Exhibit 2

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

TONY KNOWLES, GOVERNOR

Division of Air and Water Quality
Watershed Management
610 University Avenue
Fairbanks, AK 99709-3643

Director's Office: (907) 465-5260
Fairbanks Office: (907) 451-2101
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July 22, 1998

Mr. Robert R. Robichaud
Manager, NPDES Permits Unit
Environmental Protection Agency
1200 Sixth Avenue
MS OW-130
Seattle, WA 98101

Re *NPDES AK-003865-2, Red Dog Mine Site*

Dear Mr. Robichaud

In accordance with Section 401 of the Clean Water Act of 1977 and provisions of the Alaska Water Quality Standards, the Alaska Department of Environmental Conservation (ADEC) is issuing the enclosed Water Quality Certification for NPDES Permit No AK 003865-2 for the discharge of treated wastewater from the Red Dog Mine, located approximately 100 miles northwest of Kotzebue. As part of this certification we are also issuing a site-specific criterion, based on natural conditions, for zinc of 210 µg/L. That site-specific criterion is established under 18 AAC 70.235(b). A record of that criterion, and of all future site-specific criteria established under 18 AAC 70.235(b), will be available for public review at the department's Juneau office. We also propose to add a footnote to the regulation, advising the public of where they can review such site-specific criteria, as part of our next round of revisions to 18 AAC 70. The certification and site-specific criteria were public noticed on June 3 and 4, 1998.

This project was found consistent on June 1, 1995, and the Alaska Coastal Management Program has determined that no additional review will be conducted.

Department of Environmental Conservation regulations provide that any person who disagrees with any portion of this decision may request an adjudicatory hearing in accordance with 18 AAC 15.200 – 920. That request should be mailed to the Commissioner of the Alaska Department of Environmental Conservation, 401 Willoughby Ave., Suite 105, Juneau, AK. 99801-1795. Please send a copy of any such request to the undersigned. Failure to submit a hearing request within thirty days of receipt of this final determination letter shall constitute a waiver of that person's right to judicial review of this decision.

Sincerely,

William D. McGee

William D. McGee
Watershed Development

Enclosures: Certificate of Reasonable Assurance
Appendix A: Basis for Zinc Criteria and Limits
Appendix B: Whole Effluent Toxicity.
Appendix C: pH

cc:
USFWS/Fairbanks
ADNR/Fairbanks
USCOE/Anchorage
ADF&G/Fairbanks
Mr. Phillip Driver/Kotzebue
NANA Corporation/Kotzebue
Northwest Arctic Borough/Kotzebue
Trustees for Alaska/Anchorage
Sierra Club Legal Defense Fund /Juneau
USGS/Fairbanks
DGC/Anchorage
EPA/Anchorage
EPA/Seattle
NMFS/Anchorage
City of Kivalina
ADEC/Juneau
DCED/Fairbanks
NPS/Kotzebue
Northern Alaska Environmental Center/Fairbanks
Attorney General/Fairbanks
Cominco Alaska Inc./Kotzebue

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CERTIFICATE OF REASONABLE ASSURANCE

A Certificate of Reasonable Assurance, as required by Section 401 of the Clean Water Act, has been requested by Cominco Alaska, Inc., P.O. Box 1230, Kotzebue, AK 99752, for the proposed discharge of 2.418 billion gallons per year of treated wastewater through Outfall 001 to the Red Dog Creek, and the proposed discharge of treated construction camp site wastewater to the tundra through Outfall 002, in accordance with discharge points, effluent limitations, monitoring requirements, and other conditions set forth in the U.S. Environmental Protection Agency NPDES Permit No. AK-003865-2.

The proposed activity is located at the Red Dog Mine Site on Red Dog Creek, 82 miles north of Kotzebue, Alaska, 68° 4'17" North Latitude, 162° 52'5" West Longitude. Public Notice of the application for this certification has been made in accordance with 18 AAC 15.140.

Water Quality Certification is required for the proposed activity because the activity will be authorized by a U.S. Environmental Protection Agency permit identified as AK-003865-2, and discharges are expected from the proposed activity.

Appendices A-C are hereby incorporated by reference as part of this Certification. Appendix A provides the Department's rationale for the establishment of site-specific criteria, based on natural conditions, as the applicable water quality criteria for Zinc. This action is taken under 18 AAC 70.235(b). Appendix B provides the Department's rationale for the effluent limits for whole effluent toxicity (WET), while Appendix C explains the pH limits.

Having reviewed the application and comments received in response to the public notice, the Alaska Department of Environmental Conservation certifies that there is reasonable assurance that any discharge from the proposed activity, if it is conducted in accord with the conditions outlined below, will be in compliance with the Alaska Water Quality Standards, 18 AAC 70.

Cominco has documented problems with sample collection at Station 73 due to stream morphology, ice breakup and possible water quality influences. They have to relocated Station 73 to a point approximately 1.6 miles downstream. The department concurs that this relocation has appropriate to provide the most reliable monitoring data for this section of Ikalukrok Creek.

The limits specified in this permit comply with Alaska's antidegradation policy established under 18 AAC 70.015. That policy does not require that a discharger improve the natural water quality of its receiving water.

The Department has several special conditions that it would apply to Outfall 001, as set out below. Some of the listed conditions are more stringent than the terms of the draft NPDES permit, while others would make the draft permit less stringent. The authority for conditions 1-3 is discussed in the respective appendices for those three conditions. The authority for conditions 4-6 includes AS 46.03.110; AS 46.03.710; 18 AAC 15.090; 18 AAC 70; and 18 AAC 72.

The effluent limits for Zinc shall be 257.3 µg/L maximum daily limit (MDL), and 119.6 µg/L average monthly limit (AML). (see Appendix A)

2. The WET maximum daily limit shall be 12.2 TU_c, and the average monthly limit shall be 9.7 TU_c. (see Appendix B)

3. The pH effluent limits are 6.0 to 10.5 pH units. (see Appendix C)

4. Within 30 days of the effective date of this certification, Cominco shall submit for approval to the Department and to the Department of Fish and Game, a monitoring and analysis plan, including sampling sites and schedule, designed to detect possible Aquatic Community changes related to the mine effluent as follows:

Sample Site	Factors Measured
Middle Fork Red Dog Creek	Periphyton (as Chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance
North Fork Red Dog Creek	Periphyton (as Chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Main Stem Red Dog Creek	Periphyton (as Chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Ikalukrok Creek Stations 9 and 7, upstream and downstream of Dudd Creek	Periphyton (as Chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Ikalukrok Creek	Fall aerial survey of returning adult chum salmon
Wulik River	Metals concentrations in Dolly Varden gill, liver, muscle, and kidney. Fall aerial survey of over-wintering Dolly Varden
Reference Streams: Anxiety Ridge Creek Evaingiknuk Creek Buddy Creek	Fish presence and use

Upon approval, Cominco will implement the plan.

5 Within 30 days of the effective date of this certification, Cominco shall submit for approval to the Department and to the Department of Fish and Game, a monitoring and analysis plan designed to answer questions on the precipitate on the streambed of Middle Fork Red Dog Creek. The plan should address the extent the precipitate extends downstream, the volume of precipitate, and its chemical composition. The plan should also address the timing and conditions under which the precipitate becomes mobilized, and when it becomes mobilized its effects on downstream water quality. Upon approval, Cominco will implement the plan.

6. Cyanide will be sampled and analyzed using the Weak Acid Dissociable (WAD) method at Station 20 at the frequency described in the NPDES permit. The permittee will notify the Department and ADF&G immediately by telephone should cyanide concentrations exceed the WAD detection limit of 0.01 ppm.

Rationale: The intent of these stipulations is to protect the water quality and protected water uses of the Red Dog Creek, Ikalukrok Creek and Wulik River water bodies as required in 18 AAC 70, ALASKA WATER QUALITY STANDARDS, and in 6 AAC 80, ALASKA COASTAL ZONE MANAGEMENT REGULATIONS.

