Fact Sheet

NPDES Permit Number: AK-004320-6
Date: October 28, 2004
Public Notice Expiration Date: November 29, 2004
Technical Contact: Cindi Godsey
1-800-781-0983
godsey.cindi@epa.gov

The U.S. Environmental Protection Agency (EPA) Proposes to Reissue a Wastewater Discharge Permit To:

Kennecott Greens Creek Mining Company
P.O. Box 32199
Juneau, Alaska 99803-2199

and

the State of Alaska

Proposes to Certify the Permit and to Conduct a Consistency Review under the Alaska Coastal Management Program

EPA proposes NPDES permit reissuance.
EPA proposes to reissue the existing National Pollutant Discharge Elimination System (NPDES) permit to the Kennecott Greens Creek Mining Company (KCGMC). The draft permit sets conditions on the discharge of pollutants from the Greens Creek Mine facilities to Hawk Inlet, Greens Creek, and Zinc Creek. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged.

This Fact Sheet includes:
- information on public comment, public hearing, and appeal procedures
- a description of the current discharges
- a listing of proposed effluent limitations and other conditions

D R A F T

- a map and description of the discharge locations
- background information supporting the conditions in the draft permit

The State of Alaska proposes certification.

The Alaska Department of Environmental Conservation (ADEC) proposes to certify the NPDES permit for the Greens Creek Mine under section 401 of the Clean Water Act. The state submitted a preliminary 401 certification prior to the public notice which is incorporated in the draft permit and is contained in this Fact Sheet as Appendix C.

Alaska State Consistency Determination

The State of Alaska, Department of Natural Resources (ADNR), Office of Project Management and Permitting (OPMP), intends to review this action for consistency with the approved Alaska Coastal Management Program (ACMP). For more information concerning this review, please contact Joe Donahue at (907) 465-4664 or P.O. Box 110030, Juneau, Alaska 99811-0030.

Public comment on the draft permit.

Persons wishing to comment on or request a public hearing for the draft permit may do so in writing by the expiration date of the public notice. A request for a public hearing must state the nature of the issues to be raised, as they relate to the permit, as well as the requester's name, address, and telephone number. All comments and requests for public hearings must be in writing and include the commenter's name, address, and telephone number and either be submitted by mail to: Office of Water Director at U.S. EPA, Region 10, 1200 6th Avenue, OW-130, Seattle, WA 98101; submitted by facsimile to (206) 553-0165; or submitted via e-mail to godsey.cindi@epa.gov.

After the public notice expires, and all substantive comments have been considered, EPA's regional Director for the Office of Water will make a final decision regarding permit reissuance. If no substantive comments are received, the tentative conditions in the draft permit will become final, and the permit will become effective upon issuance. If comments are received, EPA will address the significant comments prior to reissuing the permit. The permit will become effective no sooner than 35 days after the issuance date, unless an appeal is filed with the Environmental Appeals Board within 30 days.

Public comment on the State preliminary 401 certification

The Alaska Department of Environmental Conservation (ADEC) provides the public with the opportunity to review and comment on preliminary 401 certification decisions. Persons wishing to comment on the preliminary 401 certification should submit written comments by the public notice expiration date to Kenwyn George, Alaska Department of Environmental Conservation (ADEC), 410 Willoughby Avenue, Suite 303, Juneau, AK 99801-1795, (907) 465-5313.

Public comment on the State ACMP review

The Alaska Department of Natural Resources (ADNR), Office of Project Management and Permitting (OPMP) will conduct a consistency review under the Alaska Coastal Management Plan (ACMP). For further information or to comment on this review, contact Joe Donahue, 302 Gold Street, Juneau, AK 99801, (907) 465-4664, Joe_Donohue@dnr.state.ak.us

Documents are available for review.

The draft NPDES permit and related documents can be reviewed or obtained by visiting or contacting EPA's Regional Office in Seattle between 8:30 a.m. and 4:00 p.m., Monday through Friday (see address below).

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue, OW-130
Seattle, Washington 98101
(206) 553-0523 or
1-800-424-4372 (within Alaska, Idaho, Oregon, and Washington)

The fact sheet and draft permit are also available at:

EPA Alaska Operations Office
709 W. 9th Street Room 223A
Box 20370
Juneau, Alaska 99802

EPA Alaska Operations Office
222 W. 7th Avenue, Room 537
Box 19
Anchorage, Alaska 99513

The draft permit and fact sheet can also be found by visiting the Region 10 website at www.epa.gov/r10earth/ then click on Water Quality, Permits (under NPDES) and then draft permits.

For technical questions regarding the permit or fact sheet, contact Cindi Godsey at the phone numbers or email address at the top of this fact sheet. Services can be made available to person with disabilities by contacting Audrey Washington at (206) 553-0523 or 1-800-424-4372 (within Alaska, Idaho, Oregon, and Washington).

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LIST OF ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AML	Average Monthly Limit
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BE	Biological Evaluation
BMP	Best Management Practices
BOD_5	Biological Oxygen Demand, 5-day
BPT	Best Practicable Control Technology
CFR	Code of Federal Regulations
CV	coefficient of variation
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
gpd	gallons per day
gpm	gallons per minute
KGCMC	Kennecott Greens Creek Mining Company
LTA	long term average
MDL	maximum daily limit
mgd	million gallons per day
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
RPM	Reasonable Potential Multiplier
s.u.	standard units
TSD	Technical Support Document (EPA 1991)
TSS	Total Suspended Solids
TU	Toxic Unit (TU_c = chronic toxic unit)
WAD	weak acid dissociable
WET	Whole Effluent Toxicity
WLA	Wasteload Allocation

I. APPLICANT

Kennecott Greens Creek Mining Company
NPDES Permit No.: AK-004320-6

Mailing Address: P.O. Box 32199
Juneau, Alaska 99803

Facility Location: See Figure A-1 in Appendix A

Facility Contact: Bill Oelklaus, Environmental Affairs Supervisor
(907) 789-9170

II. FACILITY ACTIVITY

The Greens Creek Mine is a lead, zinc, silver, and gold mine and mill located on the northwest portion of Admiralty Island approximately 18 miles southwest of Juneau, Alaska (see Figure A-1). The mine and mill are owned and operated by the Kennecott Greens Creek Mining Company (KGCMC). The facility has been in operation since 1989 with a period of temporary shutdown between April 1993 and 1996. At an average production rate of 2200 to 2400 tons of ore per day, KGCMC predicts an additional 10 year mine life (as of 2003).

The mine facilities encompass approximately 273 acres in the Admiralty National Monument. The Admiralty Island National Monument is managed by the U.S. Forest Service. The mine facilities are located in the Greens Creek, Zinc Creek, Cannery Creek and Tributary Creek drainages. These creeks flow into Hawk Inlet. Major site facilities include the underground mine, waste rock storage areas, mill, tailings facility, and port facilities (Hawk Inlet terminal facilities), and roads connecting these components. The location of the major facility components are shown in Figure A-2.

A. Mining, Milling, and Tailings Disposal Processes

The ore is mined via underground methods. Waste rock removed from the mine is disposed of in permanent storage areas located adjacent to the mine (waste rock sites 23 and D). At the mill, the ore is ground and processed by flotation to produce a lead concentrate and a zinc concentrate. The following reagents are added to the flotation process: copper sulfate, alcohol-based frothers, diesel fuel, xanthate, lime, sodium cyanide, zinc sulfate, and sodium isopropyl dithiophosphate. The flotation concentrates are thickened and filtered then trucked to the Hawk Inlet terminal for shipment off-site.

The tailings from the flotation process are thickened and filtered. Approximately half of the tailings are placed in the underground mine for mine backfill. The remainder are covered and transported to the dry tailings site for disposal.

The dry tailings disposal site is located in the upper reaches of Tributary Creek drainage. Currently, the total area of the site is approximately 29 acres. The tailings

site consists of a dry tailings pile and runoff surge pond (tailings facility) situated adjacent to one another. An Environmental Impact Statement (EIS) for expansion of the tailings facility has been finalized by the U.S. Forest Service. The expansion will increase the size of the tailings facility to approximately 85 acres.

B. Wastewater and Storm Water Management

The current and proposed NPDES permit authorizes discharge of wastewaters from two outfalls into Hawk Inlet and authorizes the discharge of numerous storm water outfalls. Figure A-2 shows the location of the outfalls. The sources of wastewater contributing to each outfall are described below.

