

APPENDIX A

LIST OF SUPPORTING TECHNICAL REPORTS, MEMOS AND OTHER DOCUMENTS

APPENDIX A

List of technical reports, memos and other documents utilized in analysis of the Idaho Cobalt Project and alternatives.

- Big Sky Acoustics, LLC. 2005. Final Idaho Cobalt Project Baseline Noise Study. Prepared for Hydrometrics, Inc. July 14, 2005.
- Cascade Earth Sciences (CES). 2001. Feasibility Analysis and Recommendations for Land Application of Mine Process Water, Formation Capital Corporation, Idaho Cobalt Project, Salmon, Idaho. November 1, 2001.
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- Elliott, J. 2005. Idaho Cobalt Project Vegetation and Wetlands Resources. Prepared for Salmon National Forest. September 2005. Revised December 2006.
- Elliott, Joe C. 2006. Correspondence regarding Sensitive Plant and Wetland Survey, Big Deer Creek Pipeline Route. July 22, 2006.
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- Formation Capital Corporation (FCC). 2005. Idaho Cobalt Project Plan of Operations: Submitted to the Salmon Challis National Forest February 2005.
- Formation Capital Corporation, U.S. (FCC). 2006. Correspondence to Terry Hershey, District Ranger Salmon-Challis National Forest from Wm. G. Scales regarding Upgrades to the Idaho Cobalt Project Water Management System. March 30, 2006.
- Formation Capital Corporation, U.S. (FCC). 2006a. Correspondence to Terry Hershey, District Ranger Salmon-Challis National Forest from Wm. G. Scales regarding Meeting in Missoula, MT, April 11, 2006. April 19, 2006.
- Formation Capital Corporation, U.S. (FCC). 2006b. Correspondence to Terry Hershey, District Ranger Salmon-Challis National Forest from Wm. G. Scales regarding Idaho Cobalt Project Plan of Operations. May 1, 2006.
- Formation Capital Corporation (FCC). 2006c. Idaho Cobalt Project Application for NPDES Permit. Submitted to the Region 10 USEPA. May 22, 2006.
- Formation Capital Corporation (FCC). 2006d. Idaho Cobalt Project Plan of Operations: Submitted to the Salmon Challis National Forest. Revised June 8, 2006.
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- Formation Capital Corporation, U.S. (FCC). 2006f. Correspondence to Terry Hershey, District Ranger Salmon-Challis National Forest from Wm. G. Scales regarding Response to Comment Letter dated August 23, 2006. August 30, 2006.
- Formation Capital Corporation, U.S. (FCC). 2006g. Correspondence to Terry Hershey, District Ranger Salmon-Challis National Forest from Wm. G. Scales regarding Conceptual Design of the Tailing/Waste Rock Facility and Water Management Pond – Appendix F, and Responses to Henderson Email dated September 8, 2006. September 13, 2006.
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- Telesto Solutions, Inc. (Telesto). 2005b. Memo to Joe Scheuring, Formation Capital Corporation. Regarding Winter TWSF Operations. July 12, 2005.
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APPENDIX B

SURFACE WATER AND GROUNDWATER FLOWS AND PREDICTED WATER QUALITY

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TABLE B-1. IDAHO COBALT FEIS - PREDICTED GROUNDWATER QUALITY FOR METALS, SULFATE AND NITRATE (BUCKTAIL AND BIG FLAT CREEK DRAINAGES)

- B-1a. Most Probable Case Predictions for Dissolved Copper Concentrations
- B-1b. Most Probable Case Predictions for Sulfate Concentrations
- B-1c. Most Probable Case Predictions for Dissolved Arsenic Concentrations
- B-1d. Most Probable Case Predictions for Dissolved Cobalt Concentrations
- B-1e. Most Probable Case Predictions for Dissolved Nickel Concentrations
- B-1f. Most Probable Case Predictions for Dissolved Zinc Concentrations
- B-1g. Most Probable Case Predictions for Dissolved Nitrate Concentrations
- B-1h. Predictions for Dissolved Copper Concentrations

TABLE B-2. PERCENT CHANGE IN BASE FLOW IN STREAMS

TABLE B-3. IDAHO COBALT FEIS - DSM PREDICTED STREAM WATER QUALITY SUMMARY

- B-3a. DSM Predicted Nitrate Concentrations: Most Probable or Expected Case (50th percentile)
- B-3b. DSM Predicted Sulfate Concentrations: Most Probable or Expected Case (50th percentile)
- B-3c. DSM Predicted Zinc Concentrations: Most Probable or Expected Case (50th percentile)
- B-3d. DSM Predicted Cobalt Concentrations: Most Probable or Expected Case (50th percentile)
- B-3e. DSM Predicted Nickel Concentrations: Most Probable or Expected Case (50th percentile)
- B-3f. DSM Predicted Arsenic Concentrations: Most Probable or Expected Case (50th percentile)
- B-3g. DSM Predicted Copper Concentrations: 90th percentile Case (90% probability that actual value will be lower than value shown).
- B-3h. DSM Predicted Copper Concentrations: 10th percentile Case (90% probability that actual value will be higher than shown)
- B-3i. DSM Predicted Copper Concentrations: Most Probable or Expected Case (50th percentile, 50% probability that actual value will be higher than value shown)

Table B-1a.

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Most Probable Case Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt FEIS

		Bucktail Drainage ⁽²⁾							Big Flat Creek Drainage ⁽²⁾			
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium ⁽³⁾			LAT Area		TWSF Area	
		Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?		Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action												
	Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No		0.033	Yes	0.003	Yes
	Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
Alt II - FCC Proposal												
	Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No		Not Applicable		0.003	Yes
	Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Closure (Year 5)-Day 6636	0.090	Yes	2.652	No	1.84	No		Not Applicable		0.0027	Yes
	Closure (Year 23)-Day 13210	0.065	Yes	0.077	Yes	1.50	No		Not Applicable		0.0029	Yes
Alt III - Perpetual Dewatering & LAT												
	Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No		0.033	Yes	0.003	Yes
	Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
	Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.50	No		0.033	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek												
	Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No		Not Applicable		0.003	Yes
	Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Closure (Year 5)-Day 6636	0.043	Yes	0.337	Yes	1.54	No		Not Applicable		0.0026	Yes
	Closure (Year 23)-Day 13210	0.044	Yes	0.016	Yes	1.50	No		Not Applicable		0.0028	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek												
	Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No		Not Applicable		0.003	Yes
	Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No		Not Applicable		0.003	Yes
	Closure (Year 5)-Day 6636	0.043	Yes	0.337	Yes	1.54	No		Not Applicable		0.0026	Yes
	Closure (Year 23)-Day 13210	0.044	Yes	0.016	Yes	1.50	No		Not Applicable		0.0028	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green	= decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow	= concentration increase; does not contribute to WQ standards exceedance
orange	= substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

Most Probable Case Predictions for Sulfate Concentrations in Groundwater											
Idaho Cobalt FEIS											
		Bucktail Drainage ⁽²⁾						Big Flat Creek Drainage ⁽²⁾			
		Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium ⁽³⁾		LAT Area		TWSF Area	
Alternative	Project Phase ⁽¹⁾	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Mean Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action											
	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	1.5	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
	Closure (Year 23)-Day 13210	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes
Alt II - FCC Proposal											
	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Closure (Year 5)-Day 6636	298	No	126	No	56	Yes	Not Applicable		123	Yes
	Closure (Year 23)-Day 13210	51	Yes	25	Yes	43	Yes	Not Applicable		92	Yes
Alt III - Perpetual Dewatering & LAT											
	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	283	No	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	237	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	76	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	27	Yes	27	Yes	39.5	Yes	76	Yes	169	Yes
	Closure (Year 23)-Day 13210	27	Yes	27	Yes	39.5	Yes	76	Yes	52	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek											
	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Closure (Year 5)-Day 6636	298	No	126	Yes	56	Yes	Not Applicable		169	Yes
	Closure (Year 23)-Day 13210	52	Yes	25	Yes	43	Yes	Not Applicable		52	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek											
	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable		1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable		1.0	Yes
	Closure (Year 5)-Day 6636	298	No	126	Yes	56	Yes	Not Applicable		169	Yes
	Closure (Year 23)-Day 13210	52	Yes	25	Yes	43	Yes	Not Applicable		52	Yes

Relative Impacts from ICP-Derived Sulfate

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Water quality exceedances based on Idaho secondary constituent standard of 250 mg/L for sulfate.

Table B-1c. Jun-08
Most Probable Case Predictions for Dissolved Arsenic Concentrations in Groundwater
Idaho Cobalt FEIS

		Bucktail Drainage ⁽³⁾						Big Flat Creek Drainage ⁽³⁾			
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium		LAT Area		TWSF Area	
		Arsenic Concentration mg/L	Groundwater Quality Standard Met?	Arsenic Concentration mg/L	Groundwater Quality Standard Met?	Arsenic Concentration mg/L	Groundwater Quality Standard Met?	Arsenic Concentration mg/L	Groundwater Quality Standard Met?	Arsenic Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action											
	Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	0.001	Yes	0.0009	Yes
	Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
	Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
	Closure (Year 5)-Day 6636	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
	Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes
Alt II - FCC Proposal											
	Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
	Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Closure (Year 5)-Day 6636	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0011	Yes
	Closure (Year 23)-Day 13210	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0010	Yes
Alt III - Perpetual Dewatering & LAT											
	Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	<0.0015	Yes	0.0009	Yes
	Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
	Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
	Closure (Year 5)-Day 6636	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
	Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek											
	Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
	Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Closure (Year 5)-Day 6636	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0012	Yes
	Closure (Year 23)-Day 13210	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0010	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek											
	Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable		0.0009	Yes
	Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable		0.0009	Yes
	Closure (Year 5)-Day 6636	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0012	Yes
	Closure (Year 23)-Day 13210	(2)	(2)	(2)	(2)	(2)	(2)	Not Applicable		0.0010	Yes

Relative Impacts from ICP-Derived Dissolved Arsenic

green =	decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Arsenic concentrations for groundwater not available from Dynamic Systems Model. DSM results indicate mine water concentrations may exceed 100 parts per billion; however groundwater concentrations are expected to be significantly lower (below drinking water standard of 50 parts per billion) due to chemical attenuation.

(3) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

Idaho Groundwater Quality Standard for Arsenic=0.05 mg/L.

Most Probable Case Predictions for Dissolved Cobalt Concentrations in Groundwater											
Idaho Cobalt FEIS											
		Bucktail Drainage ⁽²⁾						Big Flat Creek Drainage ⁽²⁾			
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium ⁽³⁾		LAT Area		TWSF Area	
		Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?
Alt I - No Action											
	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	0.009	NA	0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
	Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
	Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA
Alt II - FCC Proposal											
	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Closure (Year 5)-Day 6636	0.126	NA	6.445	NA	1.55	NA	Not Applicable		0.0041	NA
	Closure (Year 23)-Day 13210	0.081	NA	0.330	NA	0.74	NA	Not Applicable		0.0026	NA
Alt III - Perpetual Dewatering & LAT											
	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	<0.03	NA	0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
	Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
	Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek											
	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Closure (Year 5)-Day 6636	0.042	NA	0.955	NA	0.82	NA	Not Applicable		0.0058	NA
	Closure (Year 23)-Day 13210	0.042	NA	0.186	NA	0.72	NA	Not Applicable		0.0034	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek											
	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable		0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable		0.0016	NA
	Closure (Year 5)-Day 6636	0.042	NA	0.955	NA	0.82	NA	Not Applicable		0.0058	NA
	Closure (Year 23)-Day 13210	0.042	NA	0.186	NA	0.72	NA	Not Applicable		0.0034	NA

Relative Impacts from ICP-Derived Dissolved Cobalt

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

No Idaho Groundwater Quality Standard exists for Cobalt.

Table B-1e. Most Probable Case Predictions for Dissolved Nickel Concentrations in Groundwater									
Idaho Cobalt FEIS									
		Bucktail Drainage ⁽²⁾				Big Flat Creek Drainage ⁽²⁾			
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		LAT Area		TWSF Area	
		Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action									
	Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Alt II - FCC Proposal									
	Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Closure (Year 5)-Day 6636	0.0080	NA	0.293	NA	Not Applicable		0.0001	NA
	Closure (Year 23)-Day 13210	0.0050	NA	0.010	NA	Not Applicable		0.0000	NA
Alt III - Perpetual Dewatering & LAT									
	Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
	Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek									
	Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Closure (Year 5)-Day 6636	0.0020	NA	0.040	NA	Not Applicable		0.0001	NA
	Closure (Year 23)-Day 13210	0.0020	NA	0.003	NA	Not Applicable		0.0001	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek									
	Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable		0.0000	NA
	Closure (Year 5)-Day 6636	0.0020	NA	0.040	NA	Not Applicable		0.0001	NA
	Closure (Year 23)-Day 13210	0.0020	NA	0.003	NA	Not Applicable		0.0001	NA

Relative Impacts from ICP-Derived Dissolved Nickel

green	= decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow	= concentration increase; does not contribute to WQ standards exceedance
orange	= substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

No Idaho Groundwater Quality Standard exists for Nickel.

Table B-1f.										Jun-08
Most Probable Case Predictions for Dissolved Zinc Concentrations in Groundwater										
Idaho Cobalt FEIS										
		Bucktail Drainage ⁽²⁾				Big Flat Creek Drainage ⁽²⁾				
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		LAT Area		TWSF Area		
		Zinc Concentration mg/L	Groundwater Quality Standard Met?	Zinc Concentration mg/L	Groundwater Quality Standard Met?	Zinc Concentration mg/L	Groundwater Quality Standard Met?	Zinc Concentration mg/L	Groundwater Quality Standard Met?	
Alt I - No Action										
	Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Alt II - FCC Proposal										
	Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Closure (Year 5)-Day 6636	0.049	Yes	0.349	Yes	Not Applicable		0.0003	Yes	
	Closure (Year 23)-Day 13210	0.045	Yes	0.026	Yes	Not Applicable		0.0001	Yes	
Alt III - Perpetual Dewatering & LAT										
	Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
	Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek										
	Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Closure (Year 5)-Day 6636	0.040	Yes	0.098	Yes	Not Applicable		0.00053	Yes	
	Closure (Year 23)-Day 13210	0.040	Yes	0.016	Yes	Not Applicable		0.00018	Yes	
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek										
	Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable		0.0000	Yes	
	Closure (Year 5)-Day 6636	0.040	Yes	0.098	Yes	Not Applicable		0.00053	Yes	
	Closure (Year 23)-Day 13210	0.040	Yes	0.016	Yes	Not Applicable		0.00018	Yes	

Relative Impacts from ICP-Derived Dissolved Zinc

green	= decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow	= concentration increase; does not contribute to WQ standards exceedance
orange	= substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
Water quality exceedances based on Idaho secondary constituent standard of 5.0 mg/L for zinc.

Table B-1g. Jun-08

Most Probable Case Predictions for Dissolved Nitrate Concentrations in Groundwater

Idaho Cobalt FEIS

		Bucktail Drainage ⁽²⁾				Big Flat Creek Drainage ⁽²⁾			
Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		LAT Area		TWSF Area	
		Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action									
	Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes
	Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes
	Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes
	Closure (Year 5)-Day 6636	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes
	Closure (Year 23)-Day 13210	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes
Alt II - FCC Proposal									
	Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Ram Operations-Day 1887	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	Not Applicable		NA	NA
	Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	Not Applicable		NA	NA
Alt III - Perpetual Dewatering & LAT									
	Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Yes	NA	NA
	Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Yes	NA	NA
	Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Yes	NA	NA
	Closure (Year 5)-Day 6636	0.50	Yes	0.55	Yes	0.30	Yes	NA	NA
	Closure (Year 23)-Day 13210	0.50	Yes	0.55	Yes	0.30	Yes	NA	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek									
	Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Ram Operations-Day 1887	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	Not Applicable		NA	NA
	Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	Not Applicable		NA	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek									
	Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Ram Operations-Day 1887	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	Not Applicable		NA	NA
	Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	Not Applicable		NA	NA
	Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	Not Applicable		NA	NA

Relative Impacts from ICP-Derived Dissolved Nitrate

- green = decrease, no change, or negligible increase that is nonmeasurable (NM)
- yellow = concentration increase; does not contribute to WQ standards exceedance
- orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

Idaho Groundwater Quality Standard for Nitrate (as N) =10 mg/L.

Table B-1h. Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt FEIS

Jun-08

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽²⁾																		Big Flat Drainage ⁽²⁾					
		Immediate Ram Mine Vicinity						Immediate Sunshine Mine Vicinity						Upper Bucktail Alluvium ⁽³⁾						TWSF Area					
		Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Groundwater Quality Standard Met?		
		Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case
Alt I - No Action																									
	Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt II - FCC Proposal⁽⁴⁾																									
	Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 5)-Day 6636	0.052	0.090	0.370	Yes	Yes	Yes	0.396	2.652	19.51	Yes	No	No	1.54	1.84	4.10	No	No	No	0.0027	0.0027	0.0028	Yes	Yes	Yes
	Closure (Year 23)-Day 13210	0.050	0.065	0.195	Yes	Yes	Yes	0.024	0.077	0.477	Yes	Yes	Yes	1.50	1.50	1.55	No	No	No	0.0029	0.0029	0.0030	Yes	Yes	Yes
Alt III - Perpetual Dewatering & LAT																									
	Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 23)-Day 13210	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek																									
	Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.062	0.337	2.417	Yes	Yes	No	1.50	1.54	1.81	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
	Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.016	0.016	0.02	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek																									
	Ram Operations (Pre BT-5)-Day 1521	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes	Yes
	Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	0.062	0.337	2.417	Yes	Yes	No	1.50	1.54	1.81	No	No	No	0.0026	0.0026	0.0027	Yes	Yes	Yes
	Closure (Year 23)-Day 13210	0.041	0.044	0.048	Yes	Yes	Yes	0.016	0.016	0.02	Yes	Yes	Yes	1.50	1.50	1.50	No	No	No	0.0028	0.0028	0.003	Yes	Yes	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green =	decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow =	concentration increase; does not contribute to WQ standards exceedance
orange =	substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase I

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

Table B-2. Percent Change in Base Flow in Streams FEIS Table						
Stream	Period	Alternatives				
		I	II	III	IV	V
Bucktail Creek	Ram Operations (Pre BT-5)	0 (-21)	-44 (-65)	-44 (-65)	-44 (-65)	-44 (-65)*
	Ram Operations	-100	-100	-100	-100	-100*
	Sunshine Operations	-100	-100	-100	-100	-100*
	Closure (Year 5)	-100	-100	-100	-100	-100*
	Closure (Year 23)	-100	-100	-100	-100	-100*
	Post-closure	-100	-100	-100	-100	-100*
S.F. Big Deer Creek	Ram Operations (Pre BT-5)	0 (-4)	-11 (-10)	-11 (-10)	-11 (-10)	-11 (-10)
	Ram Operations	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Sunshine Operations	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Closure (Year 5)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Closure (Year 23)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Post-closure	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
Big Deer Creek	Ram Operations (Pre BT-5)	0 (-1)	-1 (-2)	-3** (-4)	-1 (-2)	-3** (-4)
	Ram Operations	0 (-1)	-1 (-2)	-3** (-4)	-1 (-2)	-3** (-4)
	Sunshine Operations	0 (-1)	+2 (+1)	-3** (-4)	-1 (-2)	-3** (-4)
	Closure (Year 5)	0 (-1)	0 (-1)	-3** (-4)	0 (-1)	-3** (-4)
	Closure (Year 23)	0 (-1)	0 (-1)	-3** (-4)	0 (-1)	-3** (-4)
	Post-closure	0 (-1)	0 (-1)	0** (-1)	0 (-1)	0** (-1)
Panther Creek	Ram Operations (Pre BT-5)	0	0	0	0	0*
	Ram Operations	0	0	0	0	0*
	Sunshine Operations	0	0	0	0	0*
	Closure (Year 5)	0	0	0	0	0*
	Closure (Year 23)	0	0	0	0	0*
	Post-closure	0	0	0	0	0*
Big Flat Creek	Ram Operations (Pre BT-5)	0	-3	+5**	-3	-3*
	Ram Operations	0	-3	+5**	-3	-3*
	Sunshine Operations	0	-5	+5**	-4	-4*
	Closure (Year 5)	0	-3	+5**	-2	-2*
	Closure (Year 23)	0	-4	+5**	-3	-3*
	Post-closure	0	0	+5**	0	0*
Little Deer Creek	Ram Operations (Pre BT-5)	0	0	+3**	0	0
	Ram Operations	0	0	+3**	0	0
	Sunshine Operations	0	0	+3**	0	0
	Closure (Year 5)	0	0	+3**	0	0
	Closure (Year 23)	0	0	+3**	0	0
	Post-closure	0	0	+3**	0	0
Blackbird Creek	Ram Operations (Pre BT-5)	0	0	0	0	+10**
	Ram Operations	0	0	0	0	+10**
	Sunshine Operations	0	0	0	0	+10**
	Closure (Year 5)	0	0	0	0	+10**
	Closure (Year 23)	0	0	0	0	+10**
	Post-closure	0	0	0	0	0**

- Negative value denotes a reduction in flow; positive value denotes an increase in flow. All values based on DSM model predictions as described in the Water Resources Technical Report (Hydrometrics, 2006) except values in parentheses based on EPA predictions of cumulative effects of BMSG remedial actions and the ICP as described in May 24, 2007 letter from EPA (Lynne McWhorter) to SCNF (Ray Henderson).
- *Flow change is assumed equal to change for alternative 4 DSM version 6.0
- **Flow change is based on DSM version 4.0 results (Hydrometrics, 2006)

Table B-3a.													
Idaho Cobalt FEIS - DSM Predicted Nitrate Concentrations in Streams													
Most Probable or Expected Case (50th percentile)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.5	Yes	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	0.5	Yes	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	0.5	Yes	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	0.5	Yes	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 23	0.5	Yes	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.3	NA	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	NA	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	3.2	Yes	0.9	NA	0.15	Yes	0.14	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.4	Yes	0.1	NA	0.15	Yes	0.08	Yes	0.2	Yes	0.18	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 23	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.3	NA	0.15	Yes	0.12	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	NA	0.15	Yes	0.11	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	6.8	Yes	3.6	NA	0.15	Yes	0.14	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.4	Yes	0.2	NA	0.15	Yes	0.08	Yes	0.2	Yes	0.18	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Ram Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Sunshine Operations	No flow	No flow	0.3	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
	Closure Year 5	6.8	Yes	3.6	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.19	Yes
	Closure Year 23	0.4	Yes	0.2	NA	0.15	Yes	0.07	Yes	0.2	Yes	0.18	Yes
Primary Drinking Water Standard		10		10		10		10		10		10	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow =	DSM predicts small concentration increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of alternative 2 and 4 nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

Estimation of alternative 3 nitrate concentrations in Big Flat Creek based on alternative 4 DSM-predicted concentration to water treatment plant and predicted loads to land application compared to agronomic uptake.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV and V with nitrate removal treatment to 6 mg/L (efficiencies of 70 to 90%) during mining.