July 22, 1998
Date

William D. McGee
William D. McGee
Watershed Development

APPENDIX A
ZINC – NATURAL CONDITION
SITE SPECIFIC CRITERION

Introduction

The Red Dog Mine is a lead/zinc mine located near the Arctic Circle. It is in the foothills of the De Long Mountains of northwest Alaska, approximately 100 miles northwest of Kotzebue and 52 miles from the Chukchi Sea coastline. It is a remotely located facility accessible only by ship or chartered airplane. There are no other industrial facilities in the area. The nearest village is Kivalina, population 300, located at the mouth of the Wulik River on a barrier beach on the Chukchi Sea (Attachment A-1).

The Red Dog ore deposit is in the form of metal (zinc, lead) sulfides in a Mississippian shale formation lying on and within a ridge between the Middle Fork Red Dog Creek and South Fork Red Dog Creek (see Attachment A-2).

The mill site lies to the west of the ore deposit and above the tailings impoundment. The tailings impoundment is formed by a dam across the South Fork of Red Dog Creek. Removal of overburden from the ore deposit and construction of the tailings dam began in 1987. The first ore was delivered to the mill late in 1989, and the first concentrates were produced in December 1989.

Need for Site Specific Criterion

Cominco Alaska, Inc., the operator of the Red Dog Mine has requested that the Department of Environmental Conservation (ADEC) grant relief from the existing chronic aquatic life criterion for zinc. They have requested a site-specific criterion based on the natural condition of the Main Stem Red Creek from the confluence of North Fork Red Dog Creek to the confluence with Ikalukrok Creek; and in Ikalukrok Creek from its confluence with Main Stem Red Dog Creek to its confluence with Dudd Creek. These are the stream segments where it has been documented that the natural background zinc levels exceed the Alaska chronic aquatic life criterion.

Regulatory Requirements

Federal regulations at 40 CFR § 122.44 (d)(1)(iv) and (v) require a zinc limit to be incorporated into a National Pollutant Discharge Elimination System (NPDES) permit when a discharge has the reasonable potential to cause or contribute to an in-stream excursion above a numeric or narrative criterion within an applicable state water quality standard.

Alaska water quality standards (WQS) regulations allow for the development of a site-specific criterion (SSC) (18 AAC 70.235). More specifically, Alaska WQS contain a provision that allows the development of a SSC based on the natural condition of a water body. Under 18 AAC 70.235(b), "If the department finds that a natural condition of a water body has been demonstrated to be of lower quality than a water quality criterion for the use classes in 18 AAC 70.020(b) and that the natural condition will fully protect designated uses in 18 AAC 70.020(b), the natural condition constitutes the applicable water quality criterion." Natural condition is defined, by the State, as any physical, chemical, biological, or radiological condition existing in a waterbody before any human-caused influence on, discharge to or addition of material to, the waterbody [18 AAC 70.990(41)]. EPA approved 18 AAC 70.235(b) of the Alaska WQS on April 7, 1997. The Alaska natural condition regulation conforms with EPA's Natural Background Policy dated November 5, 1997.

Applicable Water Quality Standards

A state's WQS are composed of use classifications and numeric and/or narrative water quality criteria. The first part of a State's water quality standard is a classification system for water bodies based on the expected designated uses of those water bodies. The second part of a state's water quality standards is the water quality criteria deemed necessary to support the designated use classification of each water body. These criteria may be numeric or narrative.

Designated Uses

The State of Alaska water quality standards protect Main Stem Red Dog Creek, and Ikalukrok Creek below Red Dog Creek for the following designated uses:

- Industrial water supply,
- contact recreation, wading only,
- secondary recreation, and
- growth and propagation of fish, shellfish, other aquatic life, and wildlife

II. *Criteria to Protect the Designated Uses*

The criterion for industrial water supply is a narrative criterion that states that substances that pose hazards to worker contact may not be present. A review of the available literature indicates that criteria to protect workers have not been developed for zinc (EPA Quality Criteria for Water, 1976).

The applicable zinc criterion for contact recreation (wading only) and secondary recreation is the acute aquatic life criterion. In *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States; Compliance Final Rule* (57 FR 60848) (commonly referred to as the National Toxics Rule or NTR) EPA promulgated water quality criteria for Alaska for chemical-specific, numeric criteria for priority pollutants. In this rule, EPA identified which Federal criteria for priority pollutants applied to Alaska and the use categories to which the criteria applied (FR 57 60848, December 22, 1992) [40 CFR 131.36(d)(12)]. Alaska was included in the NTR for all of the acute aquatic life criteria, which apply to these two recreation use categories. On October 10, 1997 Alaska was removed from the NTR for most of the acute aquatic life criteria however, the acute aquatic life criterion for zinc was not part of that action (62 FR 53212), and it applies to these two use categories. The numeric value for the acute aquatic life criterion for zinc for these two recreation uses is 257 micrograms/liter (μg/L) (see discussion below).

The most stringent zinc criteria are associated with the aquatic life use designation. There are two types of criteria for the protection of aquatic life: acute and chronic. Acute criteria protect against short term deleterious effects to aquatic life, and chronic criteria protect against long term deleterious effects to aquatic life. For Alaska, the acute criterion for zinc is a hardness-based criterion that is found in the NTR. The acute criterion for zinc is 257 μg/L, is based on the site's ambient hardness of 260 mg/L. The numeric chronic criterion for zinc is 47 μg/L (18 AAC 70.020, Note 5). It is not based on ambient hardness. Alaska adopted this chronic criterion from the November 28, 1980 Ambient Water Quality Criteria (45 Federal Register 79318).

Natural Condition Determination

As part of the development of the Use Attainability Analysis (UAA) for reclassification of waterbodies in the vicinity of Red Dog mine, EPA requested information regarding any human activities (land disturbance from road building, camp construction, or exploration) that could have contributed to the water quality exceedences that were found in the pre-mining water quality data base. The UAA concludes that there were no human activities in the vicinity of the mine that could have caused significant changes in the water quality until overburden was removed in the spring of 1988 (see Attachment A-3). In accordance with 18 AAC 70.990(41) there were no anthropogenic sources of pollution and the baseline water quality (1981/1982) is representative of natural conditions.

Demonstration that the Natural Condition is of Lower Quality than the Applicable Criterion

The waters of Red Dog Creek are atypical of most undeveloped Arctic streams because of the high concentrations of cadmium, lead, and zinc that enter the Middle Fork of Red Dog Creek as it flows through a highly mineralized ore body. The unique character of the Red Dog mineralization and its interaction with ground and surface waters was recognized in scientific studies of the area in the late 1970's and early 1980's (e.g. Ward and Olson 1980). Natural levels of metals were known to be unusually high, and fish kills (in Main Stem Red Dog Creek) were documented. From 1981 through 1984, Cominco Alaska funded a series of baseline studies to document water quality and biological conditions in Red Dog Creek, Ikalukrok Creek, and the Wulik River (Houghton 1983, Petersen and Nichols 1983). In 1982, ADEC funded a detailed toxicological, biophysical, and chemical assessment of Red Dog Creek (E.V.S. Consultants, Ltd. 1983). In the 1984 Final Environmental Impact Statement (EIS), these studies formed the basis for addressing aquatic and water quality impacts associated with the development of the Red Dog Mine Project.

Water in the Middle Fork Red Dog Creek, beginning adjacent to the highly mineralized orebody was naturally degraded and remained in this condition downstream to the confluence with the South Fork (L. A. Peterson & Associates, Inc. 1983, Water Quality of Red Dog Creek, Alaska, 1983, in Supplement to Environmental Baseline Studies, Red Dog Project. Dames & Moore report to Cominco Alaska, Inc.). The Middle Fork flowed directly over heavily mineralized rock, and the creek received surface and groundwater draining from the orebody, which contained high metal and sulfide concentrations (U.S. Environmental Protection Agency and U.S. Department of the Interior. 1984. Final EIS, Red Dog Mine Project, Northwest Alaska). Recovery began at the confluence of the Middle Fork and the South Fork, but was not particularly significant until flow from the North Fork diluted the Main Stem. Red Dog Creek adversely affects the quality of Ikalukrok Creek below their confluence. This effect, in terms of zinc concentrations, extended downstream from Red Dog Creek. Ambient samples collected at station 8 confirm that Red Dog Creek has an influence on the levels of zinc in Ikalukrok Creek.