Outfall 001: Until June 1999, treated sanitary wastewater from the Hawk Inlet terminal facilities sewage treatment plant was discharged through outfall 001 into Hawk Inlet. Currently the treated sewage wastewater is routed for discharge through outfall 002. However, the permit retains outfall 001 for use as a backup discharge point. The sewage is treated in a package plant by sequencing batch reactor and chlorine addition. The average flow is 5000 gallons per day (gpd) with a maximum flow of 6000 gpd. The pollutants present in the treated sewage wastewater include biochemical oxygen demand (BOD), fecal coliform, chlorine, total suspended solids (TSS), pH, and oil and grease.

Outfall 001 extends from the Hawk Inlet terminal area into Hawk Inlet. The outfall is located in about 40 feet of water at latitude 58^{o} 07' 30" N and longitude 134^{o} 45' 15" W.

Outfall 002: Mine and mill wastewaters and storm water are treated and discharged through outfall 002 into Hawk Inlet. The specific sources of wastewater contributing to outfall 002 include:

1. Water from the underground mine - Wastewater from the underground mine is pumped to the dry tailings area for treatment prior to discharge.

2. Process water from the mill - Most of the process water collected from the mill through tailings and concentrate thickening and filtration is recycled for reuse in the milling process. However, a portion of the wastewater is purged from the system to maintain a suitable water chemistry for flotation performance. This purged wastewater is treated at the mill in an 800 gallon per minute (gpm) treatment plant. Treatment consists of hydrogen peroxide addition to destroy the cyanide and ferric iron co-precipitation, flocculation, and clarification to reduce the levels of metals in the wastewater. The treated mill process water is piped to the dry tailings facility for additional treatment prior to discharge.

3. Sanitary wastes from the mine and mill area - Sanitary wastes from the mine and mill area are treated in a sequencing batch reactor package plant then piped to the dry tailings facility for additional treatment prior to discharge.

4. Storm water from the mine and mill area - Storm water drainage from the mine and mill area are collected through of a series of lined ditches, degritting basins,

and ponds. These waters are piped to the dry tailings area for treatment prior to discharge.

5. Storm water from the Hawk Inlet terminal area - Storm water from the Hawk Inlet terminal area is collected in a sediment pond and piped to the dry tailings area for treatment prior to discharge.

6. Seepage and runoff from waste rock storage areas 23 and D - Seepage and runoff from these waste rock storage areas are collected in ponds below the waste rock storage piles. These wastewaters are routed either back to the mill for use in mill processes or are pumped to the dry tailings facility for further treatment prior to discharge.

7. Dry tailings facility seepage and runoff - Seepage from the dry tailings facility and runoff from the tailings basin watershed are collected in a pond (pond 6) located below the dry tailings facility. A new pond (pond 7) will be constructed to allow for added capacity for the proposed expansion of the dry tailings facility.

8. Outfall 001 effluent - As discussed under “outfall 001", above, treated sanitary wastewater from the Hawk Inlet terminal area is generally piped to the dry tailings area for discharge through outfall 002.

The above wastewater streams are combined and treated in an 800 gpm wastewater treatment plant located near the dry tailings facility. The treatment process is the same as that used for the mill wastewaters (ferric iron co-precipitation and neutralization). When necessary, the treated effluent is filtered through an 1800 gpm filtration system. The treated effluent is discharged through outfall 002. Sludge from the treatment plant is thickened, filtered, and disposed in the dry tailings facility.

The total discharge rate from outfall 002 averages 1.1 mgd with a maximum daily flow of 2.5 mgd. The effluent pipeline has a maximum capacity of 3.6 mgd. The pollutants present in the discharge include: cadmium, copper, lead, mercury, zinc, cyanide, BOD, TSS, pH, and fecal coliform.

Outfall 002 extends from the dry tailings area to the Hawk Inlet discharge point at latitude 53^{o} 07' 0" N and longitude 134^{o} 44' 30" W.. The effluent is discharged through a 160-foot long, 14-inch diameter diffuser. The diffuser is located at a depth of approximately 45 feet at the near shore end and 69 feet at the offshore end.

Storm Water: Storm water that is not discharged through outfall 002, may be discharged through the storm water outfalls shown in Table 1. The current permit authorized these same outfalls as well as an additional outfall (outfall 005.1). Outfall 005.1 has been discontinued since the runoff from that site, which is located in the tailings disposal area, is currently captured and discharged through outfall 002.

Table 1: Proposed Storm Water Outfalls			
Outfall[1]	Location[2]	Description of Discharge	Receiving Water
003 (527)	Hawk Inlet facilities area, near cannery buildings	runoff from parking and storage areas not otherwise captured and routed through outfall 002	Hawk Inlet
004 (520)	Pit 7 (active rock quarry)	runoff and drainage from rock extraction pit	wetlands
005.2 (539)	Zinc Creek bridge off of B-road	runoff from road cut and fill in known mineralized zone	Zinc Creek
005.3 (545)	Site E (inactive waste rock storage area)	runoff from waste rock storage area and road runoff	Greens Creek
005.4 (547)	Pit 6 (inactive rock quarry and top soil storage area)	seepage and runoff from inactive quarry site and topsoil storage area	Greens Creek
005.5 (560)	Culvert at B-road mile 7.8	road runoff	Greens Creek
006 (562)	Pond D (sediment pond from inactive waste rock storage area D)	seepage and runoff from inactive waste rock storage area D	Greens Creek
007 (565)	Pond C (sediment pond from inactive waste rock storage area C)	seepage and runoff from inactive waste rock site C	Greens Creek
008 (570)	960 laydown site for initial portal development rock	seepage and runoff from inactive waste rock placement site	Greens Creek
009 (580)	Site 1350 adit inactive waste rock storage area	runoff and seepage from inactive development rock placement site	Greens Creek

Footnotes:
1 - KGCMC's site sampling numbers are shown in parenthesis for each outfall.
2 - See Figure A-2 which shows storm water outfall locations

III. FACILITY BACKGROUND

A. Permit History

EPA first issued an NPDES permit for Greens Creek Mine on March 31, 1987. The current permit was reissued by EPA on October 15, 1998. The current permit expired on November 17, 2003. A timely application for renewal of the permit was submitted to EPA in a letter dated May 6, 2003. Additional information related to the permit application was submitted in letters dated May 28, 2003 and May 30, 2003. Because KGCMC submitted a timely application for renewal, the 1998 permit has been administratively extended and remains fully effective and enforceable until reissuance.

B. Compliance History

KGCMC submits monthly discharge monitoring reports (DMRs) to EPA summarizing the results of effluent monitoring required by the permit. The following effluent limit

violations were noted based on review of the past five years' DMRs (since issuance of the 1998 permit):

Outfall 001: The facility had violations of the outfall 001 permit limits for chlorine, fecal coliform, and TSS from December 1998 through June 1999. This was due to KGCMC's inability to treat the sanitary wastewater to meet both the fecal coliform limits and the low chlorine limits. KGCMC tried repeatedly to reduce fecal coliform through the use of ozone instead of chlorine, but was not successful. In June 1999, KGCMC ceased discharging from outfall 001; instead the treated sanitary wastewater was routed to outfall 002 for discharge (see also Section II.B. of the Fact Sheet). EPA sent warning letters to KGCMC in 1999 documenting most of the violations; however, no other action was taken since the outfall 001 discharge was rerouted.

In January 2000, KGCMC again discharged through outfall 001 for four days. Emergency use of outfall 001 was needed since a section of the pipeline through which the outfall 001 discharge was routed to outfall 002 froze. It took four days to find and repair the frozen section of pipe. Chlorine limits were violated during the four days of discharge.

Outfall 002: The facility had one violation of the permit limits for pH that occurred in September 1999.

IV. RECEIVING WATERS

The Greens Creek facility wastewaters are discharged to Hawk Inlet. Storm water may be discharged to Hawk Inlet, Greens Creek, and Zinc Creek.

