the road buried debris, etc. from Pit 2 to 5 or 6. Also that the contractors did not report or clean up fuel spills correctly. Response: ADEC said this information would be turned over to the appropriate ADEC staff.

Kotzebue, May 14, 1996, Public Workshop and Meeting

Visual aids included an aerial map of Red Dog Mine as well as the topographical map of the area with overlays showing the proposed reclassification.

The same ADEC, ADF&G and Cominco representatives were present, along with the local translator. After the initial presentation, ADEC received the following local questions and comments.

-Questions about the reclassification-

*When will these changes go into effect?

Response: Probably during the fall, 1996.

*What will be the monitoring affects of lifting these regulations?

Response: There will be not be less monitoring. Red Dog and Ikalukrok Creeks will be monitored as long as the mine is there. Effluent limits are getting stricter.

-Tailings Impoundment questions-

*Question: Is the dam leaking?

Response by Charlotte MacCay: Water quality data show that the dam is not leaking. There was a spill in 1989 because the alarms did not work. This has been fixed and there are 2 trips per shift to the pond below the dam to check its water level.

-Water Quality questions-

*Question: Has water quality improved since the mine?

Response: It appears that for the most part, the metals in the creek are the same or slightly lower than in pre-mining days. Aluminum from Rachael Creek increased last year when there was a lot of rain. But this was natural, not related to mining.

-Metals in fish-

Question: How are the fish?

Response: Dr. Weber Scannell referred to the ADF&G annual reports which include the results of fish tissue analysis. She stated that she checks metals concentrations in gill, liver, kidney and muscle. Liver and kidney concentrate metals, so there are lower concentrations in muscle. Even so, the studies done so far show that the fish do not have high enough metals

concentrations to damage them. They are less contaminated with metals than lower 48 fish.

-Metals in Animals (Caribou & Moose)-

*Question: Are the caribou affected by metals at the mine? What happened to the study results?

Response: Jim Dow, ADF&G, and the North Slope Borough, conducted the study. Results will take about 6 months. Metals concentrate over time in all animals, caribou move.

*Local Concern: Caribou which are shot are often grossly infected, having pus sacs. Meat is not eatable. There must be a cause. Its human nature to look at the mine.

Response: Dr. Weber Scannell recommended that the local hunters work with Jim Dow, ADF&G, and the North Slope Borough, which has an excellent parasitologist. Dr. Weber Scannell would like locals to continue to send her diseased fish.

*Question: What about moose? A moose was seen swimming in the tailings impoundment. Also moose graze along the side of the road at the Kivalina shale stockpile.

Response: ADF&G thought the swimming moose was incidental, since there is no vegetation in the tailings impoundment. There was no comment on the moose along the road.

-Air Quality questions-

*Question: How far does the mineralized dust blow? Where does it settle? Are there any studies going on to prove that its not getting into streams and vegetation?

Response: Charlotte MacCay said that the air quality regulations require air modeling to show that the dust levels meet standards outside the property boundaries. She also said that baseline soil and vegetation studies have been done 2 miles in 4 directions beyond the mine boundaries. These will be repeated in 3-5 years to see if there is any change, especially in type or amount of vegetation.

*Question: Wha. about blasting?

Response: Charlotte MacCay told the group that blasting, although visible, is not the major contributor to dust. The road contributes more. She detailed the improvements to reduce dust that the company has implemented at the mine, road and port.

*Question: Haul Road spills? Any extra precautions? Monitoring?

Charlotte MacCay Response: There have been some spills. In winter a spill is easy to clean up because the concentrate stands out against the snow. At one site where a spill occurred in summer/fall, the area was flooded and vacuumed up. Testing soils at this site show higher metals levels than normal. Vegetation has come back though.

*Question: Have these road studies been given to ADEC?

Charlotte MacCay Response: No, they are not finalized, but they show that along the road, metals are confined to the 5-6 feet alongside.

-Reclamation-

Question: What will happen to the area when the mine is gone?