Table B-3b.													
Idaho Cobalt FEIS - DSM Predicted Sulfate Concentrations in Streams													
Most Probable or Expected Case (50th percentile)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	22	Yes	23.3	NA	22.8	NA	7.3	NA	1.6	NA	10.4	NA
	Ram Operations	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.1	NA
	Sunshine Operations	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.1	NA
	Closure Year 5	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.1	NA
	Closure Year 23	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.1	NA
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	1.6	NA	10.4	NA
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.6	NA	1.6	NA	10.1	NA
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.3	NA	1.6	NA	10.0	NA
	Closure Year 5	298	Yes	32.7	NA	4.5	NA	6.1	NA	13.7	NA	10.3	NA
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	5.2	NA	9.9	NA	10.2	NA
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.8	NA	7.3	NA	186	NA	10.4	NA
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	155	NA	10.1	NA
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	50	NA	10.1	NA
	Closure Year 5	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	50	NA	10.1	NA
	Closure Year 23	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	50	NA	10.1	NA
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	9.9	NA	1.6	NA	10.6	NA
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	7.1	NA	1.6	NA	10.3	NA
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.3	NA	1.6	NA	10.1	NA
	Closure Year 5	298	No	32.7	NA	4.5	NA	9.9	NA	13.7	NA	10.7	NA
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	5.2	NA	4.7	NA	10.2	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	1.6	NA	10.6	NA
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.3	NA
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	1.6	NA	10.1	NA
	Closure Year 5	298	No	32.7	NA	4.5	NA	4.7	NA	13.7	NA	10.7	NA
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	4.7	NA	4.7	NA	10.2	NA
Water Quality Standard - Aquatic Life Criterion		None (5)		None (5)		None (5)		None (5)		None (5)		None (5)	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow =	DSM predicts small concentration increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II. For Alternatives II and IV, simulations assume water treatment effluent of <50 mg/L and <400 mg/L, respectively.

(5) For comparison, the Federal Secondary Drinking Water Standard is 250 mg/L.

Table B-3c.

Idaho Cobalt FEIS - DSM Predicted Zinc Concentrations in Streams

Most Probable or Expected Case (50th percentile)

Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.005	Yes	0.003	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	0.005	Yes	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	0.005	Yes	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.005	Yes	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.005	Yes	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.003	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.049	No	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.045	No	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.003	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.003	NA	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.040	Partial	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.040	Partial	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.003	NA	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 5	0.040	Partial	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
	Closure Year 23	0.040	Partial	0.001	NA	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes
Water Quality Standard - Aquatic Life Criterion		0.0365		0.0365		0.0365		0.0365		0.0365		0.0365	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3d.													
Idaho Cobalt FEIS - DSM Predicted Cobalt Concentrations in Streams													
Most Probable or Expected Case (50th percentile)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1) (3)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.02	Yes	0.13	NA	0.093	No	0.017	Yes	0.021	Yes	0.019	Yes
	Ram Operations	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 5	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.13	NA	0.098	No	0.016	Yes	0.021	Yes	0.018	Yes
	Ram Operations	No flow	No flow	0.06	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.05	NA	0.003	Yes	0.004	Yes	0.022	Yes	0.017	Yes
	Closure Year 5	0.126	No	0.17	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.081	No	0.04	NA	0.003	Yes	0.003	Yes	0.022	Yes	0.017	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.019	Yes
	Ram Operations	No flow	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 5	No flow	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	No flow	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes
	Ram Operations	No flow	No flow	0.06	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.05	NA	0.003	Yes	0.004	Yes	0.022	Yes	0.017	Yes
	Closure Year 5	0.042	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.042	Yes	0.05	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes
	Ram Operations	No flow	No flow	0.06	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Sunshine Operations	No flow	No flow	0.05	NA	0.003	Yes	0.004	Yes	0.022	Yes	0.017	Yes
	Closure Year 5	0.042	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	0.042	Yes	0.05	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
Site-specific Blackbird cleanup value		0.086		0.086		0.086		0.086		0.086		0.086	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow =	DSM predicts small concentration increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than cleanup value.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture ar was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the cur increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Altern to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3e.													
Idaho Cobalt FEIS - DSM Predicted Nickel Concentrations in Streams													
Most Probable or Expected Case (50th percentile)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.002	Yes	0.002	NA	0.002	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Ram Operations	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Sunshine Operations	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 5	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 23	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.002	NA	0.002	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.001	Yes	0.000	Yes	0.001	Yes	0.001	Yes
	Closure Year 5	0.008	Yes	0.004	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 23	0.005	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.002	NA	0.002	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 5	No flow	No flow	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 23	No flow	No flow	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.002	NA	0.002	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.001	Yes	0.000	Yes	0.001	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.001	Yes	0.000	Yes	0.001	Yes	0.001	Yes
	Closure Year 5	0.002	Yes	0.003	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 23	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.002	NA	0.002	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.001	NA	0.001	Yes	0.000	Yes	0.001	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.001	NA	0.001	Yes	0.000	Yes	0.001	Yes	0.001	Yes
	Closure Year 5	0.002	Yes	0.003	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
	Closure Year 23	0.002	Yes	0.001	NA	0.001	Yes	0.001	Yes	0.001	Yes	0.001	Yes
Water Quality Standard - Aquatic Life Criterion Hardness		0.016		0.016		0.016		0.016		0.016		0.016	
		25		25		25		25		25		25	

Key to Color Shading:

green =	DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow =	DSM predicts small concentration increase that is potentially measurable.
red =	DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3f.													
Idaho Cobalt FEIS - DSM Predicted Arsenic Concentrations in Streams													
Most Probable or Expected Case (50th percentile)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (5)	Water Quality Standard Met? (1)	Concentration (mg/L) (5)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.037	Yes	0.0008	NA	0.001	Yes	0.0006	Yes	0.002	Yes	0.001	Yes
	Ram Operations	0.037	Yes	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Sunshine Operations	0.037	Yes	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Closure Year 5	0.037	Yes	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Closure Year 23	0.037	Yes	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.0008	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0010	Yes	0.002	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0010	Yes	0.002	Yes	0.001	Yes
	Closure Year 5	0.103	Yes (5)	0.0003	NA	0.001	Yes	0.0010	Yes	0.002	Yes	0.001	Yes
	Closure Year 23	0.118	Yes (5)	0.003	NA	0.001	Yes	0.0010	Yes	0.002	Yes	0.001	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.0008	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Ram Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Closure Year 5	No flow	No flow	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
	Closure Year 23	No flow	No flow	0.0003	NA	0.001	Yes	0.0005	Yes	0.002	Yes	0.001	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.0008	NA	0.001	Yes	0.0009	Yes	0.002	yes	0.001	yes
	Ram Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0008	Yes	0.002	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0003	Yes	0.002	Yes	0.001	Yes
	Closure Year 5	0.107	Yes (5)	0.050	NA	0.001	Yes	0.0022	Yes	0.002	Yes	0.001	Yes
	Closure Year 23	0.122	Yes (5)	0.050	NA	0.001	Yes	0.0025	Yes	0.002	Yes	0.001	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.0008	NA	0.001	Yes	0.0009	Yes	0.002	yes	0.001	yes
	Ram Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0008	Yes	0.002	Yes	0.001	Yes
	Sunshine Operations	No flow	No flow	0.0003	NA	0.001	Yes	0.0003	Yes	0.002	Yes	0.001	Yes
	Closure Year 5	0.107	Yes (5)	0.050	NA	0.001	Yes	0.0022	Yes	0.002	Yes	0.001	Yes
	Closure Year 23	0.122	Yes (5)	0.050	NA	0.001	Yes	0.0025	Yes	0.002	Yes	0.001	Yes
Water Quality Standard - Aquatic Life Criterion		0.15		0.15		0.15		0.15		0.15		0.15	
Federal Primary Drinking Water Standard		0.01		0.01		0.01		0.01		0.01		0.01	
Idaho Human Health Standard		0.05		0.05		0.05		0.05		0.05		0.05	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow = DSM predicts small concentration increase that is potentially measurable.
red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

(5) The DSM does not simulate geochemical reactions that are expected to attenuate arsenic in the groundwater system. Natural attenuation of arsenic is expected to result in arsenic concentrations at Ram Spring and Bucktail Creek that are similar to existing conditions as shown in the no action alternative and that meet water quality standards.

Table B-3g.													
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams													
90th percentile Case (90% probability that actual value will be lower than value shown).													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.370	No	0.64	NA	0.002	Yes	0.009	No	0.002	Yes	0.004	Partial
	Closure Year 23	0.195	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.046	No	0.03	NA	0.002	Yes	0.004	Yes (4)	0.002	Yes	0.003	Yes
	Closure Year 23	0.048	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.046	No	0.14	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.048	No	0.04	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow = DSM predicts small concentration increase that is potentially measurable.
red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.
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In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3h.													
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams													
10th percentile Case (90% probability that actual value will be higher than shown)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.052	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.050	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.041	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.041	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.041	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.041	No	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Water Quality Standard - Aquatic Life Criterion Hardness		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
		25		25		25		25		25		25	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow = DSM predicts small concentration increase that is potentially measurable.
red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3i.													
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams													
Most Probable or Expected Case (50th percentile, 50% probability that actual value will be higher than value shown)													
Alternative	Mine Stage	Ram Spring		Bucktail Creek (3)		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1) (3)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt II - FCC proposal with post-closure groundwater capture and treatment mitigation	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.090	No	0.07	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.065	No	0.01	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.043	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.043	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
Hardness		25		25		25		25		25		25	

Key to Color Shading:

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(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

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APPENDIX C

WATER MANAGEMENT GOALS AND DECISIONS

TABLE OF CONTENTS

TABLE C-1. WATER MANAGEMENT REQUIREMENTS, PERFORMANCE STANDARDS, TRIGGER LIMITS, AND CORRECTIVE ACTIONS

FIGURE C-1. FLOW CHART AND DECISION TREE FOR INSTALLATION OF POST-CLOSURE WATER CAPTURE

Table C-1.**Water Management Requirements, Performance Standards, Trigger Limits and Corrective Actions**

Goals	Performance Standard/Trigger Limits	Corrective Actions if Performance Standard Not Met
Maintain groundwater in baseline condition	Groundwater quality (metal concentrations) better than groundwater standards and/or baseline conditions	Control release of mine-impacted groundwater to the extent necessary in accordance with ID Groundwater Quality Rule (IDAPA 58.01.11.400)
		Increase groundwater capture efficiencies
		Mine dewatering to extent necessary
Prevent additional chemical load to BMSG systems	Groundwater flux of chemical mass loads not greater than baseline at BMSG capture systems	Execute terms of agreement with BMSG & EPA
		Increase groundwater capture efficiencies
		Mine dewatering to extent necessary
Prevent additional chemical load to SF Big Deer Creek and Big Deer Creek	Flux of chemical mass loads not greater than baseline at lower Bucktail Creek	Execute terms of agreement with BMSG & EPA
		Control release of mine-impacted groundwater to the extent necessary to comply with NPDES permit special condition II.D
		Increase groundwater capture efficiencies
		Mine dewatering to extent necessary
Prevent discharges to surface water in excess of water quality standards	Compliance with effluent limits in NPDES Permits	Improve water treatment
		Improve capture/treatment of sources

FIGURE C-1. Flow Chart and Decision Tree for Installation of Post-Closure Water Capture

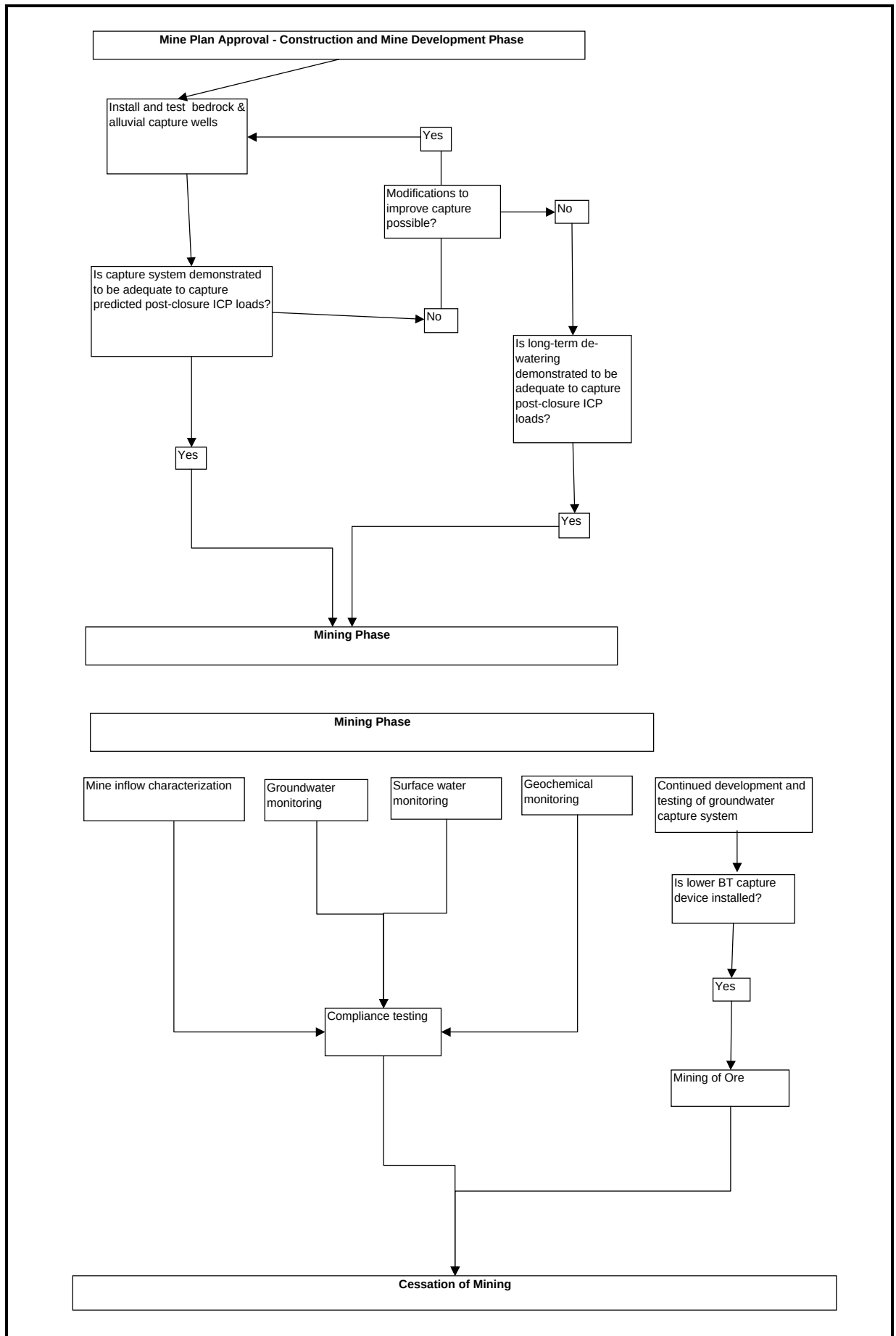


FIGURE C-1. Flow Chart and Decision Tree for Installation of Post-Closure Water Capture (continued)