Hawk Inlet is located adjacent to Chatham Strait. The Alaska State Water Quality Standards (WQS) designate beneficial uses for the state (18 AAC 70). Hawk Inlet and Chatham Strait are classified for protection of the following uses: water supply (for aquaculture, seafood processing, and industrial uses); primary and secondary contact recreation; growth and propagation of fish, shellfish, other aquatic life and wildlife; and, harvesting for consumption of raw mollusks or other raw aquatic life (18 AAC 70.020).

Greens Creek and Zinc Creek are classified for protection of the following uses: water supply (for drinking, agriculture, aquaculture, and industrial uses); primary and secondary contact recreation; and, growth and propagation of fish, shellfish, other aquatic life, and wildlife (18 AAC 70.020).

The WQS specify water quality criteria that is deemed necessary to support the use classifications. These criteria may by numerical or narrative. The water quality criteria applicable to the proposed permit are provided in Appendix B (Section III.A.).

V. EFFLUENT LIMITATIONS

EPA followed the Clean Water Act (CWA), state and federal regulations, and EPA's 1991 *Technical Support Document for Water Quality-Based Toxics Control* (TSD) to develop the effluent limits in the draft permit. In general, the CWA requires that the

effluent limit for a particular pollutant be the more stringent of either the technology-based limit or water quality-based limit. Appendix B provides discussion on the legal basis for the development of technology-based and water quality-based effluent limits.

EPA sets technology-based limits based on the effluent quality that is achievable using readily available technology. The Agency evaluates the technology-based limits to determine whether they are adequate to ensure that WQS are met in the receiving water. If the limits are not adequate, EPA must develop additional water quality-based limits. Water quality-based limits are designed to prevent exceedances of the WQS in the receiving waters.

A. Outfall 001

Table 2 compares the existing effluent limits for outfall 001 with the proposed effluent limits. The effluent limits for BOD_5 and TSS are technology-based. The effluent limits for fecal coliform, chlorine, and pH are water quality-based. See Appendix B for a detailed discussion on how the proposed permit limits were developed.

Table 2: Effluent Limitations for Outfall 001

Parameter	units	Existing Effluent Limitations			Proposed Effluent Limitations		
		average monthly	average weekly	maximum daily	average monthly	average weekly	maximum daily
BOD_5	mg/l	30	45	--	30	45	--
	lbs/day	--	--	--	0.36	0.54	--
	% removal	--	--	--	85%		
TSS	mg/l	30	45	--	30	45	--
	lbs/day	--	--	--	0.36	0.54	--
	% removal	--	--	--	85%		
Chlorine, total residual	ug/l	1.6	--	3.3	6.1[1]	--	12.3[1]
	lbs/day	--	--	--	0.000072	--	0.00015
Fecal Coliform	#/100 ml	7000	--	21500	7000	--	21500
pH	s.u.	within the range of 6.0 - 9.0			within the range of 6.5 - 8.5		

Footnote 1: The effluent limits for total residual chlorine are not quantifiable using EPA-approved analytical methods. EPA will use 100 ug/l (the Minimum Level) as the compliance evaluation level for this parameter.

B. Outfall 002

The proposed effluent limits for outfall 002 are the same as the existing limits (see Table 3), except the proposed average monthly flow limit has increased to 2.39 mgd and the pH range limits have become more stringent. The limits for metals and TSS are

technology-based. The limits for pH are water quality-based. See Appendix B for a detailed discussion of how the permit limits were developed.

Table 3: Current and Proposed Effluent Limitations for Outfall 002

Parameter	units	average monthly limit	maximum daily limit
flow	mgd	current - 1.66 proposed - 2.39	3.6
cadmium, total recoverable	ug/l	50	100
copper, total recoverable	ug/l	150	300
lead, total recoverable	ug/l	300	600
mercury, total	ug/l	1.0	2.0
zinc, total recoverable	ug/l	500	1000
TSS	ug/l	20	30
pH	ug/l	current - within the range of 6.0 - 9.0 proposed - within the range of 6.5 - 8.5	

C. Storm Water Outfalls

Monitoring data indicated that some of the storm water discharges exceed WQS (see section III.D. of Appendix B for a discussion of the storm water discharges and concentrations compared to water quality criteria). However, numerical effluent limits were not developed for the individual storm water outfalls. This is due to the difficulty in developing numerical limits for storm water discharges that are extremely variable in flow and pollutant concentrations and the uncertainty regarding the effect of the storm water outfalls on the receiving waters.

Rather than developing numerical effluent limits for each storm water outfall, the permit includes:

- A general requirement that the storm water outfalls must not cause or contribute to a WQS violation.

- Requirements to develop a best management practices (BMP) plan and outfall-specific BMPs. The NPDES regulations allow for the use of BMPs where development of numerical effluent limits are infeasible (40 CFR 122.44(k)). See section VII.B., below for more information regarding the BMP requirements.

– Monitoring of the storm water outfalls and a new requirement to monitor the receiving waters to determine whether storm water is impacting the receiving waters (see section VI.C. below).

VI. MONITORING REQUIREMENTS

Section 308 of the CWA and federal regulation 40 CFR 122.44(i) require that monitoring be included in permits to determine compliance with effluent limitations. Monitoring may also be required to gather data for future effluent limitations or to monitor effluent impacts on receiving water quality. KGCMC is responsible for conducting the monitoring and reporting the results to EPA on monthly DMRs and in annual reports. This section describes the monitoring requirements in the draft permit.

A. Effluent Monitoring

The effluent monitoring requirements in the draft permit are summarized in Table 4. The monitoring requirements for outfalls 001 and 002 are the same as included in the current permit, with the following exceptions:

– Monthly monitoring for BOD and fecal coliform have been included for outfall 002 to monitor the influence of the sanitary discharges that are included in the outfall 002 waste stream.

– Whole effluent toxicity (WET) monitoring is no longer required (see Section VI.B., below).

– Total cyanide monitoring of outfall 002 has been replaced with weak acid dissociable (WAD) cyanide, since recent revisions to the WQS specify that cyanide be expressed as WAD (see section III.A. of Appendix B). If EPA does not approve the revisions to the WQS before issuing the permit, then total cyanide monitoring will remain.

Table 4: Outfall 001 and 002 Effluent Monitoring Requirements

Parameter	Outfall 001		Outfall 002	
	frequency	sample type	frequency	sample type
outfall flow, gpd	daily	recording	continuous	recording
BOD_5, mg/l	weekly	grab	monthly	24-hour composite
Total Residual Chlorine, ug/l	weekly	grab	--	--
Fecal Coliform Bacteria, #/100 ml	weekly	grab	monthly	24-hour composite
TSS, mg/l	weekly	grab	weekly	24-hour composite
pH, standard units (su)	weekly	grab	daily	grab
temperature, ^oC	weekly	grab	weekly	grab
metals with effluent limits[1], ug/l	--	--	weekly	24-hour composite

Table 4: Outfall 001 and 002 Effluent Monitoring Requirements				
Parameter	Outfall 001		Outfall 002	
	frequency	sample type	frequency	sample type
WAD cyanide, ug/l	–	–	weekly	24-hour composite

Footnotes:
1 - Metals to be measured include: cadmium, copper, lead, mercury, and zinc. The metals are to be monitored as total recoverable.

B. Whole Effluent Toxicity Testing

Whole effluent toxicity (WET) is defined as the aggregate toxic effect of an effluent measured directly by an aquatic toxicity test. WET tests are standardized laboratory tests that measure the total toxic effect of an effluent by exposing organisms to the effluent and noting the effects. There are two different durations of toxicity tests: acute and chronic. Acute toxicity tests measure the test organisms survival over a 96-hour test exposure period. Chronic toxicity tests measure reductions in survival, growth, and reproduction over a 7-day exposure.

Federal regulations at 40 CFR 122.44(d)(1) require that permits contain limits on WET when a discharge has reasonable potential to cause or contribute to an exceedence of a water quality standard. In Alaska, the relevant WQS states that an effluent discharge to a water may not impart chronic toxicity to aquatic organisms, expressed as 1.0 chronic toxic units (TUc), at the point of discharge, or if the department authorizes a mixing zone, at or beyond the mixing zone boundary, based on the minimum effluent dilution achieved in the mixing zone (18 AAC 70.030.).