The data collected prior to the development of the mine site is summarized in Attachment A-4. In Middle Fork Red Dog creek (station 30) zinc data were collected from May 30, 1982 through September 3, 1983. The zinc data ranged from 2400 μg/L to 49800 μg/L. In Main Stem Red Dog Creek (station 10) data were collected from May 30, 1982 through September 3, 1983. The data ranged from 66 μg/L to 5060 μg/L. In Ikalukrok Creek (station 8), below the Main Stem Red Dog Creek, data were collected from May 30, 1982 through August 17, 1987. The data ranged from 140 μg/L to 4200 μg/L. All of the data collected in these stream segments demonstrate that the water is of lower quality than the zinc chronic aquatic life criterion of 47 µg/L.

Natural Condition Site-Specific Criterion Development

The natural levels of zinc in the ambient waters vary in two ways. First, the zinc levels decease as the distance downstream from the orebody increases. The zinc levels are highest in Middle Fork immediately after passing through the orebody, and lowest in the Ikalukrok Creek below the Main Stem. Ikalukrok Creek below Main Stem represents the highest quality water of those stream segments affected by the orebody. To ensure that zinc levels in Ikalukrok Creek do not increase above pre-mining levels, this stream segment (station 8) was used to develop the site-specific criterion.

Second, the zinc levels vary over time. The Department ' s regulation states, in part, that A if a natural condition varies with time, the natural condition will be determined to be the prevailing highest quality natural condition measured during an annual, seasonal, or shorter time period. Pre-mining data exist from 1981 to 1987. Water quality monitoring was conducted in 1981 and 1982 in order to establish the pre-mining baseline water quality for use in the EIS that was being prepared before mine development. Additional pre-mining water quality data were gathered in 1983, 1986, and 1987. All available pre-mining zinc data were used to develop the site specific criterion to ensure that variation in the levels of zinc from year to year is represented.

To represent the highest quality water, the 5th percentile of the pre-mining data set has been used. The 5th percentile of the data set is 210 µg/L. This means that 5 times out of 100 the natural zinc concentration was equal to or lower than 210 µg/L (better water quality). Another way of stating this is that 95 percent of the natural zinc concentrations were greater than 210 µg/L (lower water quality). Using this site specific criterion (210 µg/L) means the mine effluent will be required to reflect the highest quality water that naturally occurred at the site. Therefore, 95 percent of the time the zinc concentration in the mine's effluent will be lower than the concentration of zinc in the receiving water. The 5th percentile approach to developing the SSC is a conservative approach.

Designated and Existing Use Protection

Federal WQS regulations require that a State specify the water uses to be achieved and protected and there are two broad use categories, designated uses and existing uses. A designated use is a use specified in State WQS regulations for a water body whether or not it is being attained. The designated uses for the waterbodies at the site are listed on page 2: industrial water supply; contact recreation (wading only); secondary recreation; and growth and propagation of fish, shellfish, other aquatic life and wildlife. An existing use is, by definition [18 AAC 70.990(24)], "the uses actually attained in a waterbody on or after November 28, 1975."

The Alaska WQS regulations contain two separate provisions that require protection of designated uses and existing uses. The Antidegradation Policy at 18 AAC 70.015(a)(1) states, in part, that "existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected." The natural condition SSC Policy at 18 AAC 70.235(b) states that "if the department finds that a natural condition of a waterbody is demonstrated to be of lower quality than a water quality criterion… and that the natural condition will fully protect designated uses…, the natural condition constitutes the applicable water quality criterion".

Therefore, these two Alaska WQS regulatory provisions require that existing uses and designated uses must be protected by a SSC.

The following discussion examines whether each designated and existing use could be protected by a site-specific zinc criterion of 210 μg/L. The analysis of designated uses looks at the current and future condition of the waterbody. For example, is aquatic life currently found at the site or is growth and propagation of aquatic life a future goal for the waterbodies at the site. The time frame for the analysis of an existing use extends from November 28, 1975 to the current time.

Industrial, Contact Recreation (wading only), and Secondary Recreation Uses

The Red Dog and Ikalukrok Creeks Use Attainability Analysis (UAA) (December 1996) evaluated whether the industrial, contact recreation, and secondary recreation designated uses were existing water uses and whether the designated uses should be retained in the future. The UAA evaluated the "actual" use and the water quality adequate to support the uses. The UAA concluded that contact recreation (wading only) and secondary recreation were existing uses. The proposed site-specific criterion of 210 μg/L is more stringent than the criteria for the industrial, contact recreation (wading only), and secondary recreation uses i.e. 257 μg/L. It will therefore, protect these existing and designated uses.

II. *Aquatic Life Use*

Detailed studies were not conducted to document the presence of aquatic microinvertebrates, macrophytes, or periphyton prior to mining. Limited information is available on benthic macroinvertebrates, and fish prior to mine development. In 1995 studies were conducted to characterize microinvertebrates, macrophytes, periphyton, and benthic macroinvertebrates. Fish studies have been conducted from 1991 through 1997. A comparison of the macroinvertebrate and fish communities before and after mine development are summarized in the following paragraphs.

a. *Fish*

Before mine development, Arctic grayling were rarely seen in Main Stem Red Dog Creek and were not reported in Middle Fork Red Dog Creek (Hougton and Hilgert, 1983). Fish were observed in Main Stem Red Dog Creek within the influence of North Fork (Dames and Moore, 1983) and fish mortalities were documented in Main Stem Red Dog Creek (EVS Consultants Ltd., 1983). Before mine development, Arctic grayling adults were assumed to migrate through Main Stem Red Dog Creek in early spring when discharges were high and metals concentrations low. Outmigration of adults probably occurred during high-water events and the young-of-the-year Arctic grayling left as water temperatures cooled in the fall or were displaced by high-water events.

After mine development, use of Main Stem Red Dog Creek by Arctic grayling adults and young-of-the-year in 1995, 1996, and 1997 is higher than that reported during baseline studies in the early 1980s. Stressed or dead fish were not observed. In many cases, adult fish were observed actively feeding on drift and terrestrial insects. Beginning in 1995, juvenile Dolly Varden were caught with minnow traps in Main Stem Red Dog Creek below the North Fork. Juvenile Dolly Varden use of Main Stem continued to be documented in summers 1996 and 1997. A summary of the fish species collected during baseline studies and Post-mining use of Wulik River drainage streams by fish is presented in Attachment A-5.

The growth and propagation of fish is an existing use as well as a designated use because fish have occurred in the past and currently occur at the site. Based on the 1995 field surveys, the fish populations are not diminished compared to the pre-mining fish populations.

b. *Aquatic Benthic Macroinvertebrates, Microinvertebrates, Macrophytes, and Periphyton*

Aquatic invertebrate communities were sampled by EVS and Ott Water Engineers (1983) and Dames and Moore (1983) as part of the baseline studies conducted for Red Dog Creek. Post mining aquatic invertebrate communities were sampled by the Alaska Department of Fish and Game in 1995.

When compared to baseline studies aquatic invertebrate densities were lower in station 73 in 1995 than in station 73 or station 8 during baseline studies (Red Dog Use Attainability Analysis Aquatic Life Component, February 1996, pp. 31-34). However, these differences likely reflect the fact that the two studies used different methods to collect invertebrates and because invertebrate taxonomy has changed since the baseline sampling.