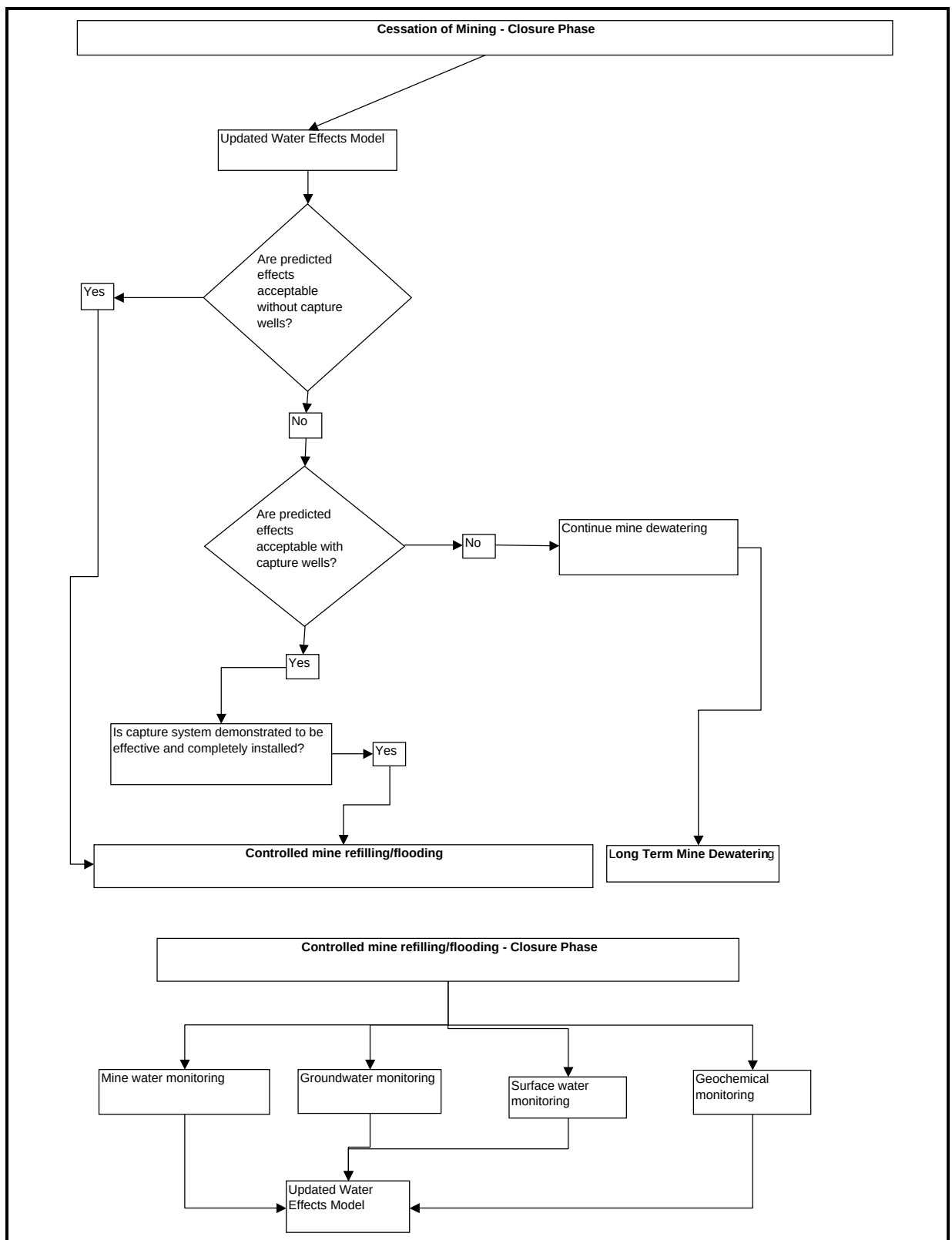
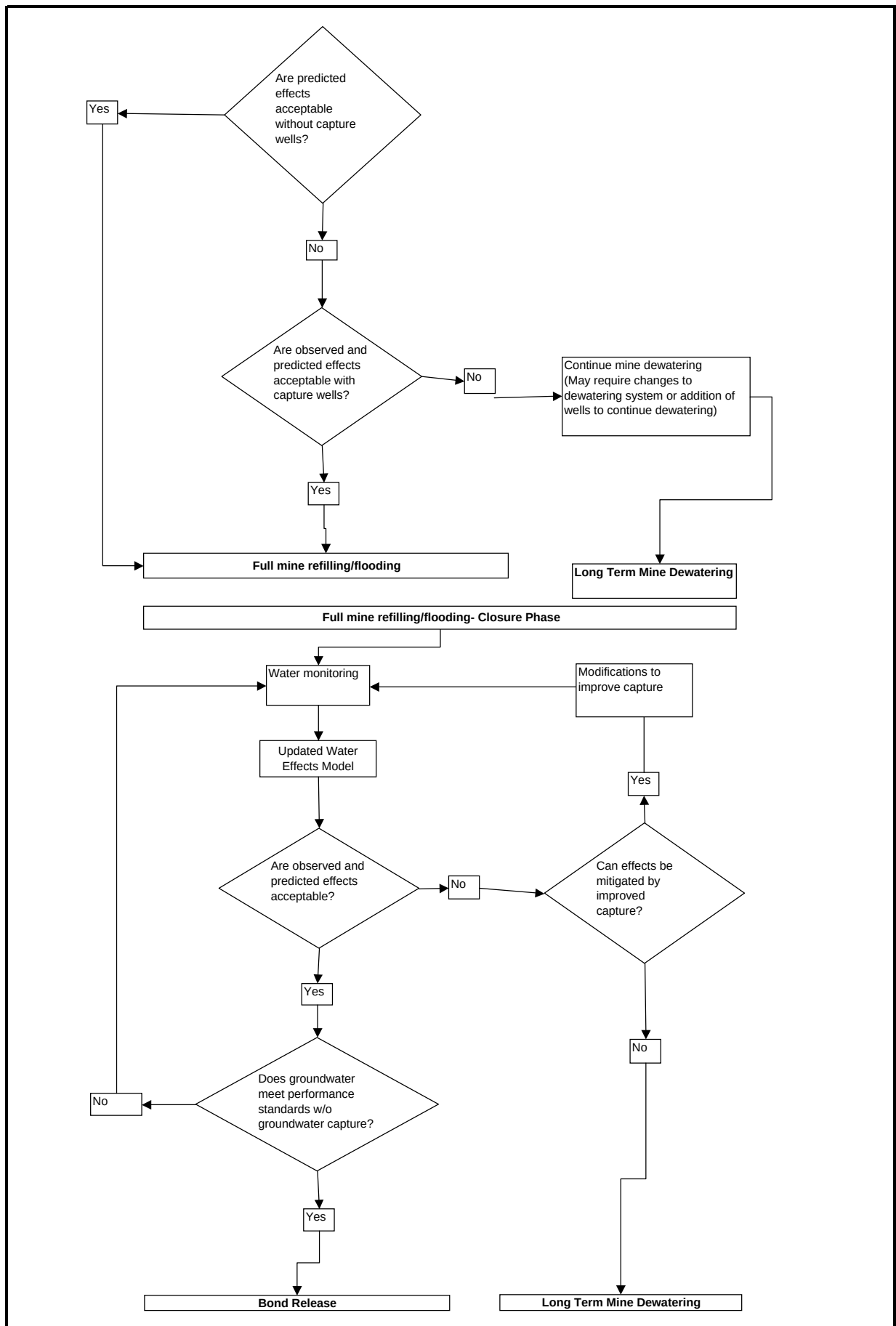


FIGURE C-1. Flow Chart and Decision Tree for Installation of Post-Closure Water Capture (continued)



APPENDIX D

RESPONSES TO COMMENTS ON THE DEIS

APPENDIX D

RESPONSES TO COMMENTS ON THE DEIS

The Draft Environmental Impact Statement (DEIS) for the proposed Idaho Cobalt Project (ICP) was noticed in the Federal Register on February 23, 2007. The public comment period ran from February 23 through May 24, 2007. Two public meetings were held to take comments on the DEIS; in Salmon on May 14, 2007 and Challis on May 15, 2007. A total of 173 comments and comment letters were received by the agencies. Each comment or comment letter was assigned a number to allow tracking of the input from each commenter. A commenter is anyone who submitted written comments in a personal letter, a form letter, a postcard, or a petition, and/or presented testimony at a public hearing on the DEIS. Table D-1 contains a list of comments received on the ICP DEIS and an identification number assigned to each comment or comment letter. The comment ID number makes it possible to track each comment and match it with a response.

Comments pertaining specifically to the Draft NPDES water discharge permit received by EPA will be addressed by EPA in issuing the Final NPDES permit.

Individual comments/issues within each comment or comment letter were assigned a code to identify the topic of the comment. Table, D-2, lists the categories and codes developed as part of the comment content analysis and to assigned to the comments; for example Geology, GEO 102, Tailings Facility Stability. Breaking the comments into categories allows similar comments to be grouped together. In cases where there are multiple comments address the same issue, a single response has been prepared to answer the multiple comments.

The comments are grouped by general topic in this response document, and further subdivided into subtopics with a header that also identifies the letter number(s) of the comment so that someone submitting a comment can track their comment to a response based on the comment code. The format of these responses to comments includes first a short description of the comment followed by the response. The comment short descriptions may not fully capture all of the content of the comment, but the responses are intended to address all substantive issues raised by the commenter. Some comments receive responses under more than one comment category. For example a comment that addresses water quality and potential impacts on fish may be addressed under both the water quality and fisheries sections.

Copies of all written comments and letters are on file at the Salmon-Challis National Forest office in Salmon, Idaho and are available for review. The agencies are not required to respond to every comment made by every person. However, "all substantive comments received on the draft statement (or summaries thereof where the response has been exceptionally voluminous), should be attached to the final statement whether or not the comment is thought to merit individual discussion by the agency in the text of the statement" (40 CFR 1503.5(b)). If a comment resulted in changes to the EIS text, then the fact that there has been a change is usually stated in the response. However, not all responses require that the text in the EIS be modified or supplemented. Where comments were of an editorial nature the response is typically listed as an "editorial correction."

TABLE D-1. Comments Received on Idaho Cobalt Project DEIS	
Commenter	Letter ID Number
Ahmed, Mustaque	70
Antonioli, Ted; Montana Mining Association	38
Arodzero, Anna	148
Baird, Joseph H; Attorney for FCC	111
Baird, Joseph H; Attorney for FCC	158
Baird, Joseph H; Attorney for FCC	159
Baldwin, Dennis	65
Baldwin, Dennis	92
Banks, R.E.	20
Barrett, Gary	28
Barrett, Lenore Hardy	89
Bartholme, Dan	141
Bearrett, William	119
Becker, Marta	131
Beke, Tony; Forest Engineer, SCNF	35
Bell, Jeffrey	22
Berry, Brent T.	55
Bilger, Lee	151
Blackadar, Bob	91
Bossert, Ray; Salmon School District 291	75
Briggs, Jack	72
Brown, Mark J.; Jenson Oil	39
Brunkow, Marlyn and Linda	152
Buntrock, William	83
Bush, James M; Lucky Friday Mine	12
Bush, Kenneth W.; Stillwater Mining Co.	13
Bush, Sharon; Essential Metals Corp	3
Bush, Timothy A.; Stillwater Mining Co.	11
Card, Bill	162
Carlson, Chris	143
Casey, Claire	90
Cleary, Brandon	86
Coates, Tom; Challis Chamber of Commerce	53
Craford, Kent	30
Dahle, Kent; Dahle Construction	124
Dahle, Norm	125
Dahle, Tyler K.	126
Davis, Stan; Mayor Salmon, Idaho	164
Davis, Stan; Mayor Salmon, Idaho	17
Davis, Stan; Mayor Salmon, Idaho	95
Dillard, Armina	142
Dizes, Ken	14
Dodd, Julie	84
Doll, Nikki	161
Edwards, Roger	123
England, Esther	135
England, Michael	140
Eppers, Kevin	96
Farnsworth, Dave; Monsanto	24
Fields, Ed	18

TABLE D-1. Comments Received on Idaho Cobalt Project DEIS (continued)	
Commenter	Letter ID Number
Fields, Ed	165
Flores, Jaime J.	62
Flynn, Roger; Attorney for Earthworks, BWCC	110
Flynn, Roger; Attorney for Earthworks, BWCC and ICL	157
Forshaw, Jacklyn	43
Forshaw, Paul	44
Forshaw, Zachary	45
Fournier, Rob; Atlas Copco CMT USA	116
Garrett, Theodore; Covington & Burling Attorney for BMSG	113
Gates, Edward	97
Gettier, David	2
Gilk, John	10
Gillerman, Virginia S.	81
Glaccum, Ellen	103
Golder Associates, Inc.	154
Grahn, Donald	71
Gunderson, Michael	73
Hager, Bill	129
Hall, Judy A.	138
Hall, Mark	153
Halton, David A.	130
Hamann, Laura	102
Hamilton, Jerry	169
Hammond, Brian F.	42
Hammond, Gordon	40
Harnish, Dale; Atlas Copco CMT USA	117
Hayball, Norm	9
Hayes, Justin; Idaho Conservation League	74
Heaps, Bret	147
Henry, Bill and Nancy	66
Hoven, Larry	61
Howell, Alan; A&D Specialists	23
Idaho Legislators	33
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TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Geology	GEO-100	Geology and Mineral Resources	Water Resources (cont.)	WTR-300-2	Surface Water Quality and Quantity - and Quantity – Inadequate Analysis
	GEO-101	Earthquake		WTR-300-3	Surface Water Quality and Quantity – Downstream Impacts
	GEO-102	Mineral Rights		WTR-300-4	Surface Water Quality and Quantity - TMDL
	GEO-102-1	Mineral Rights - Claim Validity		WTR-300-5	Surface Water Quality and Quantity – Unacceptable Impacts
	GEO-103-1	Rock Characterization & Geochemistry – Arsenic		WTR-300-6	Surface Water Quality and Quantity - Sediment
	GEO-103-2	Rock Characterization & Geochemistry – ARD		WTR-300-7	Surface Water Quality and Quantity - Arsenic
	GEO-104	Stability/Engineering		WTR-301-1	Groundwater – Groundwater Capture
Soils	SOIL-100	Reclamation & Revegetation		WTR-301-2	Groundwater – Groundwater Quality
	SOIL-100-1	Reclamation & Revegetation – Contaminated Soil		WTR-301-3	Groundwater – ARD
Water Resources	WTR-300	Surface Water Quality and Quantity		WTR-301-4	Groundwater – Grouting
	WTR-300-1	Surface Water Quality and Quantity - Hardness		WTR-301-5	Groundwater – Impacts to Meadow Creek

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Water Resources (cont.)	WTR-301-6	Groundwater – Groundwater Regulation	Water Resources (cont.)	WTR-304-1	Water Treatment – WTP Waste
	WTR-302	Water Monitoring		WTR-304-2	Water Treatment – WTP Waste
	WTR-302-1	Water Monitoring – Monitoring Location and Number		WTR-304-3	Water Treatment – Alternative IV Inadequate Detail
	WTR-302-2	Water Monitoring – Baseline		WTR-304-5	Water Treatment – Design and Operations Considerations
	WTR-302-3	Water Monitoring –Increase Monitoring		WTR-305	Stormwater Management
	WTR-302-4	Water Monitoring –Identifies Impacts After the Fact		WTR-305-1	Stormwater Management - Design
	WTR-302-5	Water Monitoring –Reporting		WTR-305-2	Stormwater Management – More Detail
	WTR-303	Water Use and Storage		WTR-306	Dynamic Systems Model
	WTR-303-1	Water Use and Storage – Water Balance		WTR-306-1	Dynamic Systems Model - Calibration
	WTR-303-2	Water Use and Storage – Potable Use		WTR-306-2	Dynamic Systems Model – Use of Model
	WTR-304	Water Treatment		WTR-307	National Pollution Discharge Elimination Permit (NPDES)

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Water Resources (cont.)	WTR-307-1	National Pollution Discharge Elimination Permit (NPDES) – Support Draft Permit	Water Resources (cont.)	WTR-307-9	National Pollution Discharge Elimination Permit (NPDES) – 401 Certification
	WTR-307-2	National Pollution Discharge Elimination Permit (NPDES) – Nitrogen		WTR-308	Wetlands and Other Waters of the U.S.
	WTR-307-3	National Pollution Discharge Elimination Permit (NPDES) – Flow		WTR-309	Federal Reserve Water Rights
	WTR-307-4	National Pollution Discharge Elimination Permit (NPDES) – Metals		WTR-310	Bedrock Fracture Characterization
	WTR-307-5	National Pollution Discharge Elimination Permit (NPDES) – Mixing Zone	Bio-Diversity	BIO-400-1	Wildlife Habitat – Inadequate Mitigation
	WTR-307-6	National Pollution Discharge Elimination Permit (NPDES) – Sulfate		BIO-400-2	Wildlife Habitat – Wetlands
	WTR-307-7	National Pollution Discharge Elimination Permit (NPDES) – Comments on Permit		BIO-401	Vegetation – Inadequate Mitigation
	WTR-307-8	National Pollution Discharge Elimination Permit (NPDES) – Water Balance		BIO-401-1	Vegetation - Species of Special Concern, Ute Lady Tress

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Fisheries	FSH-600	General Fish Species and Habitat	Threatened & Endangered Species (cont.)	TE-502-2	Section 7 Consultation – More Detail
	FSH-600-1	General Fish Species and Habitat - Sediment	NEPA	NEPA-800-1	NEPA Process and Format - Editorial
	FSH-600-2	General Fish Species and Habitat – Inadequate Analysis		NEPA-800-2	NEPA Process and Format - General
	FSH-600-2	General Fish Species and Habitat – Fish Traps		NEPA-800-3	NEPA Process and Format – Future Design/Study
	FSH-601	Threats to Fisheries and Impacts – Spills		NEPA-800-4	NEPA Process and Format - Alternative to Roadless Impact
Forest Plan	FPL-700	Salmon-Challis National Forest Plan, FLPMA, Organic Act		NEPA-800-5	NEPA Process and Format - Assumptions Unsupported
Threatened & Endangered Species	TE-500-1	Terrestrial Species – Describe Effects		NEPA-800-6	NEPA Process and Format - Violation of Requirements
	TE-501	Aquatic Species		NEPA-800-7	NEPA Process and Format – Objectives
	TE-501-1	Aquatic Species – Inadequate Analysis		NEPA-801	EIS Purpose and Need Inadequate
	TE-501-1	Aquatic Species – Describe Effects		NEPA-802	EIS Alternatives
	TE-502-1	Section 7 Consultation – Adverse Impact		NEPA-802-1	EIS Alternatives – Inadequate Alternatives

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
NEPA (cont.)	NEPA-802-2	EIS Alternatives – Support Alternative II	NEPA (cont.)	NEPA-804-5	Mitigation Measures – Remove mitigation
	NEPA-802-3	EIS Alternatives – Support Alternative IV		NEPA-805	Legal Authority
	NEPA-802-4	EIS Alternatives – Support Alternative V	Transportation	ROAD-900	Proposed Access Route and Improvements
	NEPA-803	Cumulative Impacts		ROAD-900-1	Proposed Access Route and Improvements – Upgrade
	NEPA-803-1	Cumulative Impacts – Insufficient Analysis		ROAD-900-1	Proposed Access Route and Improvements – Upgrade
	NEPA-803-2	Cumulative Impacts – Dust		ROAD-900-2	Proposed Access Route and Improvements – Busing
	NEPA-803-3	Cumulative Impacts – BMSG		ROAD-900-3	Proposed Access Route and Improvements – Maintenance
	NEPA-804	Mitigation Measures		ROAD-900-4	Proposed Access Route and Improvements – Impacts
	NEPA-804-1	Mitigation Measures – Insufficient Detail		ROAD-900-5	Proposed Access Route and Improvements – Roads Analysis
	NEPA-804-2	Mitigation Measures – Effectiveness		ROAD-900-6	Proposed Access Route and Improvements – Safety Standards
	NEPA-804-3	Mitigation Measures – Upfront Mitigation		ROAD-900-7	Proposed Access Route and Improvements – Switchback Modifications
	NEPA-804-4	Mitigation Measures – Differentiate Alternatives		ROAD-901	Access Route through Blackbird Mine Site

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Transportation (cont.)	ROAD-901-1	Access Route through Blackbird Mine Site – Impacts to BMSG	Wilderness and Roadless Areas	WLD-1200	Frank Church River of No Return Wilderness Area
	ROAD-902-1	Morgan Creek Road/Alternative Access Routes – Support Morgan Creek Route		WLD-1201	Roadless Areas
	ROAD-902-2	Morgan Creek Road/Alternative Access Routes – Impacts		WLD-1201-1	Roadless Areas – No Impacts to Roadless
	ROAD-902-3	Morgan Creek Road/Alternative Access Routes – Oppose MC Route	Scenic Resources	SCR-1300	Scenic Resources - Light
	ROAD-902-4	Morgan Creek Road/Alternative Access Routes – Inadequate Analysis	Cultural and Tribal Resources	CUL-1400	Cultural/Historic Resources – Impacts to Tribes
	ROAD-903	Road Reclamation		CUL-1401	Native American Rights – Consider Native American Rights
	ROAD-903-1	Road Reclamation – Switchbacks		CUL-1402	Tribal Consultation -
	ROAD-903-2	Road Reclamation – Reclaim Old Roads	Air & Climate	AIR-1500	Air Quality – Inadequate Analysis
	ROAD-904-1	Exploration Roads – Include Analysis	Health & Safety	HS-1600	Public Health – Fish Consumption
Powerline & Pipelines	PP-1000	Power Transmission Line and Pipeline		HS-1601	Forest Fires – Safety
Recreation	REC-1100	Recreation Mitigation		HS-1602	Materials/Chemicals/Concentrate Transport and Storage

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Health & Safety (cont.)	HS-1602-1	Materials/Chemicals/Concentrate Transport and Storage – Spills	Socio-Economics (cont.)	SOC-1702-2	Cost/Benefit – Post Mine Bust
	HS-1602-2	Materials/Chemicals/Concentrate Transport and Storage – Relocate Roads		SOC-1702-3	Cost/Benefit – Not Balanced
	HS-1602-3	Materials/Chemicals/Concentrate Transport and Storage – Fuel Storage		SOC-1701-1	Community Services – Training
	HS-1602-4	Materials/Chemicals/Concentrate Transport and Storage – Ore Transport		SOC-1701-2	Community Services – Schools
	HS-1603	Public/Mine Traffic Conflicts		SOC-1701-3	Community Services – Regional Impacts
	HS-1604-1	Spill Prevention and Response Plan – Need Plan		SOC-1701-4	Community Services – Law Enforcement
	HS-1604-2	Spill Prevention and Response Plan – Plan Components	Reclamation Bond	RCL-1800	Reclamation Bond Calculation
Socio-Economics	SOC-1700-1	Employment and Local Economy – Job & Benefit to Area		RCL-1800-1	Reclamation Bond Calculation – Excessive
	SOC-1700-2	Employment and Local Economy – Support Project		RCL-1800-2	Reclamation Bond Calculation – Need Large Bond
	SOC-1701-5	Community Services – Request Contribution to Impacted Services		RCL-1800-4	Reclamation Bond Calculation – Roads
	SOC-1702	Cost/Benefit		RCL-1800-5	Reclamation Bond Calculation – Fire
	SOC-1702-1	Cost/Benefit – Project Economics		RCL-1800-6	Reclamation Bond Calculation – Include Bond Details in FEIS

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Reclamation Bond (cont.)	RCL-1801	Reclamation Methods	Mine (cont.)	MINE-2005	Noise
	RCL-1801-1	Reclamation Methods – Adequate Reclamation a Primary Concern		MINE-2006	Closure and Long-Term Maintenance - Management
	RCL-1801-2	Reclamation Methods – Fish	Tailings Waste Rock Storage Facility	TWSF-1900	TWSF Capacity
	RCL-1801-3	Reclamation Methods – Use Native Species		TWSF-1900-1	TWSF Capacity – Permit Larger TWSF
	RCL-1802	Concurrent Reclamation		TWSF-1901	TWSF Design
Mine	MINE-2000-1	Underground Mine Backfilling		TWSF-1901-1	TWSF Design - Commingling
	MINE-2000-2	Underground Mine Backfilling – Slash Amendment		TWSF-1901-2	TWSF Design - Footprint
	MINE-2000-3	Underground Mine Backfilling – Complete or Maximize Backfill		TWSF-1901-3	TWSF Design – Cap
	MINE-2001	Surface Disturbance	Black Bird Mine Site	BMS-2100	Adjacent CERCLA Concerns
	MINE-2002	Agency Project Administration		BMS-2100-1	Adjacent CERCLA Concerns – Don't Impact CERCLA Cleanup
	MINE-2003	Project Infrastructure		BMS-2100-2	Adjacent CERCLA Concerns – Consider BMSG Impacts
	MINE-2004	Geomembrane Liners		BMS-2100-3	Adjacent CERCLA Concerns – Plan will Jeopardize BMSG Cleanup

TABLE D-2. Comment Codes for Comments Received on Idaho Cobalt Project Draft Environmental Impact Statement (continued)					
Subject Category	Category Code	Topics Covered	Subject Category	Category Code	Topics Covered
Black Bird Mine Site (cont.)	BMS-2100-4	Adjacent CERCLA Concerns – Water Treatment	Miscellaneous (cont.)	MISC-2200-8	Miscellaneous – Firearm Policy
	BMS-2100-5	Adjacent CERCLA Concerns – Sediment		MISC-2200-8	Miscellaneous – Firearm Policy
	BMS-2100-6	Adjacent CERCLA Concerns – Inadequate Description			
	BMS-2100-6	Adjacent CERCLA Concerns – Cleanup Efforts Will Not Be Impacted			
Miscellaneous	MISC-2200-1	Miscellaneous – Protect Environment			
	MISC-2200-2	Miscellaneous – Cobalt Need and Use			
	MISC-2200-3	Miscellaneous – Lighting			
	MISC-2200-4	Miscellaneous – Wilderness			
	MISC-2200-5	Miscellaneous – Support Natural Resource Development			
	MISC-2200-6	Miscellaneous – Mancamp			
	MISC-2200-7	Miscellaneous – Oppose Mine			

The following are the individual coded comment items from the public comments on the Idaho Cobalt DEIS with the agency response to each comment.