As required under their current permit, KGCMC conducts chronic WET testing on effluent from outfall 002 twice per year. The test are conducted on two species:

- either mussels (*Mytilis spp.*) or oyster (*Crassostrea gigas*) and
- either urchin (*Strongylocentrotus purpuratus*) or sand dollar (*Dendraster excentricus*)

EPA reviewed the WET data. The data show that the effluent from outfall 002 has no reasonable potential to contribute to an exceedence of the WQS for toxicity (see Appendix B, section III.B. for the reasonable potential analysis). Because adequate data existed to determine that WET limits are not needed and there is no reason to believe that the characteristics of the discharge will change over the term of the next permit, regular monitoring for WET was removed from the permit.

C. Storm Water Monitoring

The current permit requires KGCMC to monitor storm water outfalls twice per year (once during spring runoff/snowmelt and once during the fall “monsoon” months) at the locations shown in Table 1. Outfalls 003 through 005 are monitored for oil & grease, lead, zinc, TSS, and pH. Outfalls 006 through 009 are monitored for lead, zinc, TSS, and pH.

EPA reviewed the monitoring data and determined that twice yearly storm water monitoring of the outfalls must continue. Since some of the storm water monitoring showed that the storm water exceeded WQS, monitoring of the receiving water has been added to the permit to determine whether the storm water is impacting receiving water quality. The draft permit requires that, for each storm water outfall, KGCMC monitor the receiving water directly downstream of where the storm water enters the receiving water. The receiving water must be monitored at the same time as the storm water outfalls and for the same parameters.

Some of the previous storm water monitoring was conducted using analytical methods with detection limits higher than the water quality criteria. The draft permit includes a new requirements specifying the method detection limits to be used for the storm water and associated receiving water monitoring.

D. Hawk Inlet Monitoring

The current permit requires KGCMC to monitor seawater, sediments, and toxicity in Hawk Inlet. The proposed permit monitoring requirements are the same as those in the current permit with the few exceptions discussed below. The goal of the monitoring program is to demonstrate that WQS are not exceeded at the edge of the designated mixing zone and to assess whether sediments or aquatic organisms may be affected by the facility's discharges. The sampling locations are shown in Figure A-3.

Water Column Monitoring: The proposed permit requires quarterly receiving water monitoring in Hawk Inlet at three pre-existing sample locations (locations 106, 107, and 108). Location 106 represents background conditions. Locations 107 and 108 are in the areas affected by the discharges from outfall 001 and 002, respectively. The samples will be analyzed for the following parameters: cadmium, copper, lead, mercury, zinc, TSS, pH, cyanide, temperature, conductivity, and turbidity. The Hawk Inlet water quality monitoring data is used to evaluate the water quality impacts of the outfall 001 and 002 discharges. In order to perform this evaluation, it is necessary that the ambient monitoring use analytical methods that have method detection limits below the water quality criteria. Therefore, the draft permit specifies method detection limits for metals and cyanide required for surface water monitoring (see Table 4 of the draft permit).

The proposed receiving water monitoring requirements are the same as required in the current permit, except the current permit requires that the metals be monitored as total or total recoverable. The draft permit requires that the metals be monitored as dissolved assuming that EPA approves the revisions to the WQS that specify metals water quality criteria as dissolved (see section III.A. of Appendix B). If EPA does not approve the revisions to the WQS before issuance of the permit, then the ambient monitoring for metals will remain as total or total recoverable.

Sediment Monitoring: The proposed permit requires sediment monitoring in Hawk Inlet twice per year at four pre-existing sample locations (locations S-1, S-2, S-4, and S-5). Location S-2 represents background conditions. Locations S-1 and S-4 are in the areas affected by the discharges from outfall 001 and 002, respectively. Location S-5 is in the area potentially affected by the loading of concentrates onto ships. The samples will be

analyzed for the following parameters: cadmium, copper, lead, mercury, and zinc. The draft permit specifies method detection limits for these parameters (see Table 5 of the draft permit). The proposed sediment monitoring requirements are the same as required in the current permit.

In-situ Bioassays: The proposed permit requires analysis of tissues from organisms collected in Hawk Inlet twice per year at seven pre-existing sample locations. Polychaete sediment dwellers, *Nepthys procera* and *Nereis sp.* will be collected from three pre-existing sample locations (locations S-1, S-2, and S-4). These locations are the same as required for the sediment sampling, except bioassays are not required at location S-5 since the polychaete test organisms do not occur at location S-5. The filter feeder, *Mytilus edulus* (bay mussel) will be collected from four pre-existing sample locations (location Stn 1, Stn 2, Stn 3, and ESL). Location Stn 2 and Stn 3 represent background conditions. Location ESL and Stn 1 are in the area influenced by outfall 002. The tissue samples will be analyzed for the following parameters: cadmium, copper, lead, mercury, and zinc. The draft permit specifies the methods to be used for sample collection and analysis. The proposed in-situ bioassay monitoring requirements are the same as required in the current permit, except sampling at location S-5 is no longer required.

E. Representative Sampling

The draft permit has expanded the requirement in the federal regulations regarding representative sampling (40 CFR 122.41[j]). This provision now specifically requires representative sampling whenever a bypass, spill, or non-routine discharge of pollutants occurs, if the discharge may reasonably be expected to cause or contribute to a violation of an effluent limit under the permit. This provision is included in the draft permit because routine monitoring could miss permit violations and/or WQS exceedences that could result from bypasses, spills, or non-routine discharges. This requirement directs KGCMC to conduct additional, targeted monitoring to quantify the effects of these occurrences on the final effluent discharge.

VII. OTHER PERMIT CONDITIONS

A. Quality Assurance Plan

Federal regulations at 40 CFR 122.41(e) require permittees to properly operate and maintain their facilities, including “adequate laboratory controls and appropriate quality assurance procedures.” To implement this requirement, KGCMC’s current permit required that KGCMC develop a Quality Assurance Plan (QAP) to ensure that the monitoring data submitted is accurate and to explain data anomalies if they occur. The new draft permit requires KGCMC to update the QAP to reflect final permit conditions. The QAP must include standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples, laboratory analysis, and data reporting. The draft permit requires KGCMC to submit the QAP to EPA within 60 days of the effective date of the permit and implement the QAP within 120 days of the effective date.

B. Best Management Practices Plan

Section 402 of the CWA and federal regulations at 40 CFR 122.44(k)(2) and (3) authorize EPA to require best management practices (BMPs) in NPDES permits. BMPs are measures that are intended to prevent or minimize the generation and the potential for release of pollutants from industrial facilities to waters of the U.S. These measures are important tools for waste minimization and pollution prevention. KGCMC's current permit required preparation of a BMP Plan. The current permit contains general BMP Plan requirements, similar to what is required for most major industrial facilities in Alaska and Idaho (where EPA Region 10 issues permits). The draft permit requires that the BMP Plan be updated as discussed below.

Where BMPs are used in lieu of numerical effluent limits for storm water discharges, the BMPs must be demonstrated to provide adequate water quality protection. It is not apparent from the past storm water monitoring that the BMPs currently utilized by KGCMC are protecting the receiving water quality (see section III.D. of Appendix B which shows that the storm water discharges exceed WQS). Therefore, the draft permit includes a requirement that KGCMC develop BMPs for each outfall to protect the receiving water quality. The draft permit includes additional new BMP Plan requirements for storm water pollution prevention that are based on the storm water pollution prevention plan requirements for metal mining facilities (Sector G) in EPA's national NPDES Storm Water Multi-Sector General Permit for Industrial Activities. The monitoring required in the draft permit (see section VI.C., above), along with periodic inspections, are required to evaluate the effectiveness of BMPs and to provide sufficient information to determine if the storm water discharges cause or contribute to WQS exceedences.

The draft permit requires that the BMP Plan be submitted and implemented within 120 days and 180 days, respectively, of permit issuance. The draft permit requires that the BMP Plan be maintained and that any modifications to the facility are made with consideration to the effect the modification could have on the generation or potential release of pollutants. The BMP Plan must be revised if the facility is modified and as new pollution prevention practices are developed.

C. Additional Permit Provisions

In addition to facility-specific requirements, most of sections III, IV, and V of the draft permit contain "boilerplate" requirements. Boilerplate is standard regulatory language that applies to all permittees and must be included in NPDES permits. Because the boilerplate requirements are based on regulations, they cannot be challenged in the context of an NPDES permit action. The boilerplate covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and general requirements.