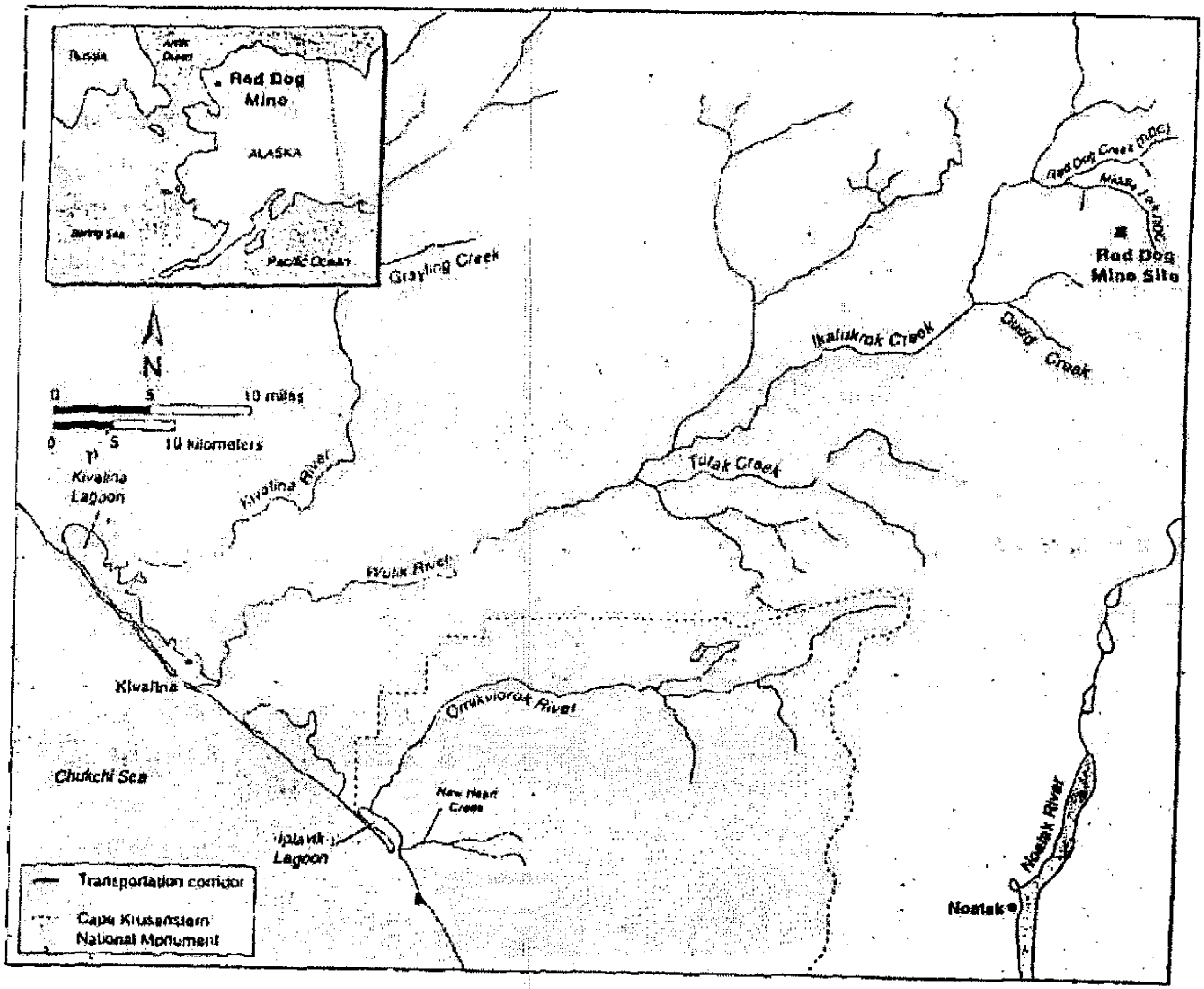
The growth and propagation of other aquatic life is an existing use as well as a designated use because macroinvertebrates and other aquatic life have occurred and currently occur at the site. The lack of microinvertebrates, macrophytes, or periphyton field survey data prior to mining and the limited pre-mining field surveys of macroinvertebrates preclude making a determination about the quality and biodiversity of these populations prior to mining. Since the pre-mining fish populations were dependent on these lower trophic levels for survival, it can be assumed that they were present in adequate numbers and diversity to maintain pre-mining fish populations. The 1995 post-mining field surveys have firmly established that growth and propagation of macroinvertebrates, microinvertebrates, macrophytes, and periphyton are an existing and designated use.

c. *Aquatic Life Conclusions*

Resident and migratory fish and other aquatic life have acclimated to the natural zinc concentrations. Current ambient zinc concentrations are no higher than the pre-mining ambient zinc concentrations. Finally, the criterion the Department is adopting is more stringent than the EPA zinc chronic aquatic life criterion (52 FR 6213), which further supports that the natural condition based site-specific zinc criterion will fully protect the natural aquatic life at the site. Therefore, because the zinc concentrations in the mine's effluent (210 µg/L) is much lower than the pre-mining natural ambient zinc concentration, the growth and propagation of fish existing and designated use will be protected.