GEOLOGY

Comment Code	Letter No.	Comment Subject
GEO-100	115	Geology and Mineral Resources

Comment: Errors and omissions in the description of Alternative II. Chapter 2, incorrect mineral resource description. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Incorrect mill recovery rate. (115)

Response: Editorial Correction. (115)

Comment: Errors and Omissions in describing the existing environment - add Congressional reservation of a portion of FCRNR for cobalt production. (115)

Response: A description of the Congressional reservation related to the Frank Church River of No Return Wilderness (FCRNRW) has been added to the discussion. (115)

Comment: Errors and omissions in the impact discussions - incorrect ICP ore reserves. (115)

Response: The June 2006 Plan of Operations states "There are 2.57 million tons of cobalt\copper reserves and resources...". The 3.78 million ton figure in the DEIS represents measured, indicated and inferred resources. The 2.57 million ton figure in the June 2006 Plan of Operations is the total measured and indicated resources. A Formation Capital Corporation press release dated September 21, 2006 announced a new measured and indicated resource calculation of 2.654 million tons based on new drilling results. The press release also updated the inferred resources to 1.122 million tons. (115)

Comment: FS acknowledgement of geologic probability that ore reserves will be expanded and additional waste disposal capacity needed. (115)

Response: Although the likelihood of finding additional cobalt/copper mineralization in the area of ICP's claims is high, the economics of mining those reserves is difficult to predict. The selection of a smaller TWSF facility in Agency Alternatives IV and V is intended to provide the required range of alternatives considered in the NEPA analysis and provides storage for the identified reserves. The alternatives are presented in such a fashion that selection of another option for the TWSF size would be possible in the Record of Decision. (115)

Comment Code	Letter No.	Comment Subject
GEO-101	110	Earthquake

Comment: The revised DEIS needs to describe how maximum probable earthquake estimates have been calculated and engineer the facility to withstand such an event for each stage of operations. (110)

Response: Earthquake design elements have been addressed in the design documents submitted by FCC and in a technical report titled Idaho Cobalt Project Geotechnical Environment (listed in Appendix A of the DEIS) that addresses the seismic design issue. In summary, this report explains that the International Building Code (IBC) shows the site to be within Seismic Zone 2, a zone of moderate seismic activity commonly called the Intermountain Seismic Belt. This report presents the existing data that is available for making predictions of seismic activity at the site and lists confidence or probability levels from 1 in 500 years to 1 in 5000 years for a range of peak seismic accelerations. Formation Capitol's stated design standard is the 1 in 500-year earthquake.

Forest Service Handbook 7109.21 does not provide specific seismic standards for mine waste dumps, but does require consideration of the critical pseudo seismic coefficient and the maximum credible earthquake in slope stability analyses. Maximum credible earthquake (MCE) estimates are not probabilistic but are deterministic, meaning that there is no way to express a "confidence level" or probability associated with their use. The MCE has not been calculated for this site because the applicable site geotechnical standards, which are listed in the technical report, are not compatible with a deterministic approach to design. For instance, the IBC includes detailed seismic standards for design of most building and facility structures that may be contemplated for the site, but IBC procedures do not make use of the MCE. For other structures at the site, such as hillside cuts or tailings piles, the applicable design standards for this project recommend the use of conservative pseudo seismic coefficients and factors of safety for design in lieu of the MCE.

Consistent use of the seismic standards contained in the IBC for design of mine buildings and facilities and the use of recommended pseudo static coefficients for design of earthen slopes will ensure that site facilities will withstand seismic forces safely during each stage of operation. (110)

Comment Code	Letter No.	Comment Subject
GEO-102	110	Mineral Rights

Comment: Violation of Organic Act, FLPMA, and Forest Service mining and special use regulations; incorrect assumptions of mining rights. (110)

Response: The ICP will not be required to obtain a right-of-way across public land for its associated facilities. The scope of the Forest Service special use regulations at 36 CFR 251.50 apply to uses of National Forest System lands except those authorized under other Forest Service authority, such as the minerals regulations at 36 CFR 228. The regulation at 36 CFR 228.5 requires operations to be conducted in accordance with an approved plan of operations. "Operations" is defined at 36 CFR 228.3 as "all functions, work and activities in connection with ...mining or processing of mineral resources, and all uses reasonably incident thereto, including roads...regardless of whether said operations take place on or off mining claims." Accordingly, the Forest Service has the authority to approve in the plan of operations all of the activities and facilities associated with mining, and is not required to grant permanent rights-of-way or easements for off-claim development.

The Secretary's special use regulations at 36 CFR 251, Subpart B exclude activities authorized under mining regulations at 36 CFR 228 Subpart A. In accordance with §228A regulations, facilities

reasonably incident to mining operations are authorized through approval of the Plan of Operations, and therefore a special use authorization is not required. (110)

Comment Code	Letter No.	Comment Subject
GEO-102-1	108, 110	Mineral Rights – Claim Validity

Comment: The FS should examine the validity of the mining claims; this assessment must include all present or future environmental protection, mitigation and reclamation costs. (108)

Response: The ICP mining claims are located on National Forest System lands that are currently open to entry and appropriation under the Mining Laws. There is no requirement under Federal laws or regulations to conclusively determine validity of mining claims before approving a proposed plan of operations on lands that are not withdrawn from mineral entry. The purpose of a validity examination would be to determine whether or not there was a discovery of a valuable mineral deposit on the claims. A valuable mineral deposit exists where minerals of such character have been found which a person of ordinary prudence would be justified in further expenditure of labor and means, with reasonable prospect of success, in developing a valuable mine. Idaho Cobalt's willingness to make substantial investment in development of a mine, based on exploration data that has been produced to date, is prima facie evidence that the test for discovery of a valuable mineral deposit has been met, and that these are valid mining claims. Further, a plan of operations may also be approved on unpatented mining claims on lands that are open to entry under the Mining Laws for exploratory work prior to the discovery of a valuable mineral deposit, or even prior to identification of any locatable mineral deposit at all. (108)

Comment: FS needs to perform validity assessment for FCC mining claims. (110)

Response: Although the US has the authority to examine unpatented mining claims to determine their validity at any time, the results of a mining claim validity exam on unpatented mining claims located on National Forest System lands open to mineral entry would have little or no bearing on a Forest's non-discretionary obligation under the 36 CFR 228 Subpart A regulations to process the proposed plan of operations. No law or Forest Service regulation supports a policy that plans of operation for lands open to mineral entry can only be processed where they involve mining claims determined to be valid under the 1872 Mining Law. (110)

Comment Code	Letter No.	Comment Subject
GEO-103-1	27, 166	Rock Characterization & Geochemistry – As

Comment: Have arsenic and iron components of ore been accounted for? Must assume that ARD will be produced. Need to bond for operational and long-term water treatment. (27)

Response: Geochemistry and acid-generation characteristics of ore was determined through geochemical testing as described in the Geochemistry section of Chapter 3 of the DEIS. Geochemical testing characterized the arsenic and iron contents of ore. All alternatives address the potential for ARD through a variety of control and mitigation measures including operational and long-term water capture and treatment. Bonding for all aspects of mine reclamation and closure would be required. (27)

Comment: What is source of arsenic and is it being considered. (166)

Response: Concentrations of arsenic in groundwater and surface water have been monitored routinely by FCC and BMSG as described in Chapter 3 of the DEIS and in the WRTR. Concentrations of dissolved arsenic are generally low in surface water and groundwater. Elevated concentrations of arsenic can occur in sediments as the result of both natural mineralization and historic mining at Blackbird as described in Section 3.7.3 of the WRTR. (166)

Comment Code	Letter No.	Comment Subject
GEO-103-2	110, 113, 115, 154	Rock Characterization & Geochemistry – ARD

Comment: Need thorough evaluation of material geochemistry and assessment of buffering capacity and ARD potential. (110)

Response: The information requested is contained in the Water Technical Report (Hydrometrics, 2006), which supplements the DEIS and is included in the administrative record. For example, Appendix B to the Water Technical Report contains an extensive discussion of the ICP geochemical testing program. Test results are described in detail and conclusions about ARD and metal leaching risk are described in detail. Additionally, the Water Technical Report contains detailed analysis of potential impacts to surface and groundwater resources downgradient of the proposed mine. Finally, Appendix A to the Water Technical Report contains a detailed description of the modeling approach and the specific predictive model used to assess potential impacts from the mine. Models such as the Dynamic Systems Model used to assess impacts from the ICP are site specific. Consequently, their application at other mines is not relevant since the accuracy of the model is dependent on the model design, implementation, and input assumptions used for the ICP. These values are unique to this mine. The EIS team has endorsed the concept of continuing to validate the predictive models as monitoring data is collected from the operational mine to better assess and improve model validity, and to re-visit post-closure model predictions. (110)

Comment: Need thorough evaluation of material geochemistry and assessment of buffering capacity and ARD potential - acid mine drainage concerns. (110)

Response: The Agencies agree that there are technical challenges faced by the ICP to adequately mix alkaline amendments with slash material underground. For this reason the DEIS required supplemental studies to be conducted during the early stages of mining. These studies will need to develop, demonstrate, and measure the performance of alkaline addition and blending to the satisfaction of the regulatory agencies. If adequate blending cannot be achieved, then other control technologies will have to be developed. It is important to remember that the alkaline amendment process is a redundant control technology that supplements to containment of load accomplished through the groundwater pumpback and water treatment systems.

There is a trade-off between maintaining a separate waste rock disposal area and commingling the waste rock within the tailings. A separate waste rock pile makes it easier to locate and treat or remove reactive waste rock if it causes environmental problems. However, commingling waste rock will greatly reduce the long-term acidification potential by reducing the supply of oxygen. A balance of these two measures would be to maintain a separate waste rock disposal "cell" but to encapsulate the cell with tailings. With any waste rock placement strategy, the primary means of environmental protection is the liner that will be constructed beneath and above the pile.

The operating plan will include the requirement that the waste rock pile will be regularly monitored for potential releases of metals or acidity, and the facility has been engineered to reduce or prevent releases of to the environment. Waste rock will not be used as general fill material at the ICP site.

The TWSF is not built to resemble original contours because this design approach conflicts with the primary purpose of the facility to reduce the potential for release of contaminants to the environment. If the facility were built to simulate original contour, it would need a much larger area to accommodate the requisite storage capacity resulting in more potential influx of meteoric water and more disturbance of natural features such as wetlands. (110)

Comment: Before evaluating the various alternatives, it is important to understand the water quality impacts that will occur if there is no mitigation or if the proposed mitigation is not successful at the ICP. The DSM used by the USFS was used to evaluate the impact of the ICP on Big Deer Creek and Panther Creek assuming the mitigation measures were ineffective. All the input values were unchanged except the groundwater capture efficiency was set to 0 percent and the pH in the Ram Slash and Backfill was set to 5.5, which is representative of moderately acidic conditions. A pH of 5.5 is less acidic than the pH 4.5 drainage that was observed within the 6930 portal at the Blackbird Mine. A pH of 5.5 or lower could be reached within the ICP mines if the proposed mitigation (amendments of the backfill) is unsuccessful. (113)

Response: We agree with the Golder Report's prediction that copper would reach the levels projected in their analysis **if the assumptions are correct**. However, we strongly disagree with the way that they have characterized their assumptions for three reasons. First, Golder implies that failure of **either** mitigation measure (e.g. the alkaline amendments or the solution recovery systems) would result in failure to protect water quality. This is untrue. **Both** systems would need to utterly fail for their analysis to be correct. The mitigation measures were designed to be redundant, providing a higher degree of protection than inter-dependent measures would.

The EIS team believes that the pH will be substantially higher than 5.5 in the underground mines. A pH of 5.5 would result in 8.9 mg/L predicted copper in the mine water. We stand by our assertion that pH in cemented tailings will be closer to 11 (Figure A) during mine life and will decrease to the range of 8.0 to 9.0 in the long-term owing to the cement addition to tailings (Figure B). Additionally, we believe that pH in slash will be closer to 8.5 during operation and 7.5 to 8.0 post closure because of alkaline amendment of slash. The resulting predicted copper levels in the underground mine (Figure B) range from 0.014 to 0.029 mg/L in backfilled tailings areas and are around 0.01 mg/L in slash zones. The overall predicted copper in the underground mine (when mine caused loads are added to background concentrations) are around 0.045 mg/L. These copper levels are more than 100 times lower than the levels predicted by Golder and are even higher than copper levels measured in the 6930 adit seep (<0.01 mg/L copper).

The groundwater recovery system is unlikely to fail as suggested by Golder because in Alternative IV, groundwater recovery would be provided by three separate recovery systems, if necessary. If the bedrock groundwater recovery system is unable to collect the requisite loads, then a second alluvial groundwater/surface water recovery system located in the lower Bucktail Creek drainage would be used to collect sufficient loads to off-set any releases from the ICP. If neither of these systems can be proven effective then the mines could be maintained in a dewatered condition post-mining. Thus, Alternative IV provides an essentially failsafe approach to post-mining groundwater containment. Under the proposed Alternative IV, the ICP essentially becomes a partner with BMSG in cleaning up Big Deer and Panther Creek, rather than a protagonist as suggested in the Golder analysis.

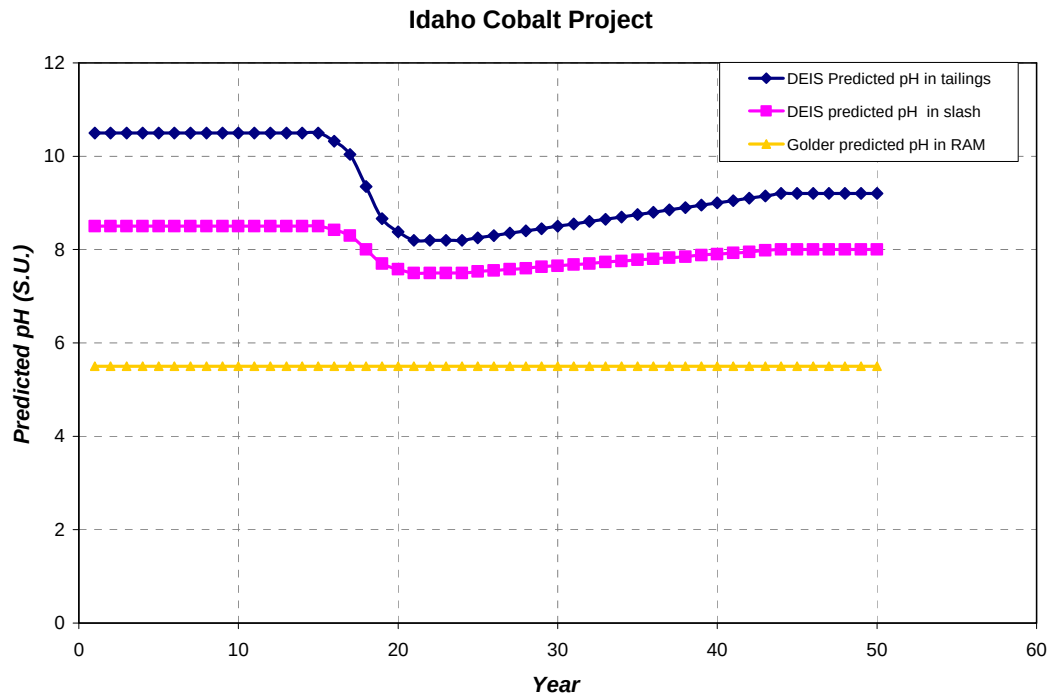


Figure A. Range of predicted copper from DEIS and Golder.

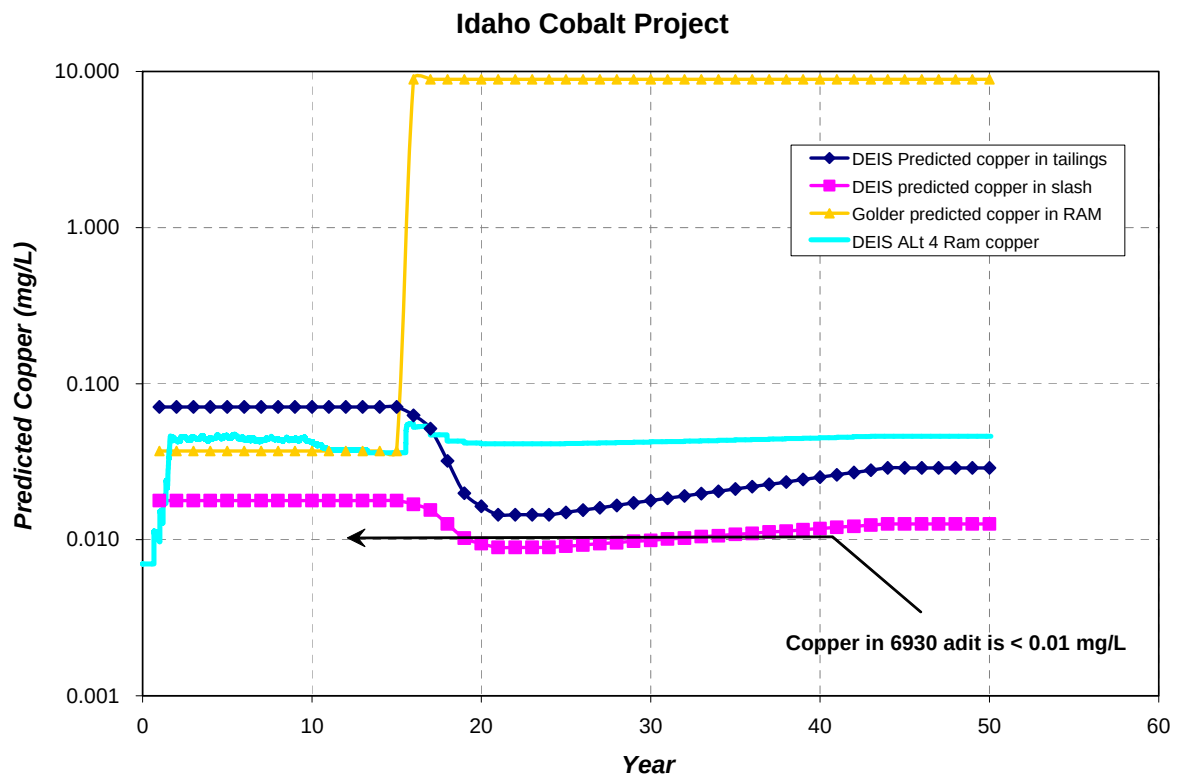


Figure B. Range of predicted copper in the Ram mine from DEIS and Golder.

Additionally, Golder erred when they performed this analysis using the ICP DSM. The ICP DSM was conducted as a stochastic analysis, meaning that a series of 30 individual model runs were performed to represent the range of conditions that may occur post-closure. Taken as a group, the model results depict the range (and probability) of potential impacts to receiving waters. Golder used a single iteration (realization 12) of the model out of this set of 30 model runs and used the single iteration as the basis for their analysis. Golder then mistakenly purports that the results from this sole run represent the expected water quality that would result if their assumptions were correct. In reality, this run represents one small portion of the range and distribution of potential outcomes if their assumptions prevail, and the results therefore can not be construed to be the expected case result even if their assumptions are correct.