Response: Charlotte MacCay explained the Reclamation Plan, which is renewed every 5 years. She stated that the company would monitor and treat until the area is cleaned up.

Some Questions and Answers about the Red Dog & Ikalukrok Creeks Proposed Reclassification

1. What are protected water quality uses?

In Alaska, water bodies are protected by State law in the Water Quality Standard regulations. The protected water quality uses are: aquatic life, drinking water, water for agriculture, water for fish farming, and recreation. People who discharge wastewater into water must meet high standards so that fish are healthy and water is good for drinking, for agriculture, for fish farming and for recreation.

2. What does reclassification mean?

Reclassification is a process the Alaska Department of Environmental Conservation (ADEC) uses to decide if the water quality uses, protected in state regulation, should be protected. There are two reasons to remove a protected use from a water body such as Red Dog Creek. One is that the protected use never existed. The other is that the protected use would not exist if manmade pollution were cleaned up. Both reasons are necessary for ADEC to remove a protected use.

3. Why is this reclassification process happening?

Cominco Alaska Inc., operator of the Red Dog Mine, requested this reclassification process because some of the protected uses in the Alaska Water Quality Standard regulations have never existed and will never exist. For example, Red Dog Creek at Red Dog Mine has such high concentrations of metals in the water that no aquatic life lives in it. Natural quality of the water does not meet the protected use standard; so, this is the wrong standard. It is difficult to have the right permit conditions for Red Dog Mine wastewater discharges until the real protected uses are identified.

4. What protected uses is ADEC considering for removal from the Alaska Water Quality Standards?

ADEC is considering removal of the following protected uses: **Water Supply** (drinking water, agriculture and aquaculture) and **Contact Recreation** from all of Ikalukrok Creek below Red Dog Creek and from all of Red Dog Creek except the North Fork; **Secondary Recreation** from all of Red Dog Creek except the North Fork; and **aquatic life** from Middle Fork Red Dog Creek and its tributaries except Connie Creek (at the Red Dog Mine).

5. What do you mean by aquatic life?

Aquatic life includes all plants such as algae and bottom-rooted plants, and all animals, such as fish and insects. It also includes all life stages of fish, such as eggs and juveniles.

6. Why aren't you proposing to remove aquatic life from Connie Creek?

Because during the 1995 Aquatic Survey, the Alaska Department of Fish and Game found algae and invertebrates (insects) in this Creek. They did not find any fish, probably because to reach Connie Creek, fish would have to swim through very toxic mineralized water which naturally occurs at the ore body.

7. Will there be any affect on the drinking water quality at the village of Kivalina if ADEC removes the protected drinking water use from sections of Red Dog Creek and Ikalukrok Creek?

No, the water quality of the drinking water at Kivalina will not change. Kivalina fills its water tank from the Wulik River in late June or early July when there is a lot of flow in the Wulik River. Any metals in the river at that time would be very low. The Wulik River has good water quality year-round, but high flow is the best time to fill the water tank.

Water quality tests are performed each year to assure that the drinking water in the tank is good. These tests have always shown that Kivalina has good quality drinking water. For example, the Environmental Protection Agency (EPA) has set a drinking water standard for Cadmium at 0.005 mg/L to protect against the risk of adverse health effects. Drinking water that meets the EPA standard for cadmium has little to none of the risk and is considered safe to drink. Water quality samples at Kivalina's water tank have always tested below this concentration, so Kivalina's water is safe to drink.

8. Will the water quality of Red Dog Creek, Ikalukrok Creek and the Wulik River get worse if these reclassifications take place? Will the fish become unhealthy?