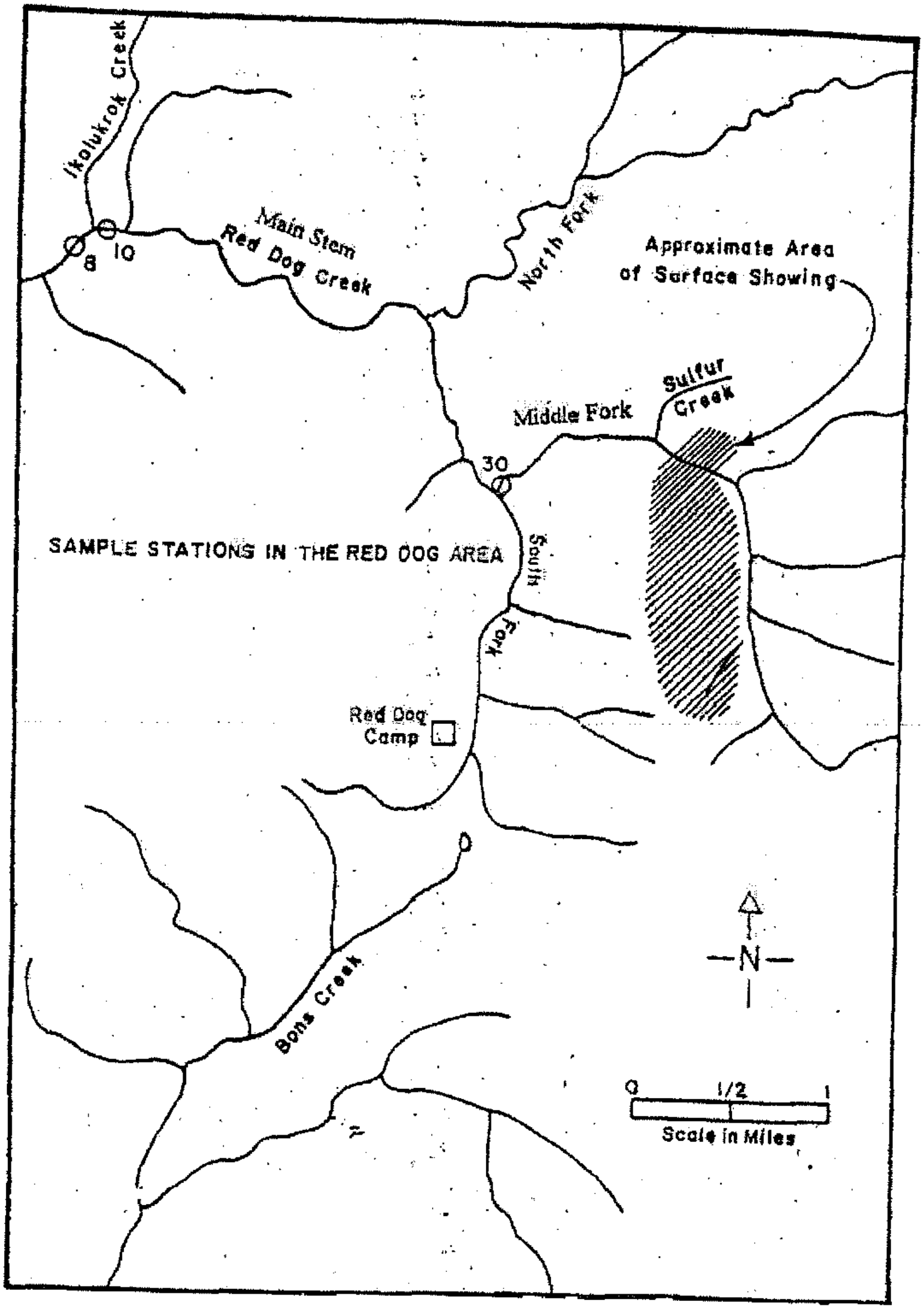
ADEC Findings

Based on the information in Attachment A-3, ADEC has determined that the baseline water quality is representative of natural conditions in accordance with 18 AAC 70.990(34). The pre-mining water quality data set demonstrates that the natural condition is of lower quality than the applicable zinc chronic aquatic life criterion. A method for determining the prevailing highest quality natural condition has been described above and used to develop the site specific criterion (210 μg/L). This site specific criterion is more stringent than the numeric criteria that protect the industrial, contact recreation, and secondary recreation uses and will therefore protect these designated uses. The site specific criterion will protect the designated growth and propagation of fish and other aquatic life because it is more stringent than the federal zinc chronic criterion and because the persistence of aquatic life both before mining began and currently demonstrates that aquatic life has acclimated to these natural zinc concentrations. This decision is consistent with the November 5, 1997 EPA policy on establishing site-specific aquatic life criteria equal to natural background, which states in part, "for aquatic life, where the natural background concentration for a specific parameter is documented, by definition that concentration is sufficient to support the level of aquatic life expected to occur naturally at the site absent any interference by humans."



ATTACHMENT A-1
Location of Red Dog Mine Site

ATTACHMENT Location of Orebody



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 travelling 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

ATTACHMENT A-4
Pre-mining Water Quality Data for Zinc

DATE	STATION 30 Middle Fork Red Dog Creek	STATION 10 Main Stem Red Dog Creek	STATION 8 Ikalukruk, below Main Stem
5/30/82		66	170
7/6/82	15900	3000	
7/8/82	15550	3300	710
7/10/82			
7/14/82		3710	
7/21/82		4180	
7/22/82		4680	
7/23/82	27600	4280	
7/24/82	25800	4730	
7/26/82	10500		
7/29/82	18600	3680	
7/30/82	16700	2870	
7/31/82	14200	2810	
8/1/82		3290	
8/7/82		4290	
8/11/82			
8/12/82		5060	1660
8/13/82	15800		
8/14/82	9120	2670	
9/13/82	22400	3810	1740
10/19/82	49800	4580	4200
5/28/83	6550	851	380
6/15/83	6860	1670	440

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DATE	STATION 30 Middle Fork Red Dog Creek	STATION 10 Main Stem Red Dog Creek	STATION 8 Ikalukruk, below Main Stem
7/10/83	14900	1910	300
8/3/83	23000	2300	260
9/3/83	2400	3800	940
6/9/86			920
6/16/86			540
6/23/86			590
6/30/86			920
7/7/86			710
7/14/86			1100
7/21/86			550
7/28/86			440
6/1/87			530
6/8/87			610
6/16/87			1200
6/22/87			1100
6/29/87			1100
7/7/87			1200
7/14/87			140
7/20/87			760
7/28/87			2100
8/3/87			2000
8/10/87			1100
8/17/87			2300

NOTE: All data is expressed in micrograms/liter and as the total fraction of the metal.

ATTACHMENT A-5
Fish Data

Fish: Baseline Studies

Baseline studies conducted by Dames and Moore (1983) reported fish use in Ikalukrok Creek, Mainstem Red Dog Creek, and North Fork Red Dog Creek (Table 24). Fish species present in the Wulik River are listed to illustrate the importance of this river for fish. Common and scientific names of fish are listed in Appendix 9.

Table 24. Fish species collected during baseline studies.

Water body	Use (fish species)	Notes
Ikalukrok Creek	Migration (AG) Spawning (AG, ChumS) Rearing (AG, DV, SSc)	few present
Mainstem Red Dog Creek	Migration (AG)	migration limited to spring high flows
Middle Fork Red Dog Creek	no fish found	
North Fork Red Dog Creek	Migration (AG) Spawning (AG) Rearing (AG)	
Wulik River	Arctic grayling slimy sculpin chum salmon Dolly Varden humpback whitefish round whitefish least cisco Bering cisco Alaska blackfish pink salmon sockeye salmon coho salmon chinook salmon ninespine stickleback	

DV = Dolly Varden, AG = Arctic grayling, SSc = slimy sculpin, ChumS = chum salmon
Shelly, Rachael, Connie, and Sulfur Creeks were not sampled.

Fish: Post-mining Studies

Summary of Arctic grayling visual observations and capture in Mainstem Red Dog Creek below confluence of North Fork and Middle Fork Red Dog Creeks since 1994. Note, surveys limited until 1994 when minnow trap sample areas were established.

Sample Date	Sample Method	Comments on Arctic grayling (YOY = young of the year Arctic grayling)
7/27/94	visual	2 adults just below North Fork
6/29/95	angling	one adult (368 mm) just below North Fork
7/17/95	angling	2 adults (296, 323 mm) near rock bluff about 0.8 km below North Fork
7/20/95	visual	one adult near rock bluff about 0.8 km below North Fork
8/11/95	visual	YOY (about 30) below North Fork
8/11/95	visual	one adult near rock bluff about 0.8 km below North Fork
8/14/95	angling	tagged/recaptured 11 (range 290-340 mm, average 319 mm), near rock bluff about 0.8 km below North Fork
6/19/96	visual	one adult near Station 10
7/15/96	angling	tagged 7 fish (range 274-382 mm, average 330 mm), about 2 km above mouth
8/11/96	visual	YOY in shallow eddies at mouth
8/12/96	visual	YOY near rock bluff about 0.8 km below North Fork
6/25/97	drift net	YOY present near Station 10, 13-15 mm long
6/25/97	visual	2 adults near rock bluff about 0.8 km below North Fork
6/26/97	angling	tagged 15 fish (range 300-416 mm, average 364 mm) in scour pool at mouth of Mainstem, 8 were spawned out
6/27/97	visual	YOY numerous near Station 10
8/10/97	visual	YOY present in backwater areas
9/29/97	traps	seven YOY caught near Station 10

Summary of total catch of Dolly Varden in Red Dog Creek, 1994-1997.

Year 39)	Month	Middle Fork above North Fork (Traps 6-10)	Mainstem below North Fork (Traps 1-5)	Mainstem below North Fork (Traps 20-29)	Mainstem above Ikalukrok (Traps 30-
	June	0	0		
	July	0	0		
	August	0	0		
	June	0	0	5	
	July	0	0	10	
	August	0	4	3	
	June	0	0	0	0
	July	0	1	3	0
	August	0	1	1	
	June	0	0	13	
	August	0	5	14	10

Fish: Post-mining Studies

Summary of Arctic grayling visual observations and capture in Mainstem Red Dog Creek below confluence of North Fork and Middle Fork Red Dog Creeks since 1994. Note, surveys limited until 1994 when minnow trap sample areas were established.

Sample Date	Sample Method	Comments on Arctic grayling (YOY = young of the year Arctic grayling)
7/27/94	visual	2 adults just below North Fork
6/29/95	angling	one adult (368 mm) just below North Fork
7/17/95	angling	2 adults (296, 323 mm) near rock bluff about 0.8 km below North Fork
7/20/95	visual	one adult near rock bluff about 0.8 km below North Fork
8/11/95	visual	YOY (about 30) below North Fork
8/11/95	visual	one adult near rock bluff about 0.8 km below North Fork
8/14/95	angling	tagged/recaptured 11 (range 290-340 mm, average 319 mm), near rock bluff about 0.8 km below North Fork
6/19/96	visual	one adult near Station 10
7/15/96	angling	tagged 7 fish (range 274-382 mm, average 330 mm), about 2 km above mouth.
8/11/96	visual	YOY in shallow eddies at mouth
8/12/96	visual	YOY near rock bluff about 0.8 km below North Fork
6/25/97	drift net	YOY present near Station 10, 13-15 mm long
6/25/97	visual	2 adults near rock bluff about 0.8 km below North Fork
6/26/97	angling	tagged 15 fish (range 300-416 mm, average 364 mm) in scour pool at mouth of Mainstem, 8 were spawned out
6/27/97	visual	YOY numerous near Station 10
8/10/97	visual	YOY present in backwater areas
9/29/97	traps	seven YOY caught near Station 10

APPENDIX B

Whole Effluent Toxicity

The Red Dog discharge presents an unusual circumstance:
while the effluent has some chronic toxicity, it is consistently less toxic than the receiving water of the middle Fork of Red Dog Creek. The Middle Fork is so naturally toxic, from elevated metal concentrations, that there is no aquatic life there, and ADEC has reclassified it to remove that designated use. This fact distinguishes the Red Dog discharge from more typical scenarios where a potentially toxic effluent enters a non-toxic receiving water. In fact, this discharge scenario appears to be unique.