VIII. OTHER LEGAL REQUIREMENTS

A. Endangered Species Act

The Endangered Species Act requires federal agencies to consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) (collectively referred to as the Services) if their actions could beneficially or adversely affect any threatened or endangered species. In a letter dated August 14, 2003, NMFS has identified the following threatened and endangered species in the vicinity of Greens Creek Mine discharges:

Endangered & Threatened Species:
Humpback Whale
Eastern Stellar Sea Lion

In 1998, EPA prepared a Biological Evaluation (BE) to evaluate the potential impacts of the NPDES discharges authorized in the current permit on the listed species. The BE concluded that issuance of the NPDES permit was not likely to adversely affect any of the threatened and endangered species. Because the effluent limits and most of the other permit conditions have not changed from the current permit conditions, EPA has determined that reissuance of the permit is not likely to adversely affect any of the species.

The EPA will provide the Services with copies of the draft permit and fact sheet during the public notice period. EPA will also request updates of the species lists. Any comments received from the Services will be considered prior to reissuance of this permit.

B. Essential Fish Habitat

Section 305(b) of the Magnuson-Stevens Act (16 USC 1855(b)) requires federal agencies to consult with the NMFS when any activity proposed to be permitted, funded, or undertaken by a federal agency may have an adverse effect on designated Essential Fish Habitat (EFH). The EFH regulations define an adverse effect as any impact which reduces quality and/or quantity of EFH and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

In the 1998 BE prepared by EPA, EPA determined that issuance of the current permit was not likely to adversely effect the threatened and endangered species. EPA believes that this same determination is appropriate for EFH for the reasons laid out in the BE. Therefore, EPA has determined that reissuance of the Greens Creek Mine permit is not likely to adversely effect EFH in the vicinity of the discharge. The EPA will provide NMFS with copies of the draft permit and fact sheet during the public notice period. Any comments received from NMFS will be considered prior to reissuance of this permit.

C. State Certification

Section 401 of the CWA requires EPA to seek certification from the State that the permit is adequate to meet WQS before issuing a final permit. The regulations allow for the state to stipulate more stringent conditions in the permit, if the certification cites the CWA or State law references upon which that condition is based. In addition, the regulations require a certification to include statements of the extent to which each condition of the permit can be made less stringent without violating the requirements of State law.

The State has provided EPA with a preliminary certification of this permit for the public draft (ADEC 2003). The preliminary certification contained mixing zone requirements that have been incorporated into the draft permit.

The above recommendations have been incorporated into the draft permit. After the public comment period, a preliminary final permit will be sent to the State for final certification. If the State authorizes different requirements in its final certification, EPA will incorporate those requirements into the permit. For example, if the State authorizes different mixing zones in its final certification, EPA will recalculate the effluent limitations in the final permit based on the dilution available in the final mixing zones.

D. Coastal Zone Management Act

The applicant has certified that the activities authorized by the draft permit are consistent with the Alaska Coastal Management Plan. Pursuant to 40 CFR 122.49(d), requirements of the State coastal zone management program must be satisfied before the permit may be reissued. The draft permit and fact sheet containing the determination will be submitted to the OPMP for state interagency review at the time of the public notice.

E. Antidegradation

In setting permit limitations, EPA must consider the State's antidegradation policy. Alaska's antidegradation policy is found at 18 AAC 70.015. This policy is designed to protect existing water quality when the existing quality is better than that required to meet the standard and to prevent water quality from being degraded below the standard when existing quality just meets the standard. For high quality waters, antidegradation requires that the State find that allowing lower water quality is necessary to accommodate important economic or social development before any degradation is authorized. This means that, if water quality is better than necessary to meet the WQS, increased permit limits can be authorized only if they do not cause degradation or if the State makes the determination that it is necessary.

Because the effluent limits in the draft permit are nearly the same as those in the current permit and these effluent limits have been shown to not cause or contribute to an exceedence of WQS, the discharges as authorized in the draft permit will not result in degradation of the receiving water. The draft permit will result in no increase in

pollutant loadings. Therefore, the conditions in the permit will comply with the State's antidegradation requirements.

F. Permit Expiration

This permit will expire five years from the effective date of the permit.

IX. REFERENCES

ADEC 2003 - pre-certification dated October 2004

EPA 1998. NPDES Permit No. AK-004320-6. Issued October 15, 1998.

EPA 1991. *Technical Support Document for Water Quality-based Toxics Control*. Office of Water Enforcement and Permits, Office of Water Regulations and Standards. Washington, D.C., March 1991. EPA/505/2-90-001.

EPA, 1996a. *EPA Region 10 Guidance For WQBELs Below Analytical Detection/Quantitation Level. NPDES Permits Unit*, EPA Region 10, Seattle, WA. March 1996.

KGCMC permit application submittal dated May 28, 2003.

1998 Biological Evaluation

APPENDIX A - LOCATION AND FACILITY MAPS

Insert figures A-1 through A-3

A-1 - Greens Creek Mine location map

A-2 - Outfall location map

A-3 - Monitoring location map

APPENDIX B - DEVELOPMENT OF EFFLUENT LIMITATIONS

This section discusses the basis for and the development of effluent limits in the draft permit. This section includes: an overall discussion of the statutory and regulatory basis for development of effluent limitations (Section I); discussions of the development of technology-based effluent limits (Section II) and water quality-based effluent limits (Section III); and, a summary of the effluent limits developed for this draft permit (Section IV).

I. Statutory and Regulatory Basis for Limits

Sections 101, 301(b), 304, 308, 401, 402, and 405 of the Clean Water Act (CWA) provide the basis for the effluent limitations and other conditions in the draft permit. The EPA evaluates the discharges with respect to these sections of the CWA and the relevant National Pollutant Discharge Elimination System (NPDES) regulations to determine which conditions to include in the draft permit.

In general, the EPA first determines which technology-based limits must be incorporated into the permit. EPA then evaluates the effluent quality expected to result from these controls, to see if it could result in any exceedances of the WQS in the receiving water. If exceedances could occur, EPA must include water quality-based limits in the permit. The proposed permit limits will reflect whichever requirements (technology-based or water quality-based) are more stringent.

II. Technology-based Evaluation

A. Technology-based Effluent Limitations for Outfall 001

The CWA requires publically owned treatment works (POTWs) to meet performance-based requirements based on available wastewater treatment technology. Section 301 of the CWA established a required performance level, referred to as “secondary treatment”, that all POTWs were required to meet by July 1, 1977. The secondary treatment standards are found at 40 CFR 133.102.

State regulations also require secondary treatment of domestic wastewater unless a reduced treatment level is established by ADEC in response to a request by the applicant. The state secondary treatment standards are found at 18 AAC 72.990(59).

The state and federal regulations specify the minimum level of effluent quality attainable by secondary treatment as the concentrations in Table B-2. Domestic wastewater from the Hawk Inlet terminal area is treated prior to discharge through outfall 001 with the use of a package-plant capable of performing secondary treatment, therefore, the technology-based effluent limits for outfall 001 are based on the secondary treatment standards.

TABLE B-1: Technology-Based Effluent Limitations for Outfall 001			
Parameter	average weekly	average monthly	percent removal
BOD_5, mg/l	45	30	85%
TSS, mg/l	45	30	85%
pH, s.u.	between 6.0 and 9.0		--

B. Technology-based Effluent Limits for Outfall 002

Section 301(b) of the CWA requires technology-based controls on effluents. This section of the CWA requires that, by March 31, 1989, for non-POTWS, all permits contain effluent limitations which: (1) control toxic pollutants and nonconventional pollutants through the use of "best available technology economically achievable" (BAT), and (2) represent "best conventional pollutant control technology" (BCT) for conventional pollutants by March 31, 1989. In no case may BCT or BAT be less stringent than "best practical control technology currently achievable" (BPT), which is the minimum level of control required by section 301(b)(1)(A) of the CWA. In many cases, BPT, BCT, and BAT limitations are based on effluent guidelines developed by EPA for specific industries.

On December 3, 1982, EPA published effluent guidelines for the mining industry. These guidelines are found in 40 CFR 440. Effluent guidelines applicable to lead-zinc mines, such as the Greens Creek Mine are found in the Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory (Subpart J) of Part 440. The BAT (40 CFR 440.103) and BPT (40 CFR 440.102) effluent limitation guidelines that apply to the Greens Creek Mine discharges are shown in the following table.