The water quality and fish health of Red Dog Creek, Ikalukrok Creek and the Wulik River will not change if these reclassifications take place for several reasons:

a. Cominco must meet very tough permit requirements to discharge treated wastewater from the mining processes. These permit requirements include treatment to remove most metals from the wastewater before it goes back into Red Dog Creek. This process has had the effect of reducing the natural metals concentrations in Red Dog Creek. In fact, Dolly Varden and Grayling are now found in Main Stem Red Dog Creek. Before mining, only Grayling were found in this stretch of Red Dog Creek. The point is that mining does not increase the natural metals concentrations of Red Dog Creek.

b. ADEC and ADF&G closely monitor the wastewater discharges from the Red Dog Mine and the water quality and the health of the fish at locations along Red Dog Creek, Ikalukrok Creek and the Wulik River. These resource agencies visit the Red Dog Mine and Creeks each year, taking water samples and checking the health of the fish, to ensure that permit conditions are being met and that water quality and fish health continues.

9. What might happen to a person who occasionally drinks a lot of water from Red Dog Creek and Ikalukrok Creeks where there are high natural metals concentrations?

A person who drinks water from the sections of these Creeks with natural high metals concentrations may have stomach irritation, vomiting and diarrhea. Drinking this water occasionally would not have any long term health effects on people. However, if a village were located on these Creeks and people drank this water for many years without removing the natural metals, the long term human health effects might be serious. Cadmium, for example, has been shown to damage kidneys in animal tests. Also, industrial workers who were exposed to large amounts of this Cadmium in their working careers suffered kidney damage.

Because of the natural high metals in Red Dog and Ikalukrok Creeks, it would not be a good idea to supply a village or a mine with drinking water from these Creeks. In fact, the Red Dog Mine gets its drinking water from Bons Creek, which has no metals and is good quality water for drinking.

10. What is the difference between Contact and Secondary Recreation?

Contact Recreation means activities such as swimming, where a person might drink some of the water. Secondary Recreation means activities where a person would not have direct contact with the water and would not be likely to drink any water. These activities include fishing, boating, hunting and hiking along the bank.

11. If recreation uses are no longer protected in the Alaska Water Quality Standard regulations, does that mean I cannot boat, fish or hunt there?

No, it only means that the State of Alaska will not protect those waters to the high standard found in the regulations for recreational use.

VALINA M. etony

5-13-96

- 1 Oscar Swan
- 2 Victor Swan
- 3 Caleb S Adams
- 4 Aunt Swan Sr
- 5 Mildred Sage
- 6 Helen S Swan
- 7 Wm D. Swan
- 8 Chester S Bready
- 9 Frank C. Koop Sr
- 10 Lizzie H
- 11 Oscar Swan Sr
- 12 Bob Hawley Jr
- 13 Oscar Sage Jr
- 14 Lizzie Hawley

Noatak Inc. Party
 5-13-96 5:40 pm

- | | | |
|----|-------------------|----------------------|
| 1 | Wendell B. ... | Noatak AK |
| 2 | Dwight ... | " " |
| 3 | Philip ... | " " |
| 4 | Ken ... | |
| 5 | Aylene ... | Noatak, AK |
| 6 | Priscilla ... | " " |
| 7 | Joseph T. ... | " " |
| 8 | Benjamin P. ... | Noatak AK |
| 9 | Frederica ... | " " |
| 10 | Samuel ... | " " |
| 11 | Elenie ... | |
| 12 | Frank ... | Kotzebue, AK |
| 13 | Frank ... | Noatak AK |
| 14 | FRANK R. GREENE | Kotzebue, AK |
| 15 | CHARLES A. GREGG | Kotzebue, AK |
| | Thurston ... | Noatak AK |
| | Ivan ... | Noatak AK |
| | Wilfred R. ... | Noatak AK |
| | ... | " " |
| | Rachel ... | Noatak AK |
| | North ... | Noatak |
| | Roland Ashby, Sr. | Noatak, AK, 485-2130 |
| | Clyde Mills | Noatak AK |

May 14, 1996

Kotzebue People's Pub
Museum Supply P.O. Box 126 Kotzebue AK 99752

Art & Supply? Menilog Assoc

Bobby Scatter Kotzebue 1997

Frank B. Steirn N.A.B. KOTZ AK

CHARLIE A. GRACEY N.A.B. KOTZ AK

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