I. APPLICABLE REGULATIONS

Federal regulations at 40 CFR § 122.44 (d)(1)(iv) and (v) require a WET limit to be incorporated into an NPDES permit when a discharge has the reasonable potential to cause or contribute to an in-stream excursion above a numeric or narrative criterion within an applicable state water quality standard.

There are two provisions in Alaska's state water quality standards that govern toxicity in fresh waters. One of the provisions, 18 AAC 70.020(b)(1)(C), includes a narrative criterion that prohibits concentrations of toxic substances in water that cause toxic effects on aquatic life. This provision also authorizes the Department to promulgate regulations to implement this narrative criterion. The other relevant provision is 18 AAC 70.030, which provides that "an effluent discharged to a water may not impart chronic toxicity to aquatic organisms, expressed as 1.0 chronic toxic unit, at the point of discharge", or at the edge of an authorized mixing zone.

At the point of discharge in Middle Fork Red Dog Creek,[1] neither of these provisions applies. The narrative criterion in 70.020, by its terms, only applies where aquatic life is a designated use, which is not the case in the Middle Fork. Section 70.030 is one of the implementing regulations specifically contemplated by the narrative criterion; like the narrative criterion it implements, it only applies to stream segments designated for the aquatic life use.

Aquatic life does exist, however, in certain stream segments down stream from the discharge point, including the Main Stem of Red Dog Creek (below the confluence of the Middle Fork and the North Fork), and the Lower Ikalukrok Creek (below the confluence with Red Dog Creek). In those segments, the narrative criterion in 70.020 applies and must be protected by the permit conditions. The Department has concluded that 70.030, by its own terms, cannot be used to implement the narrative criterion in this situation. Under 70.030, the 1.0 chronic toxic unit limit applies at the point of discharge, or "at or beyond" the edge of an authorized mixing zone. Because there is no aquatic life at the point of discharge, the limit does not apply there. The effluent is less toxic than the receiving water, so there is no way to model a mixing zone that could dilute effluent toxicity, and no mixing zone could be authorized. Therefore, while the permit limits must protect the narrative criterion in the downstream segments where the aquatic life is present, 70.030 does not provide the means for implementing that criterion in this case.

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[1]In this document, references to stream segments (e.g. Main Stem, Middle Fork, South Fork, and North Fork) all refer to segments of the Red Dog Creek system unless otherwise specified (e.g. Upper Ikalukrok or Lower Ikalukrok).

In our original draft certification, we proposed to establish a site-specific criterion for Whole Effluent Toxicity (WET) in the Main Stem, to reflect the natural condition there. However, public comment received on our draft certification, as well as continued interagency discussion, have persuaded us to abandon that approach. We simply do not have adequate data to calculate with any precision the natural toxicity of the Main Stem or the Lower Ikalukrok. Our site-specific criteria regulation, 18 AAC 70.235(b), is intended for situations where we can actually measure the natural level of a pollutant in a water body, and so establish the governing water quality criterion. It can not be applied when, as at Red Dog, the natural condition has been irretrievably altered and we lack the baseline data reflecting what it once was.

Ample data establish that significant toxicity was naturally present in the Red Dog Creek system prior to any human activity in the area. The data also show that aquatic life communities were present in certain stream segments that were affected by this natural toxicity, notably in the Lower Ikalukrok and Main Stem Red Dog Creek. In applying the narrative criterion of 70.020 to this situation, our regulatory and environmental objective is to ensure that the mine's effluent does not increase the in-stream toxicity above the levels to which the native aquatic life community was subject before mining activity affected water quality in the Red Dog Creek system. This is consistent with the regulations' goal of preventing human activity that causes or contributes to a violation of State water quality standards. See 18 AAC 70.010(a) and (b); 18 AAC 70.020(b)(preamble).

As noted above, we do not have adequate data to accurately determine the in-stream pre-mining toxicity of Main Stem Red Dog Creek or the Lower Ikalukrok. Even if we attempted to estimate downstream historic toxicities, there is no accurate method for determining what effluent toxicity would be protective of the presumed natural condition. Rather than subject our determination of an effluent limit to these two layers of approximation, we will derive a limit that can reasonably be expected to protect the natural condition without relying on an estimate of the natural toxicity in Main Stem Red Dog Creek and Lower Ikalukrok. We do this by seeking to determine a WET limit that prevents the effluent from contributing more toxicity to the downstream water than was contributed by the natural flows that were present before the mining activity began.

The mine's effluent essentially replaces the historic natural flow of the South Fork Red Dog Creek, and a portion of the historical flow from the Middle Fork. The mine's tailings dam entirely blocked any flow from the South Fork drainage. Essentially all of the historic South Fork flow is now captured in the mine's tailings pond. Diversion ditches around the mine pit divert a portion of the Middle Fork flow to the tailings pond as well. If the mines effluent contained the same volume and toxicity as these two natural pre-mining flows, then the downstream aquatic life would not be subjected to more toxicity than it was naturally. However, the permit application seeks authorization to discharge more flow volume than the sum of those two natural flows. We require that additional flow volume to have toxicity low enough to ensure that it does not increase toxicity in the segments where aquatic life is present. Our determination of a toxicity limit is based on a flow-weighted average of the toxicities of these three components of the effluent's total flow volume (South and Middle Forks of Red Dog Creek, and the additional water). We believe that this will prevent the effluent from contributing toxicity to the system beyond what was contributed by the natural flows that the mine removes from the system.

To determine whether a limit is necessary, and to calculate the limit, we must first try to calculate the toxicity that was contributed by the Middle Fork to the Mainstem under natural conditions. This is known as a wasteload allocation (WLA). Once a WLA has been developed, we determine whether a WET limit is needed by comparing the maximum projected effluent toxicity to the WLA. If the maximum projected effluent toxicity exceeds the WLA, then the effluent has the reasonable potential to cause or contribute to a violation of the narrative toxicity criterion, and a WET limit is necessary. If a limit is necessary, then it is derived so as to ensure that the effluent meets the WLA under normal operating conditions virtually all the time.

II. WASTE LOAD ALLOCATION

A Flows

The permittee has requested authorization to discharge a flow volume of 2.4 billion gallons per year (bgy) from the tailings impoundment. Therefore, that volume will be the maximum flow limit in the permit, and the WLA for WET will be derived based on that volume.

Of the 2.4 bgy requested, 1.3 bgy is from precipitation runoff from the South Fork watershed (precipitation on the tailings impoundment, and mine drainage directly into the tailings impoundment; Fact Sheet for Draft Red Dog Mine NPDES Permit, December 1993). The remainder of the discharge volume, 1.1 bgy, is pumped from the dirty water ditch in the Middle Fork drainage to the tailings impoundment. Only a portion of this flow volume can be attributed to surface runoff that would have naturally flowed into the Middle Fork prior to mine development. Surface runoff diverted by the dirty water ditch can be estimated using a drainage area of 0.62 square miles and an estimated precipitation of 28 inches (A Water Balance Model for the Red Dog Mine, Hydrometrics, Inc., Draft 1996; Fact Sheet for the Draft Red Dog Mine NPDES permit, March 1984). The surface runoff is equal to 0.3 bgy. The additional volume of water of .8 bgy may be accounted for by differences in average annual precipitation and accumulation in the tailing pond.

B Protective Toxicity Levels

Middle Fork Red Dog Creek

Since the 0.3 bgy represents water removed from the historical flow volume in Middle Fork, allowing that same volume to be discharged with historical toxicity levels typical of the Middle Fork should not result in degradation in the Main Stem or Lower Ikalukrok, compared to historical conditions. We assume the current data from station 140 is a reasonably conservative approximation of the historic toxicity of the Middle Fork [2].