Later in section 2.4 of the Golder Report they discuss five reasons why they believe that alkaline amendments will fail to control the pH in the mine. First, they assert that adequate mixing will not occur between either the tailings or slash and amendments. We concur with Golder that the degree of mixing is critical to the success of the approach. For cemented tailings, an intimate degree of mixing is readily achieved because of the fine particle size and moist condition of the tailings, which we believe will adequately insure pH control. For slash, mixing is more technically challenging. This is why Alternatives III, IV, and V require a definitive study, to be performed using actual slash at the site to develop and demonstrate successful pH control (see page 2-56 DEIS and Section 5.6.1 Water Technical Report). If the proponents cannot demonstrate successful pH control, then the regulatory agencies can require other measures to ensure environmental protection.

Golder also asserts that groundwater will bypass the underground mine void and will flow only within the unamended "damaged rock zone." The DSM model results indicated that the chemical load that develops in the zone of fractured rock surrounding the mine void is very small in comparison to loads contained in backfilled materials. Consequently, we believe that the residual alkalinity contained in mine water will neutralize any contributions from this zone. However, if this is not the case, then the groundwater collection system provides a redundant means of protecting downgradient water quality.

Golder cautions that amendments may be consumed prior to providing the buffering required in the spot-closure period. The Forest Service will require use of amendments that have sufficiently low solubility and reserve buffering capacity to ensure its longevity. Use of an appropriate design factor of safety will account for uncertainty in measured acid generation risk in the slash material.

We also agree with Golder that alkaline amendments do not control all metals, however, the empirical equations developed by the EIS team clearly demonstrate this principal for elements such as arsenic. Therefore, Golder's comment was clearly anticipated and addressed by the EIS team in their analysis of impacts from the ICP.

Finally, Golder asserts that the DSM is invalid because of the sensitivity of metal concentrations to pH. One of the values of a predictive tool such as the DSM is that it identifies the factor or factors that most strongly control the behavior of a complex system such as the ICP. Sensitivity analyses performed by the EIS revealed the importance of pH on metal behavior. It is precisely for this reason that the EIS team required alkaline amendments that are aimed at controlling the pH in the underground mine through buffering reactions. Therefore, rather than being a deficiency of the DSM, the fact that the importance of pH was recognized in fact is a strength of the DSM, and insures that the regulatory agency will focus their monitoring plan on the most important aspects of the mine. (113)

Comment: Unsupported assertions - explain release of stored acidity. (115)

Response: The phrase used by the EIS team to describe the dissolution of accumulated reaction products from the mine as "stored acidity" may be a misnomer of sorts. The primary control on pH in the amended slash is the dissolution of sulfate ion. In a system that is controlled by the solubility of calcium carbonate, the equilibrium pH theoretically approaches 8.3 (at atmospheric carbon dioxide

levels). If sulfate is abundant enough for gypsum to also precipitate from solution, the calcium ion concentration is depressed, which causes the equilibrium pH to decline to around 7.5, the level projected to occur during the early stages of mine flooding. As sulfate is removed by rinsing, the equilibrium pH will tend to rise toward 8.3 in the long-term. This is exactly the shape of the pH curve proposed by the EIS team. The pH controls described above are consistent with an alkaline pH environment and are independent of NNP levels, unless the NNP approaches zero. At low NNP levels, very different geochemical processes would tend to control the pH at more acidic levels.

Conversely, the pH in the cemented tailings zone is initially dominated by soluble calcium aluminates and silicates (pH around 11 to 12), but as the cement cures, the system will off-gas carbon dioxide and will approach more of a calcium carbonate controlled pH. The gradual transition from very alkaline pH to a typical calcium carbonate pH endpoint was demonstrated in the amended tailings kinetic test conducted by Telesto at the request of the EIS team. Again, the proposed pH trends in backfilled tailings are consistent with this process.

Contrary to the comment, there are clear geochemical mechanisms that will tend to control the pH in the approximate pH range described in the DEIS. However, a variety of factors may slightly alter the pH environment. For example, elevated levels of carbon dioxide will shift the system toward a lower pH. Kinetic controls may limit the degree to which governing reactions occur, which may similarly influence the pH domain. This uncertainty is the reason that an envelope of pH conditions (e.g. ± 1 pH unit) were used in the stochastic model. (115)

Comment: All mining disturbs the ground and produces impacts on the local water resources. (154)

Response: The EIS team disagrees with this premise, which is the foundation of the assumptions used in the Golder Report. When Golder assumes that mining will inevitably cause impact to the environment, then it is understandable that they would disagree with EIS findings to the contrary. The EIS team endeavored to complete the technical analysis without the sort of bias reflected in the Golder report. The EIS team recognized that mine development has the potential to increase chemical loads in water, however, the EIS team completed technical analysis on mitigation measures that would minimize if not avoid increases in chemical loads to surface water. Additionally, when receiving waters already contain elevated concentrations of copper and other metals, as is the case at the Blackbird site, then opportunities exist for collection and removal of ambient loads. This is the approach relied upon by the EIS team to ensure that adequate chemical load is removed and treated so that the proposed action is protective of water quality in Big Deer Creek and Panther Creek. (154)

Comment Code	Letter No.	Comment Subject
GEO-104	110	Stability/Engineering

Comment: Unstable area; IDWR dam permit required. (110)

Response: There are no impoundments proposed that are of a size that falls under IDWR dam permitting requirements. (110)

SOILS

Comment Code	Letter No.	Comment Subject
SOIL-100	115	Interim Reclamation & Revegetation

Comment: TWSF closure cap, soil balance showing quantities needed and source is needed. (115)

Response: TWSF closure cap soils would be obtained by excavating soils within the proposed facility footprint. An adequate volume of soil is available to construct the proposed cap and design details including a soil balance will be developed prior to construction. (115)

Comment Code	Letter No.	Comment Subject
SOIL-100-1	112	Closure Reclamation & Revegetation – Contaminated Soil

Comment: The DEIS does not discuss whether any of the soils excavated for construction or roads or any other purpose related to the mine operation may be contaminated soil from historic mining operations that may require special handling to avoid increased erosional transport, worker protection, etc. Is it stated explicitly that all soils will remain on-site and not disposed of off-site? If there is a possibility of off-site disposal, would sampling occur to assure the soils were disposed of at an appropriate location? Recommend including a bulleted item for contaminated soils/tailings handling and disposal (Other Mitigation). (112)

Response: The EIS has been modified to include a specific mitigation requirement to address potential disturbance of historic mine waste contaminated with metals from the Blackbird or other historic mines. The ICP would develop a plan to identify and handle any historically contaminated soils encountered while facilities or road upgrades are being constructed, these soils would be disposed of in the TWSF once it has been constructed. Alternatives III-V have been revised to clarify this point. Given the location of the mine facilities and road upgrades relative to the location of historic contaminated soils in the area, it is not anticipated that FCC will encounter any significant quantities of this historic mine waste material. (112)

Comment: The subsection discussing soils in the DEIS should also address the need to have a soils management plan in place. (112)

Response: Soils management is an integral part of the reclamation plan and is addressed in Chapter 2, pages 2-34 and 2-35 of the FEIS. (112)

WATER RESOURCES

Comment Code	Letter No.	Comment Subject
WTR-300	113, 115	Surface Water Quality and Quantity

Comment: DEIS lacks serious analysis of the ICP effects on ESA-listed fish species. (113)

Response: Conceptual models were developed to encompass the hydrologic, climatic, geochemical and mine facility processes into a single, stochastic dynamic systems model (DSM). The model was used to evaluate the storage and process pond capacities and the cumulative effects of mining on

water flows and water chemistry within the Panther Creek watershed. Throughout the development of this model, water quality regulatory agencies (EPA and IDEQ) have provided valuable input to the design, application, and interpretation of model results with the EIS team. Output from the model was used to predict changes in water quality such as daily copper concentration. The output expressed a range of possible results from highest to lowest to describe predicted values. This range in values included model simulations referred to as “expected case” or 50th percentile results, “best case” or 10th percentile case, and “worst case” or 90th percentile case. The results predict that surface water quality within the Panther Creek drainage will not violate cold water aquatic life standards nor will it interfere with the attainment goals of BMSG. However, the DEIS did identify copper concentrations (worst case) that with ground water capture may not be sufficiently mitigated in Alternative II. Furthermore, an NPDES permit will be required for all action alternatives. Draft discharge limits have been established as end-of-pipe limits and most constituents (metals) have been set for protection of cold water aquatic life standards to protect against adverse effects due to human activities (See DEIS Tables 4-4 and 4-5).

The DEIS does acknowledge the possibility of adverse impacts associated with Alternative II especially in the 90th percentile (worst case) condition for Big Deer Creek. Text has been added under Alternative II that states that if water quality criteria (for copper) increase that rainbow trout and westslope cutthroat trout would likely avoid Big Deer Creek near South Fork Big Deer Creek confluence. It has also been stated the should this condition develop and proposed mitigation measures cannot meet water quality standards this alternative has the potential to have an adverse direct impact on fish and Forest Service sensitive species in Big Deer Creek. (113)

Comment: FS should withhold ICP approval. (113)

Comment: ICP would violate Federal and State anti-degradation requirements, streams have no excess assimilative capacity. (113)

Comment: IDEQ's draft ICP certification is arbitrary and unlawful. (113)

Response: Releases that have caused and continue to cause impairment to South Fork Big Deer and Big Deer Creeks related to historic mining activities are being addressed under separate CERCLA authority. The USFS will ensure that adequate financial assurance to cover costs of operating and maintaining the TWSF, reclamation of mine facilities and long-term water treatment should ICP's mining activities have the potential to further impact the impaired stream reaches. As described in Chapter 1 under the heading Idaho Department of Environmental Quality (IDEQ), additional metal load to the already impaired streams is not allowed under Idaho water quality regulations.

While an impaired stream may be said to have no excess assimilative capacity, the IDEQ believes the antidegradation provisions of the Water Quality Standards can still be met. This will be accomplished by the “pound-for-pound” removal of any copper additions from NPDES activities from other copper impacted areas in the Big Deer watershed under influence of the Idaho Cobalt Project. The framework for these actions are outlined as a condition in the §401 certification. (113 for all three above)

Comment: Approval of the ICP without a specific, demonstrated and binding plan to avoid water quality and other environmental impacts would violate FS, EPA and IDEQ requirements and thus would be unlawful. (113)

Response: The various design components, monitoring and mitigation measures incorporated in the agency alternatives are intended to reduce environmental impacts and the risk of such impacts by the proposed mining operation. All design features, plans and mitigation measures included in whatever alternative is selected in the Record of Decision will be required to be incorporated into the ICP Plan

of Operations. All of the components of the Plan of Operations are enforceable and must be implemented. The key design components included in the preferred alternative intended to protect water quality and to avoid adverse impacts to BMSG's activities are intended to provide multiple layers of protection. While both the backfill amendment and the groundwater capture and treatment systems may each alone be effective in achieving target water quality goals, the combination of systems is intended to assure that if one system does not function as predicted that there is a backup. Additionally, the application of the DSM modeling tool specifically looks at a range of effectiveness of key operating systems. (113)

Comment: Section 7 consultation process and environmental baseline. (113)

Response: The basis for the conclusions regarding avoidance of adverse impacts is described in the DEIS and the Water Resources Technical Report that is included by reference in the DEIS.

Pre-ICP (i.e., current) impacts on fish are described in the Aquatic Baseline condition Technical Report (Kuzis, 2005) and the Biological Assessment (Kuzis, 2007). These impacts are summarized in pages 3-56 through 3-60 of the DEIS. (113)

Comment: Errors and Omissions in describing the existing environment - assessment of gaining and losing reaches of a stream/alluvium flow systems. (115)

Response: Increases in streamflow are evidence of gaining streams. The agencies agree that surface water flow increases by themselves would not necessarily indicate gains or losses to the alluvial groundwater system. (115)

Comment: Errors and Omissions in describing the existing environment - seeps in Bucktail drainage likely affected by ore bodies before mining. (115)

Response: The effects of ore bodies on water quality absent mining is described in the DEIS (see for instance page 3-23 where it states that "[spring] water quality is naturally affected by proximity to the Ram ore body"). (115)

Comment: Unsupported assertions - unfounded conclusion re: unavoidable adverse effect of sulfate on fisheries. (115)

Response: Sulfate was not identified in the chapter 4 fisheries sections as an adverse impact and the sentence containing the reference to sulfate will be removed in the fisheries section under "Unavoidable Adverse Impact" pages 4-115, 116. (115)

Comment: Errors and omissions in the impact discussions - SO₄ and Agricultural Water Supply. (115)

Response: Tables and water quality standards in the DEIS match the draft NPDES permit and/or the accompanying Fact Sheet that was current at the time of the DEIS. (115)

Comment: Errors and omissions in the impact discussions - Ram Spring, no flow vs exceedance of WQ standards, Tables 4-8 and 4-9, inappropriate indicators. (115)

Response: Table has been modified to clarify impacts to Ram spring and attainment of water quality standards. Please see footnote (3), which clarifies that water quality standards do not apply to

Bucktail Creek due to the Use Attainability Analysis. Footnote has been modified to clarify that values are shown for comparison purposes only. (115)

Comment: Errors and omissions in the impact discussions - Alt. II cumulative effects re: low probability that could prevent attainment of WQ standards in Big Deer Creek. (115)

Response: As stated on page 4-95 (DEIS), Alternative II water quality impacts have the potential to become significant. This is discussed in the Direct Effects sections on pages 4-31, 4-32 and 4-33 of the FEIS. (115)

Comment: Errors and omissions in the impact discussions - Sediment section amended to include a discussion of reduction of sediment load re: Alt. II. (115)

Response: This section does say that "sediment yields will be reduced by 12 percent below baseline levels in Bucktail Creek." It goes on to say "road density in Bucktail Creek will decrease in both the short and long-term due to road reclamation during the construction and post-mining period." A statement has been added to acknowledge the upgraded road surfaces along the access route. (115)

Comment: Errors and omissions in the impact discussions - Correct Alt. II sediment addition statement in fisheries text. (115)

Response: Text has been revised for clarification as requested. (115)

Comment: Reference is made to projected copper concentrations in Panther Creek and that a potential increase would not be "measurable", but could contribute to an exceedance of a WQS. If the increase is not measurable, it is not clear how an exceedance would be measurable. Please explain. (115)

Response: It is well established that the cumulative impacts of multiple pollution sources can sometimes cause an exceedance of water quality standards even though the individual sources do not cause exceedances individually. This is the basis of the federal Total Maximum Daily Load limitations. Similarly, cumulative impacts can be measurable even though individual impacts are not measurable individually. (115)

Comment: Blackbird Related Issues - Cleanup uncertainty/ICP impact assessment unfair. (115)

Response: The Water Resources Technical Report for the ICP (p. 4-4) recognizes there is uncertainty associated with cleanup activities and states that predictions of stream concentrations would be understated if the Blackbird cleanup doesn't meet expectations. The comment underscores the reason enhanced monitoring of the ICP activities will be included as mitigation in the approved plan of operations. The DEIS presents an analysis of effects and doesn't make judgments about the ICP or the ongoing BMSG cleanup. (115)

Comment: Blackbird Related Issues - ICP reduction in total copper load in Big Deer Creek prior to construction of BT-5 remedy. (115)

Response: Text (page 4-31) has been modified to clarify Blackbird impacts and ICP effects on copper load. (115)

Comment: Blackbird Related Issues - Continued WQ impact to Big Deer Creek is caused by Blackbird Mine pollution. (115)

Response: Text in the referenced paragraph and throughout Chapter 4 has been modified to more clearly identify the causes of existing and predicted future water quality conditions. (115)

Comment: BMSG diminution of flows in Big Deer Creek drainage. (115)

Response: The referenced section clearly states that “Blackbird cleanup actions are also expected to result in long-term decreases in streamflow in Bucktail Creek and South Fork of Big Deer Creek due to continued pumping and transport of groundwater and surface water...”. Determining the validity of water rights are beyond the scope of the EIS analysis as described on pgs 1-11 of the FEIS. (115)

Comment Code	Letter No.	Comment Subject
WTR-300-1	74, 110	Surface Water Quality and Quantity – Hardness Correction

Comment: Permit needs to utilize hardness values of 10 mg/l with regard to hardness dependent metals. (74, 110)

Response: The permit accurately reflects Idaho's EPA approved WQS at IDAPA 58.01.02.210.03.c.i: “For purposes of calculating aquatic life criteria for metals from the equations in Subsection 210.02, the minimum hardness allowed for use in those equations shall not be less than twenty-five (25) mg/l, as calcium carbonate, even if the actual ambient hardness is less than twenty-five (25) mg/l as calcium carbonate.” (74, 110)

Comment Code	Letter No.	Comment Subject
WTR-300-2	108, 115	Surface Water Quality and Quantity – Inadequate Analysis

Comment: The Tribe is not comfortable that potential impact from heavy metals has been adequately addressed in the EIS, nor adequately mitigated in the POO; potential to significantly reduce successful recruitment of fish species, potential to contaminate fish that currently reside in this area. (108)

Response: The Forest Service and EPA recognize the Tribe's position and interest with regards to fish consumption. The analysis of the ICP discharge (see Water Resources section of Chapter 4) predicts a decrease in copper and cobalt loads to the downstream fisheries during and following mining as a result of water treatment. Long-term improvements in water quality associated with the Blackbird cleanup should have a beneficial effect on fish and fish consumption.

The potential for leaching of heavy metals and ARD was one of the major concerns addressed by the EIS team. For example, in the first paragraph of Appendix B to the Water Technical Report states, “The geochemistry of mined rock material is one of the critical characteristics of the mine that has the potential to influence the environmental impacts associated with the ICP.” There is extensive analysis of the potential for elevated levels of heavy metals to exist in mine drainage or for ARD to occur. An extensive geochemical testing program (Chapter 3 & 4, Appendix B, Water Technical Report) was designed and implemented for the DEIS. Testing concluded, for example (Page 9, Appendix B, Water Technical Report), that “Overall, samples were very low in sulfide sulfur (Figure 9) with 50 % of the samples having no detectable sulfur (< 0.01 weight %) and 75 % of the samples with

less than 0.1 %. Sulfur concentrations were log-normally distributed. The highest sulfur levels in the Ram and Sunshine, which had similar sulfur distributions, were less than 2 %. Only about 5 % of the samples had more than 1 % sulfur, with many of these samples representing ore zones. The ANP of ICP samples (Figure 9) was also very low with 70 % of the samples having ANP values less than 3 kilograms/tonne (kg/t). This level of ANP would be neutralized when about 0.1% pyritic S oxidizes. About 1 % of the samples came from zones that had carbonate mineralization and yielded ANP levels in the range of 10 to 100 kg/t.” Additionally, on page 18, Appendix B, the EIS team stated, “Extensive geochemical testing conducted by FCC consultants (Telesto 2004) indicated those samples with more than about 0.15 % pyritic sulfur and a negative NNP are potentially acid generating (PAG). In this evaluation, a threshold pyritic sulfur level of 0.2 % and a negative NNP appeared to correspond to potentially acid generating waste rock. Overall, about 17% of 239 rock samples collected from the Ram and Sunshine deposits (Figure 15) were PAG while the remaining samples were either weakly acid neutralizing (80%) or uncertain (3%). All PAG samples were very low in ANP meaning they have little ability to neutralize acidity, and could become acidic quickly if there are sufficient sulfides to create acidic conditions. Kinetic testing, however, showed that chalcopyrite and cobaltite tends to oxidize slowly under oxidizing conditions. Tailings samples were non acid-generating according to the Sobek static test results.”