TABLE B-2: Technology-Based Effluent Limitations for Outfall 002		
Effluent Characteristic	daily maximum	monthly average
cadmium, ug/l	100	50
copper, ug/l	300	150
lead, ug/l	600	300
mercury, ug/l	2	1
zinc, ug/l	1000	500
TSS, mg/l	30	20
pH, su	within the range 6.0 - 9.0	

III. Water Quality-based Evaluation

In addition to the technology-based limits discussed above, EPA evaluated the Greens Creek Mine discharges to determine compliance with Section 301(b)(1)(C) of the CWA. This section requires the establishment of limitations in permits necessary to meet water quality standards by July 1, 1977.

The regulations at 40 CFR 122.44(d) implement section 301(b)(1)(C) of the CWA. These regulations require that permits include limits for all pollutants or parameters which "are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality." The limits must be stringent enough to ensure that water quality standards are met, and must be consistent with any available wasteload allocation (WLA).

In determining whether water quality-based limits are needed and developing those limits when necessary, EPA follows guidance in the *Technical Support Document for Water Quality-based Toxics Control* (TSD, EPA 1991). The water quality-based analysis consists of four steps:

1. Determine the appropriate water quality criteria (see Section III.A., below)
2. Determine if there is "reasonable potential" for the discharge to exceed the criteria in the receiving water (see Section III.B.)
3. If there is "reasonable potential", develop a WLA (see Section III.C.)
4. Develop effluent limitations based on the WLA (see Section III.C.)

The following sections provide a detailed discussion of each step.

A. Water Quality Criteria

The first step in determining the need for and/or developing water quality-based limits is to determine the applicable water quality criteria. For Alaska, the WQS are found at 18 AAC 70. The applicable criteria are determined based on the beneficial uses of the receiving water.

The beneficial uses for Hawk Inlet, the receiving waters of outfalls 001 and 002 and storm water outfall 003, and the location of the Alaska water quality criteria applicable to the uses are as follows:

aquaculture water supply - 18 AAC 70.020.(b)(2)(A)(i)
seafood processing - 18 AAC 70.020.(b)(2)(A)(ii)
industrial uses - 18 AAC 70.020.(b)(2)(A)(iii)
primary contact recreation - 18 AAC 70.020.(b)(2)(B)(i)
secondary contact recreation - 18 AAC 70.020.(b)(2)(B)(ii)
growth and propagation of fish, shellfish, other aquatic life and wildlife - 18 AAC 70.020.(b)(2)(C)
harvesting for consumption of raw molluscs or other raw aquatic life - 18 AAC 70.020.(b)(2)(D)

The beneficial uses for Greens Creek and Zinc Creek, the receiving waters of storm water outfalls 004 through 008, and the location of the Alaska water quality criteria applicable to the uses are as follows:

domestic water supply - 18 AAC 70.020.(b)(1)(A)(i)
agricultural water supply - 18 AAC 70.020.(b)(1)(A)(ii)
aquacultural water supply - 18 AAC 70.020.(b)(1)(A)(iii)

industrial uses - 18 AAC 70.020.(b)(1)(A)(iv)
primary contact recreation - 18 AAC 70.020.(b)(1)(B)(i)
secondary contact recreation - 18 AAC 70.020.(b)(1)(B)(ii)
growth and propagation of fish, shellfish, other aquatic life, and wildlife - 18 AAC 70.020.(b)(1)(C)

For any given pollutant, different uses may have different criteria. To protect all beneficial uses, the reasonable potential evaluation and permit limits are based on the most stringent of the water quality criteria applicable to those uses. The most stringent criteria are the criteria for protection of aquatic life. The most stringent aquatic life criteria for Hawk Inlet are summarized in Table B-3. The most stringent aquatic life criteria for Greens Creek and Zinc Creek are summarized in Table B-4.

Table B-3: Most Stringent of the Water Quality Criteria Applicable to Greens Creek Mine Discharges into Hawk Inlet (outfalls 001, 002, and 003)

Parameter[1] (ug/l unless otherwise noted)	Acute Aquatic Life Criteria	Chronic Aquatic Life Criteria
Cadmium (TR)	40	8.8
Copper (TR)	4.8	3.1
Lead (TR)	210	8.1
Mercury (total)	2.1	1.1
Zinc (TR)	90	81
WAD Cyanide	1.0	1.0
pH (s.u.)	within the range of 6.5 - 8.5	
chlorine (total residual)	13	7.5
fecal coliform (FC)	the FC median Most Probably Number (MPN) may not exceed 14 FC/100 ml, and not more than 10% of the samples may exceed 43 FC/100 ml	
WET (TU)	an effluent discharged to a water may not impart toxicity to aquatic organisms, as expressed as 1.0 chronic toxic units, at the point of discharge, or id the department authorizes a mixing zone, at or beyond the mixing zone boundary[3]	

Footnotes:
1 - TR = total recoverable
2 - The proposed standards for metals have been converted from dissolved to total recoverable by dividing the dissolved criteria by the conversion factor identified in the proposed regulations.
3 - 18 AAC 70.030.

Table B-4: Most Stringent of the Water Quality Criteria Applicable to Greens Creek Mine Discharges into Greens Creek and Zinc Creek (outfalls 004 through 008)

Parameter[1] (ug/l unless otherwise noted)	Acute Aquatic Life Criteria	Chronic Aquatic Life Criteria
Lead[3] (TR)	18	0.72
Zinc[3] (TR)	44	44

Table B-4: Most Stringent of the Water Quality Criteria Applicable to Greens Creek Mine Discharges into Greens Creek and Zinc Creek (outfalls 004 through 008)		
Parameter[1] (ug/l unless otherwise noted)	Acute Aquatic Life Criteria	Chronic Aquatic Life Criteria
pH (s.u.)	within the range of 6.5 - 8.5	

Footnotes:
1 - TR = total recoverable. Lead, zinc, and pH were included in this table since these are the only parameters for which there is storm water monitoring data.
2 - The proposed standards for metals have been converted from dissolved to total recoverable by dividing the dissolved criteria by the conversion factor identified in the proposed regulations.
3 - The lead and zinc criteria depend upon hardness, measured as mg/l $CaCO_3$. The 5th percentile hardness of the receiving water is used to calculate the criteria since it is a reasonably conservative value protective under most conditions. The 5th percentile hardness at Greens Creek background location 48 is 31 mg/l $CaCO_3$ based on data collected from 1998 through June 2003. Hardness data was not available for Zinc Creek..

B. Reasonable Potential Evaluation for Outfalls 001 and 002

To determine if there is "reasonable potential" to cause or contribute to an exceedence of water quality criteria for a given pollutant (and therefore whether a water quality-based effluent limit is needed), for each pollutant present in a discharge, EPA compares the maximum projected receiving water concentration to the criteria for that pollutant. If the projected receiving water concentration exceeds the criteria, there is "reasonable potential", and a limit must be included in the permit. EPA uses the recommendations in Chapter 3 of the TSD to conduct this "reasonable potential" analysis.

This section discusses how reasonable potential was evaluated for outfalls 001 and 002. Because of the extreme variability of the data from the storm water outfalls, the need for effluent limits for storm water was determined separately. The storm water analysis is provided in section III.D., below.

The maximum projected receiving water concentration is determined using the following mass balance equation, for discharges to the ocean where a mixing zone is allowed:

$$C_d = C_u + (C_e - C_u)/D$$

where,
- C_d = maximum projected receiving water concentration at the edge of the mixing zone
- C_e = maximum projected effluent concentration
- C_u = background concentration of pollutant
- D = dilution in mixing zone

Where no mixing zone is allowed: $C_d = C_e$

After C_d is determined, it is compared to the applicable water quality criterion. If it is greater than the criterion, a water quality-based effluent limit is developed for that parameter. The following discusses each of the factors used in the mass balance equation to calculate C_d.