[2]We note that the pre-mining runoff from the area that is now occupied by the mine pit may have been more or less toxic than the water presently flowing in the Middle Fork. That runoff did run over the location of the most concentrated ore deposit, compared to the other areas

Using a 5th percentile of the toxicity data from station 140 represents a conservative assumption about the natural condition of the water quality of Middle Fork. The 5th percentile of the toxicity data at station 140 is 35.2 TU_c (expressed as the IC25).

South Fork Red Dog Creek

South Fork Red Dog Creek (which is now part of the mining facility tailings impoundment) historically entered the Middle Fork near the current location of Outfall 001. Allowing the discharge of a volume of water that represents the South Fork flow volume (1.3 bgy) at historic South Fork toxicity levels should not result in degradation in the Main Stem or Lower Ikalukrok.

Only limited pre-mining water quality data are available from the South Fork drainage area. During summer, South Fork was a clear water stream having low levels of suspended solids and turbidity and high dissolved oxygen levels. pH was low, ranging between 6.0 and 7.1. Metals concentrations varied, with some exceeding aquatic life criteria. The major source of cadmium, lead and zinc in the South Fork was the first tributary upstream from the mouth of the South Fork, which drained the ore body (Water Quality of Red Dog Creek, Alaska, 1983, Peterson & Associates).[3] No WET data are available, so we estimate the historic South Fork toxicity by comparison with data available from other streams.

The North Fork and Upper Ikalukrok are the only streams within the general area of South Fork that both support aquatic life and are unaffected by the Red Dog mine effluent, making it possible to obtain WET test results that reflect natural local conditions. North Fork is of high quality and supports diverse aquatic flora and fauna. It is a clear water system with high dissolved oxygen levels during summer and breakup, and low levels of suspended solids, turbidity, and settleable solids (Supplement to

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in the Middle Fork watershed, suggesting it could have been more highly contaminated. However, in the natural condition, the deposit was covered by overburden and vegetation, which could have isolated the runoff from the mineralized rock, to some degree, in contrast to the creek bed where the water is in direct contact with mineralized rock. Metals concentrations are generally lower in post-mining samples taken from Station 140 than pre-mining concentrations were, which supports the assumption that the historic toxicity of the Middle Fork was at least as high as present WET tests at Station 140 indicate. In view of these considerations, it seems reasonable to use the current toxicity in the Main Stem as a surrogate for the historical toxicity of the historical runoff from the area that is now occupied by the mine pit.

[3]The ore body is primarily located in the drainage area of the Middle Fork Red Dog Creek, but a relatively small portion of the South Fork Red Dog Creek drainage area also comes into contact with the ore body.

Environmental Baseline Studies, Red Dog Project, Dames & Moore, 1983). The metals levels in the North Fork are much lower than they were in the South Fork.

Except for a short period of time during breakup, Ikalukrok Creek is a highly oxygenated, clear water stream that exhibits low levels of color, suspended solids, turbidity, ammonia and orthophosphate throughout the year (Final Environmental Impact Statement, Red Dog Mine Project Northwest Alaska, 1984). The metals levels in the Upper Ikalukrok are somewhat lower than they were in the South Fork.

In the report entitled Toxicological, Biophysical, and Chemical Assessment of Red Dog Creek, DeLong Mountains, Alaska, 1982, North Fork consistently reflected a healthy, diversified benthic community structure with no pollution-related stress. North Fork had consistently high numbers of taxa and individuals when compared to other sites. South Fork and Upper Ikalukrok both had moderately high numbers of taxa and individuals indicating slight or periodic stress. In five in-situ bioassays performed in South Fork and Upper Ikalukrok prior to mining activity, survival times in the South Fork were shorter than in the Upper Ikalukrok in three tests, and in the remaining two tests survival times were not distinguishable (the test individuals survived for the duration of the tests).

Generally, the data indicate that the Upper Ikalukrok had water quality comparable to or better than that of South Fork, and that North Fork had consistently and significantly better water quality than the South Fork.

In the original draft certification, we used the lowest fifth percentile WET measurement from the Upper Ikalukrok to represent the toxicity of the South Fork. One commenter argued that this was overly conservative, and for several reasons, we agree. Metals concentration are one suspected cause of the natural toxicity occurring in the Red Dog Creek system, and most metals levels are lower in the Upper Ikalukrok than they were in the South Fork. Also, the results from the pre-mining in-situ bioassays on resident fish species suggest generally that the Upper Ikalukrok may have been less toxic than the South Fork. So using lowest fifth percentile from the Upper Ikalukrok seems to add a double layer of conservatism to the estimate of historic South Fork toxicity.

The data are not adequate, however, to conclude that the Upper Ikalukrok was always less toxic than the South Fork. The benthic communities in the Upper Ikalukrok were stressed (as they were in South Fork), and in the in-situ bioassays, some of the survival times in the South Fork were as long as those in the Upper Ikalukrok. We also had reservations about using a single stream (Upper Ikalukrok) to represent the toxicity in South Fork when the streams differed in so many ways.

We do know with some confidence that water quality in North Fork is better, both chemically and biologically, than it was in the South Fork. Including toxicity tests from North Fork in the data set for our estimate of South Fork toxicity expands the data set, both because it encompasses two creeks instead of one, and because it includes more data points. We have approximately the same number of WET tests from the North Fork and Upper Ikalukrok. The higher toxicity values from the North Fork are comparable to the lower toxicity values from Upper Ikalukrok. So using a median value of the data from the two streams results in an approximation of the best quality water from Upper Ikalukrok and the lowest quality water from the North Fork. We feel this is a conservative approximation of the best quality water in South Fork since North Fork appears to have been clearly better than South Fork, and the various data suggest that Upper Ikalukrok was either comparable or better.

A toxicity of 6.1 TU_c (expressed as the IC25) is the median of the toxicity data from upper Ikalukrok and North Fork, and is an adequately conservative estimate of the historic toxicity of the South Fork.

3. Additional Flow Volume Authorized in Permit

The water of unknown origin (.8 bgy) represent additional water which Cominco seeks permission to add to the Middle Fork, that we cannot account for with our estimates of the average annul flows of the South Fork and Middle Fork. We believe that allowing this volume of water to be added to the Middle Fork at a toxicity level equal to the toxicity found in the Upper Ikalukrok would be protective of historical toxicity levels in the Main Stem and Lower Ikalukrok. Historically, the Lower Ikalukrok received a substantial amount of water from the Upper Ikalukrok, which mitigated the negative impacts on aquatic life from the degraded Middle Fork water. This implies that the Upper Ikalukrok water was of better quality than either the Main Stem or the Lower Ikalukrok. Therefore, allowing the additional sources of water at the Red Dog Mine site to be discharged at a toxicity level equivalent to the water in the Upper Ikalukrok should not have an adverse impact on aquatic life in the Main Stem or the Lower Ikalukrok, relative to historic conditions there. Using a 5th percentile of the toxicity data from station 9 represents a conservative assumption about the condition of the water quality of Upper Ikalukrok. The 5th percentile of the toxicity data at station 9 is 2.9 TU_c (expressed as the IC25).

C. Wasteload Allocation Calculation

Using the flow and toxicity values discussed above, the combined toxicity WLA calculation is as follows:

	Flow	**Toxicity**
Middle Fork (diverted portion)	0.3 bgy	35.2 TU_c
South Fork	1.3 bgy	6.1 TU_c
"Additional water"	0.8 bgy	2.9 TU_c

$$WLA = \frac{(0.3 \text{ bgy} \times 35.2 \text{ TU}_c) + (1.3 \text{ bgy} \times 6.1 \text{ TU}_c) + (0.8 \text{ bgy} \times 2.9 \text{ TU}_c)}{2.4 \text{ bgy}} = 8.7 \text{ TU}_c$$

III REASONABLE POTENTIAL

If the maximum projected effluent toxicity exceeds the WLA of 8.7 TU_c, then the effluent has the reasonable potential to cause or contribute to a violation of the narrative toxicity criterion, and a WET limit is necessary.