Despite the relatively low risk of ARD, several mitigation measures were employed to insure that release of ARD and metals were minimized. Among these measures were capture of outflow from the underground mines, perpetual water treatment (as needed base on monitoring results), commingling of tailings and waste rock, and addition of alkaline amendments to underground slash. (108)

Comment: Other - Alt II changes in WQ in Big Deer Creek are based on flawed analysis in subsequent sections. (115)

*Response: Please note that the referenced paragraph states: “It is **not** [emphasis added] likely that the model-calculated increase in copper would be measurable or would cause an exceedance of the water quality standard or cleanup goals in Panther Creek if it were to occur.” There is no contradiction in this statement, contrary to what is implied by the comment.*

It is well established that the cumulative impacts of multiple pollution sources can sometimes cause an exceedance of water quality standards even though the individual sources do not. This is the basis of the federal Total Maximum Daily Load limitations. Similarly, cumulative impacts can be measurable even though individual impacts are not. (115)

Comment Code	Letter No.	Comment Subject
WTR-300-3	108	Surface Water Quality and Quantity – Downstream Impacts

Comment: Tribe is particularly concerned about ICP and the likely impacts to water quality, fish species and human health; not just in project area but for a substantial distance downstream. Due to the inherent nature of hard rock mining, acid mine drainage will ultimately impact fish, animals, and plants not just in the project area, but also for a substantial distance downstream. (108)

Response: Although some hard rock mines generate acid mine drainage, acid mine drainage is not an inherent nature of hard rock mines. The potential for acid mine drainage from the ICP is addressed in the DEIS and in Appendix B of the Water Resources Technical Report. Alternative IV employs stringent water quality controls and therefore the potential for acid mine drainage impacts in and downstream of the project area are low. (108)

Comment Code	Letter No.	Comment Subject
WTR-300-4	110, 112	Surface Water Quality and Quantity - TMDL

Comment: 303(d) arsenic. (110)

Response: This comment is based on the assumption that the NPDES permit uses the wrong standard for arsenic. The permit accurately reflects the Idaho water quality criteria for arsenic. The permit limits will ensure compliance with the correct criteria set forth in Idaho's WQS.

The arsenic standard reported in Table 4 of the EPA fact sheet for the draft NPDES permit (50 µg/L) correctly reflects the arsenic human health criteria for recreational uses set forth in the Idaho WQS at IDAPA 58.01.02.210.01. Contrary to WMAP's assertion, Idaho's 50 ug/L criterion is effective for CWA purposes. The Idaho arsenic criteria were properly adopted under the Idaho Administrative Procedures Act and were submitted to EPA for approval as required by the CWA eight years ago, in April of 1999. This was before the May 30, 2000 "Alaska ruling". CWA regulations make it clear that water quality standards adopted and submitted to EPA before May 30, 2000 are applicable WQS for CWA purposes, unless or until EPA promulgates a more stringent standard [40 CFR 131.21(c)]. Consequently, the arsenic criterion is effective for CWA purposes, including the ICP permit. (110)

Comment: Page 3-10: This section should discuss more specifically the Idaho 303(d) listings in the surface waters in and around the ICP, including what constituents and standards are the streams listed as impaired for and what beneficial uses are not being attained. Likewise, if any state determinations have been made as to groundwater quality, it should be discussed too. (112)

Response: Table 3-3, Page 3-20 summarizes 303(d) listed streams in and around the ICP. No state determinations as to groundwater quality have been made. (112)

Comment Code	Letter No.	Comment Subject
WTR-300-5	110, 113	Surface Water Quality and Quantity – Unacceptable Impacts

Comment: The FS and EPA cannot approve ICP re: water quality violation predictions. (110)

Response: Regarding the exceedance of the drinking water standard for sulfate discussed on page 4-41, Alternative IV will include sulfate treatment if necessary to meet effluent limits established in the final NPDES permit.

Ram Spring - The DEIS says that Ram Spring will exceed the water quality standards for copper and sulfate post-mining. The current information is based on predictive modeling. Actual post-mining effects will be evaluated as information is collected and modeling is refined. If there is an exceedance of criteria based on the updated information, an NPDES permit may be required for the Ram Springs discharge.

Exceedance of the sulfate standard and possible anti-degradation for metals in groundwater is predicted post-mining upgradient of bedrock capture wells. The DEIS concludes that this is not significant because there is no domestic use of groundwater and existing groundwater exceeds standards. (110)

Comment: ICP will have unacceptable adverse water quality impacts. (113)

Response: Commenter correctly interprets the analysis presented in the DEIS that show potentially significant water quality impacts from the proposal as presented by the project proponent. However, the contention that the design components, monitoring and mitigation items contained in Alternative IV contain “serious flaws” in the “supporting science” are not substantiated in the letter or in the supporting document. Analysis of Alternative IV indicates that there would not be serious impacts to water quality in Big Deer Creek or to BMSG's ongoing cleanup actions. (113)

Comment: Absent effective mitigation, copper concentrations in Big Deer Creek would increase to over 50 ppb and concentration of copper in Panther Creek would increase to more than 8 ppb. (113)

Response: If the pH in the underground mines were to decline to 5.5 as assumed by the Golder technical report, and if there was no groundwater recovery employed, and if all metals were transported through the groundwater, alluvium and stream channel systems (as is conservatively assumed by the ICP dynamic systems model developed for the DEIS), we agree that downstream copper levels would increase by the amount described in the Golder report. However, the Agencies disagree with each of the assumptions made by Golder. Namely, the Agencies believe the pH will be substantially higher than 5.5, which would result in 8.9 mg/L predicted copper in the mine water. The Agencies believe that pH in cemented tailings will be closer to 11 (Figure A) during mine life and will decrease to the range of 8.0 to 9.0 in the long-term owing to the cement addition to tailings (Figure A). Additionally, the Agencies believe that pH in slash will be closer to 8.5 during operation and 7.5 to 8.0 post closure because of alkaline amendment of slash waste rock. The resulting predicted copper levels in the underground mine (Figure B) range from 0.014 to 0.029 mg/26L in backfilled tailings areas and are around 0.01 mg/L in slash zones. The overall predicted copper in the underground mine (when mine caused loads are added to background concentrations) are around 0.045 mg/L. These copper levels are more than 100 times lower than the levels predicted by Golder but are even higher than copper levels measured in the 6930 adit seep (<0.01 mg/L copper).

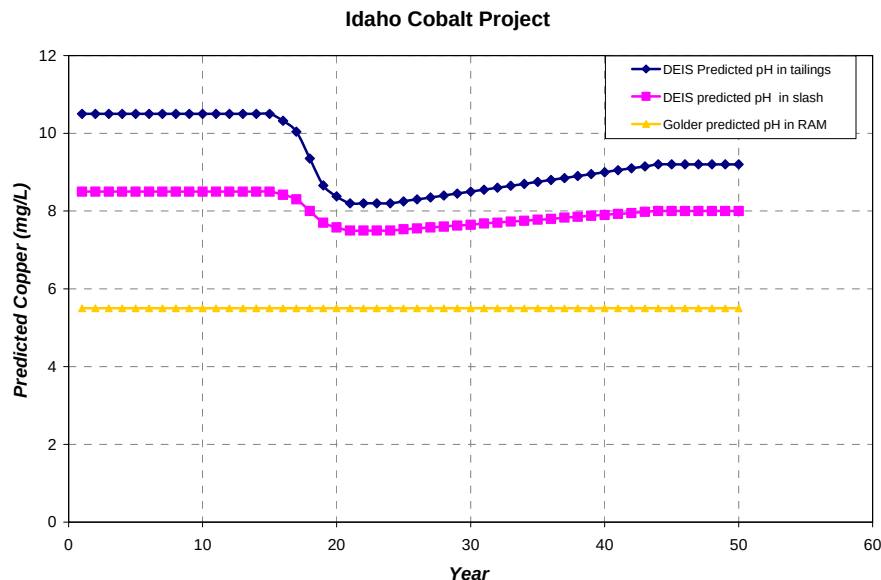


Figure A. Range of predicted copper from DEIS and Golder.

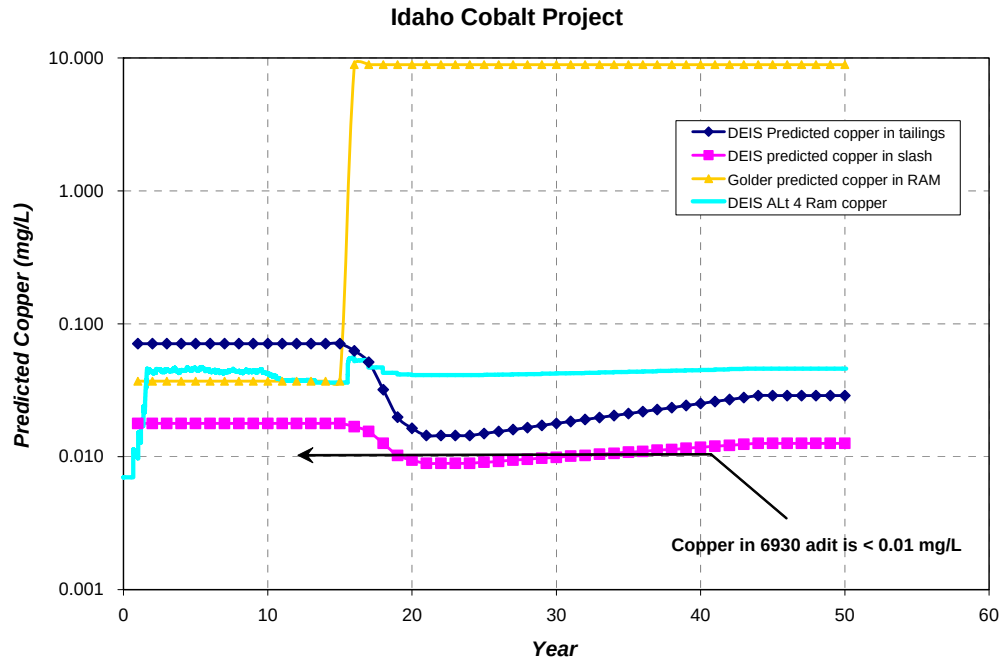


Figure B. Range of predicted copper in the Ram mine from DEIS and Golder.

The assumption made by Golder that no groundwater recovery will occur is entirely unreasonable and inconsistent with the requirements of the Plan of Operations as described in the EIS. The Agencies believe that most or all metal loads in groundwater can be intercepted and treated, if needed, and that even if some loads escaped the containment system, they would be unlikely to travel to the receiving water as was assumed in the model. Therefore, the EIS team adheres to the predictions about predicted copper levels in receiving waters described and documented in the DEIS.

Additionally, Golder erred when they performed this analysis using the ICP DSM. The ICP DSM was conducted as a stochastic analysis, meaning that a series of 30 individual model runs were performed to represent the range of conditions that may occur post-closure. Taken as a group, the model results depict the range (and probability) of potential impacts to receiving waters. Golder used a single iteration (realization 12) of the model out of this set of 30 model runs and used the single iteration as the basis for their analysis. Golder then mistakenly purports that the results from this sole run represents the expected outcome if their assumptions were correct. In reality, this run represents one small portion of the range and distribution of potential outcomes if their assumptions prevail, and the results therefore cannot be construed to be the expected case result even if their assumptions are correct. (113)

Comment Code	Letter No.	Comment Subject
WTR-300-6	112	Surface Water Quality and Quantity – Sediment

Comment: Sediment quality impacts and necessary measures to assure no further degradation or recontamination should be discussed. (112)

Response: Regarding sediment, effects in terms of sediment yield and sediment quality are described for each of the alternatives in Chapter 4 under the sub heading Sediment Yield and Sediment Quality. (112)

Comment Code	Letter No.	Comment Subject
WTR-300-7	16	Surface Water Quality and Quantity –Arsenic

Comment: What do we do with the natural occurring Arsenic? (16)

Response: Concentrations of arsenic in groundwater and surface water have been monitored routinely by FCC and BMSG as described in Chapter 3 of the DEIS and in the WRTR. Concentrations of dissolved arsenic are generally low in surface water and groundwater. Elevated concentrations of arsenic can occur in sediments as the result of natural mineralization and historic mining at Blackbird as described in Section 3.7.3 of the WRTR. Sediment remediation associated with the Blackbird CERCLA action has addressed arsenic and other metals contamination of sediment from the Blackbird Mine. (16)

Comment Code	Letter No.	Comment Subject
WTR-301-1	81, 110, 112, 113, 115, 146	Groundwater Quality, Quantity and Capture – Groundwater Capture

Comment: The pump back wells are good, but exact locations and procedures for discharge into streams may need adjusting to local conditions during implementation. (81)

Response: The comment states: “we believe the proposed treatment systems will not be sufficiently effective at capturing all contaminated groundwater flows” but gives no technical basis for this claim. The DEIS clearly states the potential difficulties in capturing groundwater, particularly from bedrock, and includes the following provisions in response:

- Based on analysis of groundwater flow through the mine areas, projected general groundwater flow directions downgradient of the mines have been defined;*
- Before the bedrock groundwater pumpback wellfield approach to groundwater containment as proposed by FCC can be considered for implementation, detailed field testing would be required. This would include installing wells along the proposed wellfield alignment and conducting long-term pumping tests to determine if a reversed hydraulic gradient can be induced between the entire capture well field alignment and Bucktail Creek.*
- An alternative capture system (lower Bucktail surface water/alluvial groundwater capture system) has been incorporated into the EIS Alternatives IV and V in response to the potential difficulty anticipated with effective groundwater containment through the bedrock pumpback system. This system would be tested during the mine operational phase to verify the achievable capture efficiency.*
- Additional monitoring wells would be installed in all directions peripheral to the Ram and Sunshine mine workings to monitor groundwater quality north, south, east and west of the mines, and to monitor groundwater drawdown patterns in response to mine dewatering. Groundwater drawdown patterns peripheral to the mines would help identify potential bedrock structures (i.e., the No Name Fault) which may act as groundwater flow conduits, with potential conduits showing a greater level of drawdown.*
- Text has been added to Chapters 2 and 4 of the FEIS stating that required capture efficiencies for the groundwater capture systems would be significantly less than 100% for Alternative IV and V in order to maintain post-mining metals loading to Bucktail Creek from the Ram and Sunshine areas at pre-mining loading levels; thus making contaminant control through groundwater capture more viable.*
- If adequate containment of potential groundwater contaminants cannot be achieved due to hydrologic conditions at the two proposed capture systems, or the existence of preferential groundwater flowpaths that would bypass the proposed capture systems (as determined through the operational phase groundwater level and mine inflow monitoring), the mines*

would be maintained in a partially or fully dewatered condition after closure to prevent groundwater outflow (see DEIS page 2-45, last paragraph). This stipulation provides a very high probability that potential contaminant migration through groundwater can be effectively controlled at the ICP mines.

Thus, the statement in the comment that “The agencies should also prepare for the eventuality that additional water interception locations and methods may be required” has already been considered in the EIS process.

Regarding the need for additional groundwater monitoring points, it is agreed that additional monitoring points and hydrologic testing will be required to verify the current hydrogeologic conceptual model and potential contaminant transport pathways prior to closure and reflooding of the ICP mine workings. See responses to WTR-302 and WTR-304.

The comment notes that “monitoring must continue throughout the mining operation and after reclamation.” Water resource monitoring would continue during mine reclamation and after mine closure. The EIS text has been revised to clarify that monitoring would continue after mining ceases. (81)

Comment: What if groundwater flow paths are different than anticipated? (110)

Response: The potential for groundwater flowpaths differing from those predicted in the DEIS, and ramifications of such a scenario, have been incorporated into the DEIS mine planning and impacts analysis. The potential for such a scenario would be determined through extensive monitoring, and potential ramifications would be addressed through inclusion of multiple groundwater containment options to insure post-mining groundwater control. See response to Comments WTR-302 and WTR-304 for discussion of measures taken in the EIS process to address the potential for groundwater flow patterns differing from those predicted in the DEIS. (110)

Comment: Page 2-38: It is our understanding that Alternative III assumes that the dewatering will be accomplished using wells drilled through the mine workings and completed at the lower levels of the workings. For clarity, the description of this dewatering technology should be provided in the text of this section. (112)

Response: As stated on page 2-38 of the DEIS, final designs and plans for the post-operational mine dewatering system(s) would be required prior to initial mine construction if Alternative III were selected. As described on FEIS page 2-39, the most likely method of post-operational mine dewatering would be through use of dewatering wells completed in the lower levels of the backfilled mine workings as referred to in the comment. (112)

Comment: Groundwater capture system is not feasible and treatment is not demonstrated. (113)

Response: Regarding the issue of the groundwater capture systems not being adequately defined in the DEIS to allow the Agencies to assess their effectiveness, this is addressed by requiring FCC to install and test the proposed bedrock groundwater capture systems and the Lower Bucktail surface water/alluvial groundwater capture system during mine development, to determine if they could adequately control contaminant migration. The only way the Lower Bucktail capture system may not effectively control contaminant migration is if one or more bedrock structures exist that could convey contaminants from the ICP mines directly to surface waters downstream of the capture system. This scenario would be evaluated and mitigated if necessary, through monitoring of mine inflows and groundwater drawdown peripheral to the mines during dewatering. If deviant flow paths were identified and contaminant migration could not be adequately controlled through grouting or

placement of additional capture wells, the mine(s) could be maintained in a fully or partially dewatered condition to prevent unacceptable impacts to downgradient water quality. Therefore, the overall groundwater capture plan (as described in the 2006 Water Resources Technical Report and 2008 Addendum) is believed to adequately assure containment of ICP-derived groundwater contaminants. It should also be noted that under Alternative IV or V, required capture efficiencies for post-mining groundwater contaminants exiting the ICP mines is less than 50% for the Ram Mine and less than 75% for the Sunshine Mine, based on a goal of maintaining post-mining copper loading to Bucktail Creek from the Ram and Sunshine orebody areas at pre-mining loading rates. The fact that the required capture efficiencies are less than 100% increases the likelihood that groundwater contaminants from the Ram and Sunshine Mine workings can be adequately controlled. The required capture efficiencies are discussed further in the 2008 Water Resources Technical Memorandum addendum.

Regarding the comment footnote stating that "it is equally likely that some contaminants will flow into the regional groundwater system and then into Big Deer Creek," this statement is incorrect. Although the potential for groundwater flow from the ICP mines to bypass Bucktail Creek and flow straight to Big Deer Creek cannot be entirely ruled out, the likelihood of this occurring is significantly less than the likelihood of groundwater following the steep topographic gradient towards Bucktail Creek. This is due to:

1. The very steep hydraulic gradient towards Bucktail Creek as compared to the gradient towards Big Deer Creek; and
2. The lack of evidence for the existence of high permeability structures trending to the north, despite the completion of numerous wells in the area, and completion of the 6930 Tunnel through a number of these structures.

Because the groundwater flow direction is dependent on the product of the hydraulic gradient and the corresponding hydraulic conductivity (permeability), the hydraulic conductivity would have to be much greater to the north (along the trend of bedrock structures and towards Big Deer Creek), as compared to the very steep gradient towards Bucktail Creek (0.33), in order for groundwater to flow to the north. Therefore, groundwater flow IS NOT equally as likely to occur to the north as towards Bucktail Creek. Nonetheless, numerous safeguards have been incorporated into the EIS to ensure that ICP-derived groundwater contaminants do not cause unacceptable water quality changes downstream of Bucktail Creek. These safeguards include monitoring/hydrologic testing requirements and multiple approaches to post-closure groundwater containment, including the possibility of maintaining the mines in a dewatered condition after closure.

In summary, the approach in the EIS process has been to:

1. Develop a reasonably representative conceptual site model of groundwater flow which, based on bedrock properties and other site characteristics, relies on the equivalent porous media (EPM) model approach;
2. Identify potential real world deviations from the conceptual model that could result in unacceptable impacts or risks to the environment (which this comment does a good job of outlining);
3. Implement monitoring/testing to evaluate the likelihood of such deviations actually occurring (to be completed during mine development and operations); and
4. Incorporate adequate safeguards/contingencies in the design and planning process to address potential deviations with a reasonably high likelihood of occurring, to ensure that unacceptable impacts to the environment do not result (i.e., multiple options for groundwater containment, including long-term mine dewatering).

This approach is consistent with bedrock groundwater characterization programs generally used at mine sites and other projects involving excavations into saturated bedrock, including the Blackbird Mine. If the commentor's contention is that groundwater cannot be adequately monitored or controlled in fracture flow systems, this would imply that development of all mines, tunnels, or any

other large excavations into saturated bedrock, cannot occur, which certainly is not the case. Additional detail on the appropriateness of the EPM approach at the ICP site is provided in Chapter 4 of the FEIS and in a 2008 water resources technical memorandum. (113)

Comment: Errors and omissions in the description of Alternative II. Summary Section, Table S1. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, General regarding bedrock extraction wells. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, incorrect characterization of post mining ground water capture. (115)

Response: Editorial Correction. (115)

Comment: Table 4-7, include FCC proposal for use of post mine bedrock capture wells re: copper standards. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives. Effects of Blackbird groundwater flows and fresh water. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives. Bedrock capture wells and/or alluvial water capture system discontinuation via monitoring results. (115)

Response: Editorial Correction. (115)

Comment: Errors and Omissions in describing the existing environment - replace Figure 3-6 with Appendix C POO. (115)

Response: Editorial Correction. (115)

Comment: Unsupported assertions - Table S-2 and text, basis for estimated effectiveness of bedrock capture wells. (115)

Response: Text in Table S-2 has been revised to change the phrase "unlikely to be effective" to "may not be effective."