C_e (maximum projected effluent concentration): Per the TSD, the maximum projected effluent concentration in the mass balance equation is represented by the 99th percentile of the effluent data. The 99th percentile is calculated using the statistical approach recommended in the TSD, i.e., by multiplying the maximum reported effluent concentration by a reasonable potential multiplier (RPM):

C_e = (maximum measured effluent concentration) x RPM

The RPM accounts for uncertainty in the effluent data. The RPM depends upon the amount of effluent data and variability of the data as measured by the coefficient of variation (CV) of the data. When there are not enough data to reliably determine a CV, the TSD recommends using 0.6 as a default value. Once the CV of the data is determined, the RPM is determined using the statistical methodology discussed in Section 3.3 of the TSD. See Tables B-5 and B-6 for a summary of the maximum reported effluent concentrations, CVs, and RPMs used in the reasonable potential analysis.

C_u (background concentration of pollutant): The ambient concentration in the mass balance equation is based on a reasonable worst-case estimate of the background pollutant concentration. Where sufficient data exists, the 95th percentile of the ambient data is generally used as an estimate of worst-case. The C_u's used for each parameter are provided in Tables B-5 and B-6.

D (dilution): Mixing zones are defined as a limited area or volume of water where the discharge plume is progressively diluted by the receiving water. Water quality criteria may be exceeded in the mixing zone as long as acutely toxic conditions are prevented from occurring and the applicable existing designated uses of the water body are not impaired as a result of the mixing zone. Mixing zones are allowed at the discretion of the State, based on the WQS regulations.

The WQS allow for the use of mixing zones. Section 18 AAC 70.250. of the standards provide general conditions for mixing zones and 18 AAC 70.255 provides quality and size specifications for mixing zones. The standards allow water quality within a mixing zone to exceed chronic water quality criteria so long as chronic water quality criteria are met at the boundary of the mixing zone. Acute water quality criteria may be exceeded within a zone of initial dilution inside the chronic mixing zone. For a marine inlet, such as Hawk Inlet, the length of the mixing zone may not exceed 10% of the total length of the inlet and the horizontal area of the mixing zone may not exceed 10% of the surface area.

As discussed in Section VIII.C. of the fact sheet, ADEC has prepared a preliminary CWA Section 401 Certification proposing the following mixing zones for the Greens Creek Mine discharges.

> Outfall 001: ADEC has proposed a mixing zone for fecal coliform representing a 500:1 dilution. This is the same size mixing zone as authorized in the current permit.

Outfall 002: ADEC has proposed a mixing zone for metals representing a 107:1 dilution. The authorized mixing zone is the same size as that authorized in the previous permit but the dilution factor is different.

If ADEC authorizes a different size mixing zone in its final 401 certification, EPA will recalculate the reasonable potential and effluent limits based on the final mixing zones. If the State does not authorize a mixing zone in its final 401 certification, EPA will recalculate the limits based on meeting water quality criteria at the point of discharge (i.e., "end-of-pipe" limits).

Reasonable Potential Summary: Results of the reasonable potential analysis for outfalls 001 and 002 are provided in Tables B-5 and B-6. Based on the reasonable potential analysis, water quality-based effluent limits were developed for chlorine and fecal coliform for outfall 001. Water quality-based limits were not needed for metals, cyanide, WET, or fecal coliform in outfall 002.

TABLE B-5: Reasonable Potential Determination for Outfall 001

Parameter[1]	Effluent Data[2]				Background Receiving Water Conc. (Cu)[4]	Maximum Projected Receiving Water Conc. (C_d)	Reasonable Potential[5] (yes or no)
	Maximum Effluent Conc.	Coefficient of Variation (CV)[3]	Number of Samples	Reasonable Potential Multiplier (RPM)			
Fecal Coliform, FC/100 ml	350,000	0.6	37	2.0	0	1400	yes
Chlorine, ug/l	32.8	0.6	24	2.2	0	72	yes

Footnotes:
1 - Parameters where there is both water quality criteria and effluent monitoring data available.
2 - The effluent data is based on sampling of Outfall 001 conducted by KGCMC from Jan. 1999 through Jan 2000.
3 - Due to inconsistent performance of the sanitary treatment plant, the representativeness of the data is uncertain so an accurate CV of the data cannot be calculated. Therefore, the default CV of 0.6 was used.
5 - Background data was not available for chlorine and fecal coliform. Therefore, 0 was used as Cu.
6 - Reasonable potential exists if Cd exceeds the water quality criteria in Table B-3.

TABLE B-6: Reasonable Potential Determination for Outfall 002

Parameter[1] (ug/L unless otherwise noted)	Effluent Data				Background Receiving Water Conc. (C_u)[6]	Maximum Projected Receiving Water Conc. (C_d)	Reasonable Potential[7] (yes or no)
	Maximum Effluent Conc.[2]	Coefficient of Variation (CV)[3]	Number of Samples[4]	Reasonable Potential Multiplier (RPM)[5]			
Cadmium	100	0.6	na	1	0.0922	0.93	no
Copper	300	0.6	na	1	0.595	2.8	no
Lead	600	0.5	na	1	0.303	5.6	no

TABLE B-6: Reasonable Potential Determination for Outfall 002

Parameter[1] (ug/L unless otherwise noted)	Effluent Data				Background Receiving Water Conc. (C_u)[6]	Maximum Projected Receiving Water Conc. (C_d)	Reasonable Potential[7] (yes or no)
	Maximum Effluent Conc.[2]	Coefficient of Variation (CV)[3]	Number of Samples[4]	Reasonable Potential Multiplier (RPM)[5]			
Mercury	2	0.6	na	1	0.00294	0.019	no
Zinc	1000	0.6	na	1	2.25	9.3	no
Cyanide	34	0.6	277	1	0	0.32	no
WET, TUc	11.1	0.6	9	3.2	0	0.33	no
Fecal Coliform, FC/100 ml	5	0.6	48	2.0	0	10	no

Footnotes:

1 - Parameters where there is both water quality criteria and effluent monitoring data available.

2 - For parameters with technology-based effluent limitation guidelines (cadmium, copper, lead, mercury, zinc), the maximum effluent concentration used to determine reasonable potential is the technology-based maximum daily limitation (see Table B-2). The technology-based limit is used since water quality-based limits are only required if discharge at the technology-based limits has the reasonable potential to exceed water quality standards in the receiving water. For cyanide, WET, and fecal coliform the maximum effluent concentration used is the maximum detected concentration based on effluent samples collected by KGCMC from Jan. 1998 through April 2003.

3 - The CV is calculated as the standard deviation of the data divided by the mean. The CV for zinc was calculated based on outfall 002 effluent samples collected by KGCMC from Nov. 1998 through April 2003. The CVs for cadmium, copper, and lead are based on samples collected from Nov. 2000 through April 2003 (data earlier than Nov. 2000 were not used since the majority of this data was non-detect at high detection limits). The majority of the effluent data available for cyanide, mercury, and fecal coliform (data from Jan. 1998 through April 2003) was reported at less then detection limits, therefore effluent-specific variability cannot be determined, so a default CV of 0.6 was used. The default CV was also used for WET since less than 10 data points were available.

4 - The number of samples is used to develop the RPM. For parameters with technology-based effluent limitation guidelines the RPM is 1 therefore the number of samples is not needed (na).

5 - For parameters with technology-based effluent limitation guidelines, the RPM is 1. For other parameters the RPM is based on the CV and the number of data points.

6 - The receiving water concentrations are based on samples collected from Hawk Inlet monitoring location 106, which represents background of Outfall 002, from 1998 through 2002. The concentrations are the 95th percentile of the data, except for cyanide and WET. The background WET and fecal coliform was assumed to be zero and all of the cyanide data at location 106 was reported at less than the detection limit (therefore zero was used as background).

7 - Reasonable potential exists if Cd exceeds the water quality criteria in Table B-3.

C. Water Quality-Based Permit Limit Derivation for Outfall 001

Based on the above analysis, water quality-based effluent limits are needed for fecal coliform and chlorine in outfall 001. This section shows how the water quality-based limits for outfall 001 were calculated.

Once EPA has determined that a water quality-based limit is required for a pollutant, the first step in developing the permit limit is development of a wasteload allocation (WLA) for the pollutant. A WLA is the concentration (or loading) of a pollutant that the permittee may discharge without causing or contributing to an exceedence of WQS in the receiving water. WLAs and permit limits for toxic pollutants are derived based on guidance in the TSD. WLAs for outfall 001 were established in two ways: based on a mixing zone for fecal coliform and based on meeting water quality criteria at "end-of-pipe" for chlorine.