EPA has developed a statistical approach to characterize the effects of effluent variability. The approach combines knowledge of effluent variability as estimated by a coefficient of variation with the uncertainty due to a limited number of data points to project an estimated maximum toxicity for the effluent. Toxicity data for the effluent were collected from 9/18/94 through 10/7/97. Fifteen data points were used to calculate the coefficient of variation of the effluent. The coefficient of variation ("CV") of the data set is 0.34. Based on 15 data points and a CV of 0.34, the reasonable potential multiplier used to calculate the estimated maximum effluent toxicity is 1.7 (see TSD, table 3-1). The estimated maximum toxicity for the effluent is equal to the highest observed toxicity value of the data set (9.6 TUc) multiplied by the reasonable potential multiplier. In this case, the expected maximum effluent toxicity is 16.3 TU_c (9.6 TU_c X 1.7). Since the expected maximum effluent toxicity is greater than the WLA of 8.7 TU_c, a WET limit is required. A summary of the valid WET test data used in this analysis in included as Attachment B-1.

IV DETERMINATION OF LIMI'

In order to prevent the effluent from causing an exceedance of the narrative criterion for toxicity, the WET limit must prevent the effluent from exceeding the WLA. To support the implementation of EPA's national policy for controlling the discharge of toxicants, EPA developed the "Technical Support Document for Water Quality-Based Toxics Control" (EPA/505/2-90-001, March 1991). The following is a summary of the procedures recommended in the TSD for deriving water quality-based effluent limitations for toxicants from the WLA. This procedure translates water quality criteria to "end of the pipe" effluent limits.

Step 1

$WLA_{chronic} = 8.7\ TU_c$

Step 2

The chronic WLA is then converted to a Long Term Average concentrations (LTA_c) using the following equation:

$LTA_{chronic} = WLA_{chronic} \times e^{[0.5\sigma^2 - z\sigma]}$ where,
$\sigma^2 = \ln(CV^2/4 + 1) = 0.02849$
$z = 2.326$ for 99th percentile probability basis
CV = coefficient of variation = standard deviation/mean = 0.34

Step 3

Using the equations in step 2 calculate the $LTA_{chronic}$:

$8.7 \times e^{((0.5 \times 0.1956) - (2.326 \times 0.4424))} = 5.96$

Step 4

The TSD recommends using the 95th percentile for the Average Monthly Limit (AML) and the 99th percentile for the Maximum Daily Limit (MDL).

Step 5

To derive the MDL and the AML the calculations would be as follows:

$MDL = LTA_{chronic} \times e^{[z\sigma - 0.5\sigma^2]}$
where,
$\sigma^2 = \ln(CV^2 + 1)$
$z = 2.326$ for 99th percentile probability basis
CV = coefficient of variation

$$5.96 \times e^{((2..326 \times 0.33075) - (0.5 \times 0.10939))} = 12.2\ TU_c$$

$$= LTA_{chronic} \times e^{[z\sigma - 0.5\sigma^2]}$$

where,
$\sigma^2 = \ln(CV^2/n + 1)$
$z = 1.645$ for 95th percentile probability basis
CV = 0.93
n = number of sampling events required per month = 1

$$= 5.96 \times e^{((1.645 \times 0.33075) - (0.5 \times 0.10939))} = 9.7\ TU_c$$

V ADDITIONAL SUPPORT BASED ON FISHERY INFORMATION

Field studies of the fisheries in the Red Dog drainage are consistent with the conclusion that the toxicity limits derived above will prevent an increase in receiving water toxicity above the natural (pre-mining) condition. Fieldwork done by the Alaska Department of Fish and Game (ADF&G) over the last several years generally suggests that during 1995, 1996, and 1997, both Arctic grayling and Dolly Varden used the Main Stem of Red Dog Creek (below the confluence of the Middle Fork and the North Fork). Limited visual surveys suggest that use may have been more limited prior to mining activity. Reports of ADF&G's field observations and conclusions are available from either ADF&G or ADEC upon request.

More specifically, while pre-mining data are limited, ADF&G believes that prior to mining, the Main Stem did not provide suitable rearing habitat for juvenile Dolly Varden. Since 1995, ADF&G has documented juvenile Dolly Varden rearing in the Main Stem. Arctic grayling are believed to have only used the Main Stem as a migratory corridor to the North Fork, prior to mining. Since 1995, both adult and young-of-the-year grayling have used the Main Stem for summer rearing and ADF&G believes that grayling spawned in the Main Stem in 1997.

ADF&G's field observations are consistent with the conclusion that under the conditions that prevailed in 1995 through 1997, the toxicity level in the Main Stem was not significantly impairing the fish population, compared to historical conditions. This is consistent with the conclusion that as long as effluent toxicity or flow do not increase significantly over the levels that prevailed since 1995, the toxicity in the Main Stem would not be elevated above its natural level.

EPA has examined the results of WET testing of mine effluent. From 1994 through 1997, 15 WET test results have varied from a low of 2.1 TU_c to a high of 9.6 TUc. Five of the test results were over 7 TU_c. The median was 5.9 TU_c. While a monthly average WET limit of 9.7 TU_c will allow some increase in effluent toxicity, we conclude that there are enough conservative assumptions incorporated in our analysis that such a limit will still keep the toxicity in the Mainstem below its natural level prior to opening of the mine.

Finally, given all the uncertainties that surround not only our estimate of the natural toxicity in the Red Dog system, but also in the precision of WET testing itself, it makes sense to take advantage of the comprehensive biological monitoring that is occurring in those waters. Ultimately, direct observation and sampling of aquatic life in the system is more meaningful than laboratory WET testing. For that reason, we are strengthening the monitoring program that is already occurring. The new monitoring plan is included on p.2 of the revised draft certification. It may be that when this draft permit is reissued in five years, we will have enough confidence in our biological monitoring that we can dispense with WET limits altogether.

ATTACHMENT B-1
Summary Of Wet Tests
Valid Ceriodaphnia Tests

Test Date	Middle Fork Red Dog Creek (Station 140)	Outfall 001	North Fork Red Dog Creek (Station 12)	Upper Ikalukrok Creek (Station 9)
9/18/94		9.6		
9/20/94		5.7		
11/17/94		7.0		
11/29/94		3.6		
11/30/94		2.1		
12/06/94		7.1		
6/13/95	61.0			
6/20/95	45.4			
7/7/95	>100			
8/8/95	>100			
9/6/95				3.6
5/21/96	38.5	5.9	1.4	13.9
5/29/96	30.3	3.8	<1.0	11.9
6/11/96		4.9	9.3	2.0
6/26/96	83.3		3.4	>100
7/31/96	>100	5.0		16.7
8/6/96	>100			
8/14/96	>100			
8/21/96	>100		3.7	>100
9/10/96	>100	6.4	1.1	>100
9/18/96	>100		62.5	6.1
6/24/97			7.2	
8/5/97		9.6	1.3	6.5
8/19/97			<1.0	11.1
9/3/97		4.9	2.0	3.5
9/18/97		6.5	2.6	14.1
10/7/97		8.6		

NOTE: All data is expressed as the IC_{25}

APPENDIX C

Rationale for pH Range

The most stringent Alaska Water Quality Standard regulation for pH protects Growth and Propagation of Fish, Shellfish, other Aquatic Life and Wildlife. It requires that pH "not be less than 6.5 or greater than 9.0 and not vary more than 0.5 pH unit from natural conditions."

An optimum pH, approximately 9.5 to 10 pH units, will precipitate metals from the effluent before it is discharged. Baseline pH at Station 30 (just above the present effluent discharge location) ranged from 5.8 to 6.7. Data collected at the discharge and in the receiving waters since mine operations began, indicate that pH stabilizes shortly after discharge into Red Dog Creek. pH is above 6.5 at Station 20 and is approximately 7 pH units at the mouth of Red Dog Creek; i.e., the mixing of basic discharge waters with acidic creek waters results in a slightly basic to neutral pH where fish occur. No mixing zone for pH is needed with the NPDES effluent limit range of 6.0 to 10.5 pH units.

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