The basis for the assumed capture system efficiencies are stated on pages 4-24 and 4-25 of the DEIS. The 75% and 90% capture efficiencies are based on "best professional judgment, in conjunction with knowledge of the localized hydrogeology" (i.e., fracture flow system), as well as the

four bulleted items on page 4-24. This is considered reasonable based on the locations of the capture systems, and the difficulties inherent to groundwater capture in fractured bedrock. The higher efficiency applied to the Ram capture system as compared to the Sunshine is based on the potential to induce a reversed hydraulic gradient between the Ram capture wellfield and Bucktail Creek, which most likely would not be possible for the Sunshine wellfield.

The 75% and 90% capture efficiencies provide a reasonable scenario for assessing potential environmental effects of the project, lacking specific information from the applicant regarding achievable capture efficiencies. The actual capture system efficiencies would be determined during the mine development/operational phase. The EIS Team believes this is a reasonable and justifiable approach to evaluate impacts from the project based on the ability to capture mine water through alternative capture systems (Lower Bucktail capture system or maintaining the mines in a dewatered state) if the bedrock groundwater capture wells prove incapable of adequately protecting downstream water quality. That being said, it should be noted that based on a target of maintaining post-mining copper loading to Bucktail Creek from the Ram and Sunshine areas at pre-mining loading rates, required capture efficiencies would be less than those assumed above for Alternative IV and V. Required groundwater capture efficiencies are described further in the 2008 Water Resources Technical Report Addendum.

Regarding the lack of DSM results for bedrock capture system alone, as described in Section 4.1.2 of the 12/06 WRTR (Water Resources Technical Report), two distinct post-operational groundwater management scenarios were modeled in the DSM: 1) no post-closure groundwater capture for Alternative 2, and 2) capture with the bedrock wells (assumed 90% capture efficiency for Ram, 75% for Sunshine) and with the Lower Bucktail system to capture all FCC loads. This was done to evaluate FCC's assertion that post-closure groundwater capture and treatment would not be needed (Alt 2 simulation), and to evaluate ramifications of operating both the bedrock and lower Bucktail capture systems on downstream flows and water quality. In this way, both ends of the groundwater capture spectrum were evaluated in the DSM. Actual groundwater capture requirements would be based on post-operational mine water and groundwater quality, and the proven bedrock groundwater capture system efficiency as determined through mine development/ operational phase testing. (115)

Comment: Errors and omissions in the impact discussions - Mine remaining dewatered indefinitely. (115)

Response: Keeping the mines dewatered after closure is not expected to significantly alter the mine water chemistry as compared to that estimated for Alternatives IV and V. This is because the mine inflow water would still have ample opportunity to interact with the backfill material after entering the backfilled workings and flowing towards the dewatering wells that would be completed in the lower portions of the backfill. As for groundwater impacts, this is accurately depicted in the DEIS since impacts to groundwater quantity and quality downgradient of the ICP mines would be identical after closure to those predicted for the operational period under Alternative III. (115)

Comment: Miscellaneous - Extraction wells vs. bedrock capture wells, alluvial water capture site vs. contingency water capture site. (115)

Comment: Miscellaneous - Title of backup capture system. (115)

Response: The Bucktail capture system is not a contingency; in fact the EIS analysis predicts that it will be necessary. However, since there is a possibility that the proposed bedrock capture system can be constructed to effectively capture alluvial as well as bedrock groundwater, the bedrock system will be installed and tested to determine if the Bucktail alluvial system is required. If the lower Bucktail system is not required there would be a slight decrease in road and pipeline impacts in the Bucktail drainage. (115 for both above)

Comment: In the effects comparison there is a statement that says "bedrock capture wells are unlikely to be effective at capturing required volume of groundwater necessary for metals load removal." (Alternative II) Do you have proof that this is the case? (146)

Response: Text has been revised to change the phrase "unlikely to be effective" to "may not be effective." (146)

Comment Code	Letter No.	Comment Subject
WTR-301-2	112, 115	Groundwater Quality, Quantity and Capture – Groundwater Quality

Comment: Page 3-18: References to contaminant levels in groundwater should be accompanied by relevant regulatory or risk-based standards to enable a comparison. (112)

Response: Table 3-1 includes Idaho groundwater standards for parameters of concern to allow comparison. (112)

Comment: Unsupported assertions - explain why copper concentrations in groundwater below Sunshine Mine are different in alternatives. (115)

Response: Addition of alkaline amendments to slash in Alternative IV and V increases pH and results in lower predicted long-term copper levels in the Sunshine mine. (115)

Comment: DSM Model Results and the ICP EIS - FEIS should focus less on model results and more on project design and adaptive management - need table showing where groundwater concentrations are being evaluated. (115)

Response: The location where the predicted groundwater concentrations apply is described in the Water Resources Technical Report (WTR). For instance, page 4-22 of the WTR states that the predicted groundwater concentrations downgradient of the Ram and Sunshine mines would apply to the entire area between the mine workings and Bucktail Creek. To clarify this, a footnote has been added to Table 4-7 describing where the predicted groundwater concentrations apply. (115)

Comment Code	Letter No.	Comment Subject
WTR-301-3	27, 108	Groundwater Quality, Quantity and Capture – ARD

Comment: Have arsenic and iron components of ore been accounted for? Must assume that ARD will be produced. Need to bond for operational and long term water treatment. (27)

Response: Geochemistry and acid-generation characteristics of ore was determined through geochemical testing as described in the Geochemistry section of Chapter 3 of the DEIS. Geochemical testing characterized the arsenic and iron contents of ore. All alternatives address the potential for ARD through a variety of control and mitigation measures including operational and long-term water capture and treatment. Bonding for all aspects of mine reclamation and closure would be required. (27)

Comment: Waste rock and mine tailings should be used to completely backfill the mine shafts; waste rock should be mixed with concrete so that potential groundwater contamination (acid mine drainage) is minimized. (108)

Response: All DEIS alternatives utilize declines rather than shafts to access the ore. The use of mine shafts was considered but dismissed as described in Chapter 2. Backfill of the mine declines was also considered and dismissed and the FEIS has been revised to describe the rationale for dismissal. In the agency alternatives III, IV and V (see Chapter 2 DEIS), the risk of ARD from waste rock is reduced through: 1) ongoing geochemical characterization program; 2) amendment of waste rock with alkaline materials (e.g. lime, limestone, cement) as needed to ensure long-term acid control; and 3) encapsulation of waste rock within low permeability tailings in the TWSF. (108)

Comment: The Tribe requests the FS to take stringent steps to maximize the avoidance of acid mine discharge; monitor surface water pH downstream; other monitoring and treatment measures. (108)

Response: As described above in response to the comment on Page 7, paragraph 4 of letter 108, a number of mitigation measures will be employed to reduce or eliminate uncontrolled discharge of ARD and metals. Additionally, the water monitoring program will be designed to detect sources of metals or acidity that escapes the mine water capture system. Finally, a plan is already in place to collect and treat mine water in perpetuity should this measure be necessary to protect water quality. (108)

Comment Code	Letter No.	Comment Subject
WTR-301-4	108	Groundwater Quality, Quantity and Capture – Grouting

Comment: Operator should grout the inside walls of mine shafts to help prevent groundwater seepage into the new mine shafts; reduce likelihood of further fracturing the bedrock and allowing cross-contamination with water from the Blackbird Mine. (108)

Response: Grouting of the mine workings has not been proposed in the agency alternatives because: 1) grouting would only reduce, but not prevent inflow to the mines, 2) mine inflow is predicted to be relatively small and to an extent is needed as makeup water for the process circuit; 3) grouting is not believed to be an effective method for preventing fracturing of the wall rock surrounding underground mine openings; 4) grouting (because it would only reduce the rate of flow) would not significantly change the possibility that there would be groundwater interaction between the ICP and the Blackbird mines. Groundwater flow from the ICP to the Blackbird is considered unlikely because of the existing and predicted groundwater gradients. Grouting would not change groundwater flow conditions except for a very narrow zone immediately around the mine openings. The ICP may use grouting during operations to control local groundwater inflows, but normal operational grouting would only be expected to reduce inflows not stop them completely. (108)

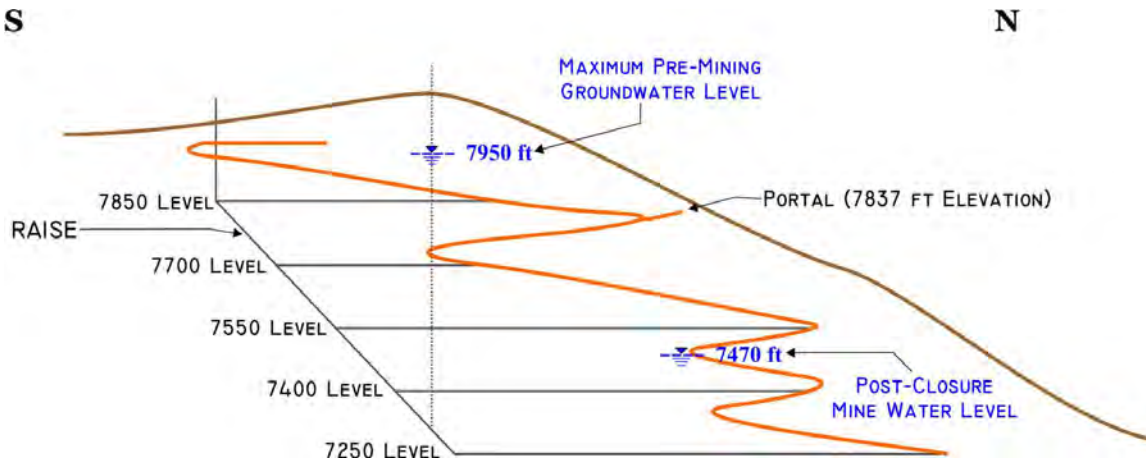
Comment Code	Letter No.	Comment Subject
WTR-301-5	112, 155	Groundwater Quality, Quantity and Capture – Impacts to Meadow Creek

Comment: Page 4-6, Item No. 4: This likely increase in copper concentrations for Alternatives IV and V should be described in the text. (112)

Response: The FEIS has been modified to include a discussion of the projected groundwater quality changes, which are also tabulated in Table 4-7. (112)

Comment: There is no evaluation in the DEIS on the potential for groundwater to migrate into the Meadow Creek drainage. (155)

Response: The potential for southward groundwater flow from the Sunshine Mine into the Meadow Creek drainage was evaluated by the EIS team and found to not be significant. This is based on the fact that only a small portion of the upper access decline tunnel would be located south of the topographic divide, and the post-mining reflooded portion of the Sunshine workings would all be located north of the topographic divide. As shown in the figure below, the Sunshine workings are predicted to refill with groundwater to an approximate elevation of 7470 feet amsl after mine closure. Based on this prediction, all of the flooded workings would be located north of the topographic divide, thus minimizing the potential for southward migration of mine water into Meadow Creek drainage. (155)



Comment Code	Letter No.	Comment Subject
WTR-301-6	109	Groundwater Quality, Quantity and Capture – Groundwater Regulation

Comment: Section 1-19 of the DEIS goes into detail on the Idaho Ground Water Quality Rule, but fails to mention the explicit policy of the Rule “to protect ground water and allow for the extraction of minerals above and within ground water.” IDAPA 58.01.11.006. In addition, the DEIS does not cite the explicit authorities under the Rule for developing site specific ground water quality levels, IDAPA 58.01.11.400.05, or for mineral extraction, IDAPA 58.01.11.400.06. The fact that these authorities were not mentioned gives the false impression that the Idaho

Ground Water Quality Rule does not recognize any policies or exceptions that lie at odds with the references included in the DEIS. (109)

Response: Note that the correct cite is page 1-19 not Section 1-19 of the DEIS. A short description and reference to IDAPA 58.01.11.006. have been added to the FEIS. (109)

Comment Code	Letter No.	Comment Subject
WTR-302	115	Water Monitoring

Comment: Errors and omissions in the description of Alternative II. Chapter 2, post mine water treatment and monitoring. (115)

Response: Editorial Correction. (115)

Comment Code	Letter No.	Comment Subject
WTR-302-1	81, 110	Water Monitoring – Monitoring Location and Number

Comment: The proposed [water quality] monitoring and coordination (Alt. IV) between the Forest Service, agencies, and company during and after the projects are the best way to catch any problems early on. (81)

Response: The agencies agree and have placed considerable emphasis on monitoring and reporting. (81)

Comment: Water quality impacts of the operation need to be monitored and mitigated as needed. (110)

Response: All action alternatives include water quality monitoring prior to, during, and after mine operation and reclamation as described in Chapter 2 DEIS. FCC has proposed a monitoring plan for Alternative 2 (FCC MPO, 2006). The Agency alternatives include additional monitoring requirements. The monitoring framework for Alternatives 3, 4, and 5 are described in Section 5.5 of the Water Resources Technical Report. This framework includes a requirement that ICP monitoring frequencies and methods would be similar to those employed for Blackbird Mine monitoring. Consistency in monitoring between the two sites will enhance the comparability of the data. Specific final monitoring requirements would be specified by the Agencies following the ROD.

All of the monitoring parameters requested except WAD cyanide are included in FCCs proposed monitoring plan. FCC has not proposed the use of cyanide at the ICP and no cyanide was detected during baseline monitoring. The draft NPDES permit includes effluent limits for nitrate and ammonia. Nitrate concentrations in streams resulting from the alternatives were evaluated with the DSM and are described in Table B-3a of Appendix B of the DEIS. Expected nitrate concentrations in Big Deer Creek are less than 0.2 mg/L for all alternatives. (110)

Comment Code	Letter No.	Comment Subject
WTR-302-2	64, 121, 165	Water Monitoring – Baseline

Comment: Page 3-16, Groundwater Quality, Table 3-1 Summary of 2002-2005 Groundwater Quality Monitoring Results . . .Substituting the analytical detection limit for below detection limit values when calculating descriptive statistics, such as the mean, is likely to result in a misleadingly high value for the 'background' concentration. . . . recommends that an alternative approach be used in generating descriptive statistics for the FEIS. Helsel and Hirsch (2002), Chapter 13 "Methods for Data Below the Reporting Limit," provides a detailed description of alternative approaches. (64)

Response: As discussed in the reference cited by the commenter (Helsel and Hirsch, 2002), there are a variety of methods for addressing below detection limit values when calculating summary statistics. These methods include simple substitution (using a constant such as the detection limit, $\frac{1}{2}$ the detection limit, or some other value), as well as more computationally-intensive distributional and so-called "robust" probability plot methods. Helsel and Hirsch (2002) recommend against simple substitution because it has no theoretical basis. Other researchers have noted that simple substitution methods can perform as well as distributional or robust methods for statistical hypothesis testing of small data sets ("Evaluation of Censored Data Methods To Allow Statistical Comparisons among Very Small Samples with Below Detection Limit Observations," J.U. Clarke, Environmental Science and Technology 32:177-183 (1998)).

The substitution method selected for the Idaho Cobalt Project groundwater summary statistics (use of the detection limit to replace below detection limit values) was selected because it is a straightforward, readily implemented method of obtaining summary statistics for a set of data with multiple reporting limits. While a high bias for a calculated mean might be expected for a highly censored data set with many values below detection limits, the Idaho Cobalt groundwater data set has relatively low censoring rates. For the dissolved metals data in Table 3-1, the percentage of data below detection limits ranged from 11 to 36% for arsenic, 0 to 15% for cobalt, and 0 to 22% for copper. A comparison of $\frac{1}{2}$ -detection limit substitution with full detection limit substitution for the primary constituents of concern (cobalt and copper) was conducted for the areas with the highest percentages of below detect values (15% for cobalt in the Big Flat area data, and 22% for copper in the Sunshine area data). In both cases, the mean value reported in Table 3-1 for the parameter in question (0.009 mg/L cobalt for Big Flat, 0.013 mg/L copper for Sunshine) was unchanged whether the full detection limit or $\frac{1}{2}$ the detection limit was used.

Furthermore, it is important to note that the data presented in Table 3-1 is intended to provide a summary of recent water quality data from the ICP site. The data is not intended to represent "background" or baseline conditions for future comparison to operational phase data. Establishment of a baseline water quality dataset for comparison to operational phase data is currently being completed by IDEQ. (64)

Comment: The definition of "ML" in the definitions section defines this term as similar to the concept of Practical Quantitation Limit (PQL), but without benefit of accounting for matrix effects of the solution being analyzed. The requirement of this analytical sensitivity may be impossible due to naturally occurring solution matrix interference. The laboratory's PQL determines the sensitivity of an EPA analytical method, when applied to the actual condition of the water being analyzed. The "Maximum ML" should be removed from the permit and replaced with PQL requirements that are relative to the specific constituent matrix of the liquid being analyzed. (121)

Response: NPDES monitoring requirements described in the DEIS match the draft NPDES permit that was current at the time of the DEIS. Requirements have been modified in the FEIS to match the NPDES requirements expected for the preferred alternative. (121)

Comment: Has there been groundwater monitoring and will EPA require cleanup to cleaner that existing groundwater? (165)

Response: There has been extensive groundwater quality monitoring at the ICP site both by FCC and by others parties involved with the Blackbird Mine cleanup. Table 3-1 summarizes groundwater quality data collected from 18 different monitoring wells by FCC from 2002 through 2005. Baseline groundwater monitoring has continued on a seasonal basis in 2006 and in 2007 under FCC's annual Baseline Monitoring program, under the direction of IDEQ, to assure that an adequate baseline database is established for comparison to future ICP Mine operational-phase water quality data.

The EIS assesses environmental impacts to groundwater from the various mine plan alternatives, the predicted mining-phase groundwater quality is compared to pre-mining, or current groundwater quality as well as to applicable groundwater standards. (165)

Comment Code	Letter No.	Comment Subject
WTR-302-3	74, 108, 110, 112	Water Monitoring – Increase Monitoring

Comment: Permit needs to call for more extensive network of groundwater monitoring wells. The draft permit at IID outlines requirements for surface water monitoring. A parallel permit condition needs to be created for groundwater monitoring. (74)

Comment: Groundwater monitoring network described in DEIS is not sufficient to ensure the contaminate plumes are detected. (110)

Response: Regarding the need for a more extensive network of monitoring wells, it is agreed that additional monitoring points ultimately will be required to adequately assess the hydrologic response to mining and potential contaminant transport pathways. Several additional wells are proposed for completion to increase the operational phase monitoring network. These include nine new wells recently completed or proposed for completion by FCC, and more than a dozen wells proposed by the EIS team for operational phase monitoring. Therefore, we believe that an adequate monitoring network will be in place prior to startup of mining operations.

Additional monitoring wells have been completed since preparation of the DEIS or are proposed for completion in 2007 by FCC. These include five additional wells around the Ram Mine, two additional wells at the Sunshine Mine, and two new wells in the Big Flat area. Several additional monitoring wells would be required for completion during the mine development and operational phase to evaluate various EIS-related issues. The EIS-proposed wells include two additional wells north of the Ram workings to evaluate potential groundwater flow and quality between the mine and Big Deer Creek, two wells south of the Ram to evaluate groundwater flow between the Ram and Blackbird Mine workings, at least one additional well downgradient of the Ram workings, at least four additional wells peripheral to the Sunshine Mine workings, and multiple testing wells at the locations of the proposed Sunshine Mine and Ram Mine bedrock groundwater capture systems and the Lower Bucktail surface water/alluvial groundwater capture system. The additional wells completed by FCC in 2006 have already expanded the groundwater monitoring network from that shown in the DEIS. The additional wells proposed by FCC and the EIS team will increase the groundwater monitoring coverage even further. In all, approximately 25 additional wells (beyond those shown in the DEIS) have been or will be completed prior to or during mine operations.

In addition to the monitoring wells, Section 5.0 of the WRTR outlines other recommendations for future monitoring. Specific goals of the monitoring program include: providing information on post-operational effects to groundwater; and providing information for post-operational water management planning and design (i.e., final groundwater capture design, if needed). Groundwater-related

elements of the monitoring program include monitoring of groundwater levels peripheral to the ICP mines in response to mine dewatering, and operational phase monitoring of the spatial and temporal distribution of groundwater inflows to the underground workings. (74, 110)

Comment: The Tribe requests the FS to take stringent steps to maximize the avoidance of acid mine discharge; monitor surface water pH downstream; other monitoring and treatment measures. (108)

Response: As described above in response to the comment on Page 7, paragraph 4 of letter 108, a number of mitigation measures will be employed to reduce or eliminate uncontrolled discharge of ARD and metals. Additionally, the water monitoring program will be designed to detect sources of metals or acidity that escapes the mine water capture system. Finally, a plan is already in place to collect and treat mine water in perpetuity should this measure be necessary to protect water quality. (108)

Comment: The draft permit fails to incorporate groundwater monitoring. (110)

Response: Groundwater monitoring is required under the Operating Plan, but not by the NPDES permit. (110)

Comment: The FS, EPA and IDEQ should require additional groundwater monitoring systems throughout the project area. (110)

Regarding the need for additional groundwater monitoring points, it is agreed that additional monitoring points and hydrologic testing will be required to verify the current hydrogeologic conceptual model and potential contaminant transport pathways prior to closure and reflooding of the ICP mine workings. See response to Comment Letter 110 above.