Chlorine limits: No mixing zone was authorized for chlorine, therefore the criterion becomes the WLA.

Chlorine $WLA_{a,c}$ = acute criterion = 13 ug/l (see Table B-3)
Chlorine WLA_c = chronic criterion = 7.5 ug/l (see Table B-3)

The WLAs are statistically converted to long-term average (LTA) concentrations. This conversion is dependent upon the CV of the effluent data and the probability basis used. The probability basis corresponds to the percentile of the estimated concentration. EPA uses a 99th percentile for calculating the LTA, as recommended in the TSD. The following equation from Chapter 5 of the TSD is used to calculate the LTA concentrations (alternately, Table 5-1 of the TSD may be used):

$$LTA = WLA \times \exp[0.5\sigma^2 - z\sigma]$$

where: $\sigma^2 = \ln(CV^2 + 1)$ for acute aquatic life criteria = 0.30748
$= \ln(CV^2/4 + 1)$ for chronic aquatic life criteria = 0.08618
CV = coefficient of variation = 0.6
z = 2.326 for 99th percentile probability basis, per the TSD

therefore,

$LTA_c = 7.5 \times \exp[(0.5)(0.08618) - 2.326(0.2936)] = 3.953$ ug/L
$LTA_{a,c} = 13 \times \exp[(0.5)(0.30748) - 2.326(0.5545)] = 4.173$ ug/L

The LTA concentration is calculated for each criterion and compared. The most stringent LTA concentration is then used to develop the maximum daily (MDL) and monthly average (AML) permit limits. The MDL is based on the CV of the data and the probability basis, while the AML is dependent upon these two variables and the monitoring frequency. As recommended in the TSD, EPA used a probability basis of 95 percent for the AML calculation and 99 percent for the MDL calculation. The MDL and AML are calculated using the following equations from the TSD (alternately, Table 5-2 of the TSD may be used):

MDL or AML = LTA x $\exp[z\sigma - 0.5\sigma^2]$

for the MDL: $\sigma^2 = \ln(CV^2 + 1)$
z = 2.326 for 99th percentile probability basis, per the TSD

therefore,
for the chlorine MDL: $\sigma^2 = \ln(0.6^2 + 1) = 0.3075$
chlorine MDL = 3.953 x exp[2.326(0.5545) - 0.5(0.3075)] = 12.3 ug/l

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

therefore,
for the chlorine AML = $\sigma^2 = \ln(0.6^2/4 + 1) = 0.08618$
chlorine AML = 3.953 x exp[1.645(0.2936) - 0.5(0.08618)] = 6.1 ug/l

Fecal coliform limits: Where the state authorizes a mixing zone for the discharge, the WLA is calculated as a mass balance, based on the available dilution, background concentration of the pollutant, and the water quality criterion. WLAs are calculated using the same mass balance equation used in the reasonable potential evaluation. However, C_d becomes the criterion and C_e the WLA.

$WLA = D(criterion - C_u) + C_u$

for fecal coliform, $C_u = 0$ (see Table B-5), therefore, WLA = D(criterion)

The fecal coliform criteria are found in Table B-3. The median fecal criterion of 14 FC/100 ml is expressed as an average monthly limit and the maximum fecal criterion of 43 FC/100 ml is expressed as a maximum daily limit. Based on a dilution of 500:1, the fecal coliform effluent limits are calculated as follows:

Fecal coliform AML = 14 x 500 = 7000 FC/100 ml

Fecal coliform MDL = 43 x 500 = 21,500 FC/100 ml

D. Water Quality Analysis for Storm Water Outfalls

KGCMC monitors the storm water twice per year during storm events. The results of storm water monitoring are summarized in Table B-7, below.

Table B-7: Summary of Storm water Monitoring Data					
Outfall	Receiving Water	Range of Data from Storm Water Monioring[1]			
		Flow, gpm	Lead[2], ug/l	Zinc, ug/l	pH, s.u.
003	Hawk Inlet	0.25 -75	0.318 - 5.79	71 - 563	6.53 - 7.78
004	wetlands	3 - 150	18.5 - 65.6	128 - 727	6.74 - 7.78
005.2	Zinc Creek	0.264 - 30	6.03 - 623	3.52 - 8.18	3.52 - 8.18
005.3	Greens Creek	3 - 897	4.38 - 171	< 20 - 1040	6.02 - 7.88
005.4	Greens Creek	5 - 100	0.214 - 3.42	2.44 - 138	6.48 - 7.77
005.5	Greens Creek	3.5 - 200	1.18 - 73.7	62.4 - 634	7.06 - 8.14
006	Greens Creek	20 - 200	< 150 - 385	779 - 1420	6.52 - 7.88
007	Greens Creek	5 - 100	105 - 3590	313 - 2300	7.09 - 8.17
008	Greens Creek	0.25 - 20	0.506 - 235	4680 - 56,400	2.71 - 7.15
009	Greens Creek	2 - 75	0.727 - 1.72	55.4 - 697	6.39 - 7.79

Footnotes:
1 - Storm water monitoring data is based on samples collected by KGCMC twice per year during storm events from September 1998 through December 2002.
2 - Much of the lead data was reported as non-detect at a detection limit of 150 ug/l. This data was not included in the table.

Comparing the lead and zinc data in Table B-7 with the water quality criteria in Tables B-3 and B-4 shows that all the outfalls have exceeded the water quality criteria at some times. However, numerical effluent limits were not developed for the for the individual storm water outfalls. This is due to the difficulty in developing numerical limits for storm water discharges that are intermittent and extremely variable in flow and variable in pollutant concentrations and the uncertainty regarding the effect of the storm water outfalls on the receiving waters.

Rather than developing numerical effluent limits for each storm water outfall, the permit includes a general requirement that the storm water outfalls must not cause or contribute to a WQS violation and also includes the requirement to develop outfall-specific BMPs. The NPDES regulations allow for the use of BMPs where development of numerical effluent limits are infeasible (40 CFR 122.44(k)).

IV. Summary of Draft Permit Effluent Limitations

As discussed in Section I of this appendix, technology-based limits were applied to each discharge and evaluated (via the reasonable potential evaluation discussed in Section III) to determine whether these limits may result in any exceedences of WQS in the receiving water. If exceedences could occur, then water quality-based effluent limits were developed. The following summarizes the final proposed effluent limits developed for each outfall.

Outfall 001: The state does not have WQS for BOD and TSS, therefore, the BOD and TSS limits in the draft permit are the technology-based limits shown in Table B-1. The limits for chlorine and fecal coliform are the water quality-based limits calculated in the previous section. The pH limit is based on the WQS shown in Table B-3 since a mixing zone was not authorized for pH and the pH WQS are more stringent than the technology-based pH limits.

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The NPDES regulations (40 CFR 122.45(f)) require that effluent limits also be expressed in terms of mass, with a few exceptions. The following equation is used to convert the concentration-based limits into mass-based limits:

mass limit (lb/day) = concentration limit (mg/l) x effluent flow rate (MGD) x conversion factor

where,

conversion factor = 8.34 (to convert units on the right side of the equation to lb/day)
effluent flow rate = maximum discharge rate in gpd = 6000 gpd for outfall 001

Outfall 002: The reasonable potential analysis in Section III.B. demonstrated that discharge of metals at the technology-based effluent limits would not cause or contribute to an exceedence of WQS in Hawk Inlet. Therefore, water quality-based limits are not needed for metals, and the effluent limits for metals in the draft permit are the technology-based limits shown in Table B-2. In addition, the reasonable potential analysis showed that the cyanide, fecal coliform, and toxicity of the discharge would not cause or contribute to an exceedence of WQS, therefore water quality-based limits are not needed for these parameters. The pH limit in the draft permit is based on the WQS shown in Table B-3.

The draft permit also includes flow limits to ensure that the volume discharged does not exceed the flow assumptions used to develop the allowable dilution (mixing zone). Since flow limits are included in the permit, mass limits are not needed. Controlling flow and concentration is the same as controlling mass.

Storm Water Outfalls: Based on the discussion in Section III.D., numerical effluent limits were not developed for the storm water outfalls. Rather, a general requirement is included in the permit that the storm water outfalls must not cause or contribute to a WQS violation. The permit also includes the requirement to develop outfall-specific BMPs.

APPENDIX C - 401 Certification