The comment notes that “monitoring must continue throughout the mining operation and after reclamation.” Water resource monitoring would continue during mine reclamation and after mine closure. The EIS text has been revised to clarify that monitoring would continue after mining ceases. (110)

Comment: Page 2-35: FCC's proposal is for three years ground and surface water monitoring following cessation of pumpback. It is unclear which section discusses monitoring for a longer period of time for Alternatives III, IV, and V. Monitoring would be required for significantly longer than three years. Please clarify in the EIS. (112)

Response: The Agencies have not finalized or approved a monitoring program at this time. However, a ten year post closure monitoring plan has been specified as one of the components of the post closure monitoring program. (112)

Comment Code	Letter No.	Comment Subject
WTR-302-4	113	Water Monitoring – Identifies impacts after the fact

Comment: After the fact approach to correcting effects to ESA-listed species. (113)

Response: As described in Item 1, top of page 4-7 of the DEIS, the changes in water quality in area streams, including Big Deer Creek, are not expected to be significant.

The impacts to water quality due to discharge of mine water from the ICP Alternatives II, III, and IV to Big Deer Creek during operations would be positive and would improve water quality in Big Deer Creek (see Tables 4-8 and 4-9 that shows concentrations for Alternatives II, III, and IV that are lower than Alternative I No-Action). Currently, Big Deer Creek does not meet water quality standards largely due to releases of contaminants from historic Blackbird Mine disturbances. The draft NPDES Permit requires that all water discharged from the ICP meet water quality standards prior to discharge, thus the ICP would dilute contaminant concentrations from Blackbird and natural sources and improve stream water quality.

During closure, impacts to area streams are not expected to be significant under Alternatives II, III, IV, and V (see Item 1, top of page 4-7 DEIS).

The comment erroneously states that mitigation measures are offered as “performance-based approach to compliance assessment” and references DEIS at 2-47. Please note that the “performance-based approach to compliance assessment” on page 2-47 (under the section titled “Water Monitoring”) refers to the Alternative IV changes to the water monitoring program, not mitigation measures designed to negate chemical mass loads to Big Deer Creek.

The groundwater capture and treatment systems to mitigate potential chemical mass loads from the mine workings are described on DEIS pages 2-45 and 2-46. Note that these measures would be constructed and tested during the first year of mine operations, not after-the-fact. Further, the mine workings would remain dewatered unless monitoring data indicates that no unacceptable effects to water quality objectives or cleanup goals would result from mine flooding (page 2-45 FEIS). (113)

Comment Code	Letter No.	Comment Subject
WTR-303	110, 115	Water Use and Storage

Comment: Insufficient information on specific source and validity of water rights; project should use low-flow water facilities. (110)

Response: Water use is discussed on page 2-22 of the DEIS and water rights described on page 2-30. Proposed water supply well locations are shown on Figure 2-1. The State of Idaho will determine the validity of any water rights and the Forest Service has no authority to require any specific standards for toilets or other facilities. (110)

Comment: Miscellaneous - explain moving of water management pond. (115)

Response: The pond location has been corrected in the FEIS. (115)

Comment: Miscellaneous - Requirement for a design to prevent ice damage to liners. (115)

Response: The agencies have had experience with ice damage to pond liners using similar lining material as proposed by FCC. The damage has occurred in the pond corners. The owner placed a rub sheet of liner material in the pond corners, which alleviated the problem. This is an example of a simple and relatively inexpensive solution to the ice damage issue. FCC's pond design engineers may have alternative methods of protecting the liner against ice damage. (115)

Comment Code	Letter No.	Comment Subject
WTR-303-1	112, 157	Water Use and Storage – Water Balance

Comment: Page 2-24, Figure 2-8: The quantity of water and solids should be identified for each input and output shown on Figure 2-8. (112)

Response: The Figure has been revised as requested. (112)

Comment: Page 2-45 and Figure 2-13: The description of Alternative V does not address supply of clean and/or treated makeup water for the milling processes. (112)

Response: Alternative V is no different than the other alternatives in regard to makeup water for milling, as is indicated in the opening paragraph of the Alternative V description. (112)

Comment: Page 4-33 and page 4-40: The text regarding flows in Bucktail Creek during Ram operations and after BT-5 is constructed for Alternatives III and V is potentially confusing as written. (112)

Response: Referenced text and Table B-2 have been edited for clarification as requested. (112)

Comment: The Draft EIS says that only 51 gpm will be drained from the mine (43 from the Ram workings, 8 from the Sunshine workings). DEIS at 2-22. Where will the additional 24 gpm come from (75-51)? (157)

Response: The referenced flows are average values. FCC estimates that average annual mine water inflow rate (i.e., 50% exceedance probability) would be 51 gpm as described at DEIS 2-22. For water treatment and discharge engineering design and permitting purposes, FCC assumed and applied for a higher annual inflow value of 75 gpm that corresponds to a 500-year recurrence interval (i.e., 0.2% exceedance probability). EPA has used this value in the NPDES permit. (157)

Comment Code	Letter No.	Comment Subject
WTR-303-2	112	Water Use and Storage – Potable Use

Comment: This chapter discusses a few places that groundwater may be used for human use. The EIS should clarify that only groundwater meeting drinking water standards could be used for this purpose. (112)

Response: Where reference is made in the DEIS to use of groundwater for human consumption, such as the 4th full paragraph on page 2-22, it has been clarified that only water of suitable quality would be used. (112)

Comment Code	Letter No.	Comment Subject
WTR-304	113, 115	Water Treatment

Comment: Groundwater capture system is not feasible and treatment is not demonstrated. (113)

Response: Regarding the issue of the groundwater capture systems not being adequately defined in the DEIS to allow the Agencies to assess their effectiveness, this is addressed by requiring FCC to install and test the proposed bedrock groundwater capture systems and the Lower Bucktail surface water/alluvial groundwater capture system during mine development, to determine if they could adequately control contaminant migration. The only way the Lower Bucktail capture system may not effectively control contaminant migration is if one or more bedrock structures exist that could convey contaminants from the ICP mines directly to surface waters downstream of the capture system. As described in the preceding comment response, this scenario would be evaluated and mitigated if necessary, through monitoring of mine inflows and groundwater drawdown peripheral to the mines during dewatering. If deviant flow paths were identified and contaminant migration could not be adequately controlled through grouting or placement of additional capture wells, the mine(s) could be maintained in a fully or partially dewatered condition to prevent unacceptable impacts to downgradient water quality. Therefore, the overall groundwater capture plan (as described in the 2006 WRTR and 2008 addendum) is believed to adequately assure containment of ICP-derived groundwater contaminants. It should also be noted that under Alternative IV or V, required capture efficiencies for post-mining groundwater contaminants exiting the ICP mines is less than 50% for the Ram Mine and less than 75% for the Sunshine Mine, based on a goal of maintaining post-mining copper loading to Bucktail Creek from the Ram and Sunshine orebody areas at pre-mining loading rates. The fact that the required capture efficiencies are less than 100% increases the likelihood that groundwater contaminants from the Ram and Sunshine Mine workings can be adequately controlled. The required capture efficiencies are discussed further in the 2008 Water Resources Technical Memorandum addendum. Also see Comment Response 301-1.

Regarding the comment footnote stating that "it is equally likely that some contaminants will flow into the regional groundwater system and then into Big Deer Creek," this statement is incorrect. Although the potential for groundwater flow from the ICP mines to bypass Bucktail Creek and flow straight to Big Deer Creek cannot be entirely ruled out, the likelihood of this occurring is significantly less than the likelihood of groundwater following the steep topographic gradient towards Bucktail Creek. This is due to:

- 1. The very steep hydraulic gradient towards Bucktail Creek as compared to the gradient towards Big Deer Creek; and*
- 2. The lack of evidence for the existence of high permeability structures trending to the north, despite the completion of numerous wells in the area, and completion of the 6930 Tunnel through a number of these structures.*

Because the groundwater flow direction is dependent on the product of the hydraulic gradient and the corresponding hydraulic conductivity (permeability), the hydraulic conductivity would have to be much greater to the north (along the trend of bedrock structures and towards Big Deer Creek), as compared to the very steep gradient towards Bucktail Creek (0.33), in order for groundwater to flow to the north. Therefore, groundwater flow IS NOT equally as likely to occur to the north as towards Bucktail Creek. Nonetheless, numerous safeguards have been incorporated into the EIS to ensure that ICP-derived groundwater contaminants do not cause unacceptable water quality changes downstream of Bucktail Creek. These safeguards include monitoring/hydrologic testing requirements and multiple approaches to post-closure groundwater containment, including the possibility of maintaining the mines in a dewatered condition after closure.

In summary, the approach in the EIS process has been to:

- 1. Develop a reasonably representative conceptual site model of groundwater flow which, based on bedrock properties and other site characteristics, relies on the equivalent porous media (EPM) approach;*
- 2. Identify potential real world deviations from the conceptual model that could result in unacceptable impacts or risks to the environment (which this comment does a good job of outlining);*
- 3. Implement monitoring/testing to evaluate the likelihood of such deviations actually occurring (to be completed during mine development and operations); and*
- 4. Incorporate adequate safeguards/contingencies in the design and planning process to address potential deviations with a reasonably high likelihood of occurring, to ensure that unacceptable impacts to the environment do not result (i.e., multiple options for groundwater containment, including long-term mine dewatering).*

This approach is consistent with bedrock groundwater characterization programs generally used at mine sites and other projects involving excavations into saturated bedrock, including the Blackbird Mine. If the commentor's contention is that groundwater cannot be adequately monitored or controlled in fracture flow systems, this would imply that development of all mines, tunnels, or any other large excavations into saturated bedrock, cannot occur, which certainly is not the case. Additional detail on the appropriateness of the EPM approach at the ICP site is provided in Chapter 4 of the FEIS and in a 2008 technical memorandum included as an addendum to the WRTR. (113)

Comment: Water treatment operation and maintenance costs are severely underestimated, capital costs for construction of a water treatment plant are not included. (113)

Response: The annual operating costs are based on the actual 2006 annual labor cost and power requirements of a mine water treatment facility having very similar operating requirements as the water treatment process proposed by the DEIS, vendor pricing for water treatment chemicals, actual electric rates provided by the local power company, and actual sludge disposal rates quoted by the Lemhi County Landfill. The water treatment system used as the labor cost basis is leased by a mine in northern Nevada, and operated on a contract basis by a private water treatment company. The annual operating costs are therefore current, and based on an actual case example. The flow rates and water treatment equipment hydraulic capacity are based on the water treatment flow capacity requirements used in the DEIS. The bond estimate includes \$25,000 per year for 100 years to cover equipment replacement, which will be adequate for the type of equipment used in the treatment process.

The water treatment plant will be built by, and costs incurred by FCC in order to start mining and milling activities. Therefore the capital cost of the water treatment plant is not included in the reclamation bond calculation. (113)

Comment: Object to assumption that BMSG will further reduce copper loadings or achieve compliance with water quality standards in the Bucktail drainage. Releases to BMSG collection system are unacceptable. (113)

Response: It is the FS understanding that the Blackbird cleanup is not currently required to achieve compliance with water quality standards in Bucktail Creek as a Use Attainability Assessment (IDEQ, 2002) was conducted and approved by IDEQ and EPA (see footnote 3, Tables 4-8 and 4-9, DEIS). The DEIS makes no assumptions that Bucktail Creek will achieve compliance with water quality standards.

It is the FS and EPA understanding that the Blackbird cleanup will include additional remediation actions that are expected to further reduce copper loadings in Bucktail Creek so that water quality

standards may be met, as required by the Unilateral Administrative Order, in South Fork Big Deer Creek, Big Deer Creek and Panther Creek. As summarized in the DEIS (p. 4-9) and described in the Water Resources Technical Report (page 4-2 through 4-4), the DSM assumed a future water quality condition based on the completion of the Blackbird Cleanup. These conditions include reductions in Blackbird loads to Bucktail Creek, the BT-5 pipeline, and compliance with water quality standards per the UAO. However, in no case, did the DSM or the water quality effects evaluation assume any capture and treatment of ICP chemical mass loads by BMSG. Any loads predicted to be released from the ICP were assumed to report to Big Deer Creek and Panther Creek. Thus, the DEIS does not assume capture and treatment of ICP loads by BMSG in order to meet water quality standards. (113)

Comment: Incomplete descriptions of Alternatives IV and V Water Treatment. (115)

Response: Alternative II proposes use of RO and management of the ensuing waste brine. The Water Resources Technical Report (Hydrometrics, 2006) page 4-16 states that this stabilized waste is predicted to be between 3,114 cubic yards (FCC estimate) to 26,000 cubic yards (Hydrometrics estimate) per year. Alternative IV has been modified in the FEIS and includes an ion exchange step, but no reverse osmosis. During operations the ion exchange waste solids would be handled in the same manner as the metals removal solids (disposal in the TWSF). Alternative IV requires FCC complete water treatability studies as part of the design process in order to confirm what treatment processes will be used to meet NPDES limits. This testing will determine the final water treatment process design details.

The revised description of water treatment for Alternative IV combined with the information established for Alternatives II and IV, provides sufficient information to evaluate the effects of water treatment and resulting waste. (115)

Comment: Effluent Water Quality. (115)

Response: Regarding Alternatives IV and V, the effects are predicted based on the analysis of a full-scale treatment plant operating at another mine site having similar wastewater characteristics, as stated in DEIS p 4-37. (115)

Comment: Water Treatment Waste Disposal. (115)

Response: The DEIS provides a qualitative evaluation of effects from Alternative IV and V water treatment wastes, using the data provided in the description of Alternative II as a basis. Alternative II results in a stabilized brine waste to be disposed in the TWSF, whereas Alternative IV will not. The Water Resources Technical Report (Hydrometrics, 2006) page 4-16 states that this stabilized waste is predicted to be between 3,114 cubic yards (FCC estimate) to 26,000 cubic yards (EIS Team estimate) per year. (115)

Comment: Lack of comparative analysis of effects, water treatment. (115)

Response: The agencies approach to water treatment for Alternatives IV and V was to not dictate what type of water treatment equipment or processes be used, but rather let the required water treatability testing and water treatment design professionals advance a treatment plant design best suited to the project with two goals: effluent must meet NPDES effluent limits, and minimize water treatment waste. The revised water treatment description provided in the FEIS (page 2-45) modifies and provides additional detail on the proposed water treatment system. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, post mine location of water treatment plant. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the impact discussions - Alt. II assumption that closure water treatment is not needed. (115)

Response: Alternative II was evaluated assuming that groundwater capture and closure water treatment would be employed as needed, however a DSM simulation of this condition was not run (see discussion page 4-31 and 4-32 FEIS). (115)

Comment: Other - Alt II changes in WQ in Big Deer Creek are based on flawed analysis in subsequent sections. (115)

*Response: Please note that the referenced paragraph states: "It is **not** [emphasis added] likely that the model-calculated increase in copper would be measurable or would cause an exceedance of the water quality standard or cleanup goals in Panther Creek if it were to occur." There is no contradiction in this statement, contrary to what is implied by the comment.*

It is well established that the cumulative impacts of multiple pollution sources can sometimes cause an exceedance of water quality standards even though the individual sources do not. This is the basis of the federal Total Maximum Daily Load limitations. Similarly, cumulative impacts can be measurable even though individual impacts are not. (115)

Comment: Bonding does not include worst-case contingencies - uncertainties about water treatment requirement. (115)

Response: The annual operating costs are based on the actual 2006 annual labor cost and power requirements of a mine water treatment facility having very similar operating requirements as the water treatment process proposed by the DEIS, vendor pricing for water treatment chemicals, actual electric rates provided by the local power company, and actual sludge disposal rates quoted by the Lemhi County Landfill. The water treatment system used as the labor cost basis is leased by a mine in northern Nevada, and operated on a contract basis by a private water treatment company. The annual operating costs are therefore current, and based on an actual case example. The flow rates and water treatment equipment hydraulic capacity are based on the water treatment flow capacity requirements used in the DEIS. The bond estimate includes a component to cover equipment replacement, which will be adequate for the type of equipment used in the treatment process.

The water treatment plant will be built by, and costs incurred by FCC in order to start mining and milling activities. Therefore the capital cost of the water treatment plant is not included in the reclamation bond calculation. (115)

Comment: Miscellaneous - confirmation of treatment process efficiencies. (115)

Response: The agencies approach to water treatment for Alternatives IV and V was to not dictate what type of water treatment equipment or processes be used, but rather let the required water treatability testing and water treatment design professionals advance a treatment plant design best suited to the project with two goals: effluent must meet NPDES effluent limits, and minimize water treatment waste. (115)

Comment: Miscellaneous - Removal of requirement for fill over water discharge pipeline to prevent freezing. (115)

Response: Water will freeze in pipelines when the temperature of water in the pipe drops below 32°F. As the pipeline will contain low spots in the profile, the pipeline cannot completely drain if flow in the pipeline stops. The potential for water to freeze during periods of no flow is real.

FCC has not provided a detailed design of the pipeline and there is no information to show that the line would be completely self-draining. If discharge were to be intermittent or to be temporarily suspended during cold winter weather low spots in the pipe could retain water and freeze. Even without low spots heat from the groundwater system would be dissipated rapidly from a surface pipe and freezing is a possibility. (115)

Comment Code	Letter No.	Comment Subject
WTR-304-1	146	Water Treatment – WTP Waste

Comment: There should not be much mine water since FCC is proposing to backfill with a cement paste so most of the mine tunnels will be full. Does it really matter what type of water treatment is employed as long as works? The NPDES permit requires certain levels in the water which FCC will have to meet. The main concern is how much and what type of waste will be a by-product of this process. With reverse osmosis the waste will be buried in the TWSF. Why isn't this placed in the backfill paste going into the mine? (146)

Response: Backfill of access tunnels (declines) with tailings is not proposed in any of the Alternatives, only the stopes would be backfilled. Backfill of stopes is not predicted to limit the amount of groundwater inflow into the mine workings.

All water treatment methods have advantages and disadvantages. As the comment identifies, one disadvantage of reverse osmosis is the generation of large amounts of waste, relative to some other water treatment technologies, such as those incorporated in Alternative IV. Disposal of reverse osmosis waste is a potential economic and environmental liability. To address these potential liabilities, alternative water treatment technologies were included in Alternative IV.

FCC did not propose placement of RO waste in the mine backfill paste and thus it is not included in Alternative II. Other Alternatives do not include RO and so they do not have RO waste to dispose. (146)

Comment Code	Letter No.	Comment Subject
WTR-304-2	8, 23, 68, 69, 70, 80, 83, 85, 96, 97, 98, 99, 100, 101, 102, 128, 136, 141, 142, 148	Water Treatment – Support RO

Comment: It makes more sense to handle water treatment in the manner the company has proposed, with reverse osmosis and placing the extremely clean discharge into Big Deer Creek. (8)

Comment: Support FCC design for pumpback wells and water treatment. (23)

Comment: Formation has proposed to treat its water using a state-of-the-art reverse osmosis technology that will leave the water cleaner than surrounding natural water. By comparison, the Forest Service's plan does not define a water treatment plan and may use a less efficient,

less effective method that will leave our lakes and streams polluted for years. (68, 69, 70, 83, 96, 97, 98, 99, 100, 101, 102)

Comment: Alternative II provides for a better and more thorough water treatment system. Alternative IV doesn't identify a specific water treatment plan and may propose something that is less effective. (80)

Comment: The water treatment defined in FCC's plan, Alternative II, uses reverse osmosis technology to treat the water used in the operations. Water discharged from the mine will be much cleaner than the water discharged from the old Blackbird Mine and will be even cleaner than the water in the immediate environment. (85)

Comment: It's nice to see Formation Capital is willing to spend the money to employ a water treatment system that will help support a strong fishery. (128)

Comment: The mine will treat the water used in their operations with a state-of-the-art reverse osmosis technology that will actually leave water cleaner than the natural water in the surrounding environment. By comparison, the Forest Service's plan does not define a water treatment plan and may use a less effective method that will leave our lakes and streams polluted. (136)

Comment: The mine will treat its water using a state-of-the-art reverse osmosis technology that will leave water cleaner than surrounding natural water. By comparison, the Forest Service's plan does not define a water treatment plan and may use a less efficient, less effective method that will leave our lakes and streams polluted for years. (141, 142)

Comment: The mine will treat the water used in the mine with a state-of-the-art reverse osmosis technology that will leave water cleaner than the natural water in the surrounding environment. By comparison, the Forest Service's preferred alternative does not define a water treatment plan and may use a less efficient method that will leave our lakes and streams polluted. (148)

Response: Support for the selection of water treatment as presented advanced by FCC and in Alternative II has been noted in the final analysis of this alternative. (8, 23, 68, 69, 70, 80, 83, 85, 96, 97, 98, 99, 100, 101, 102, 128, 136, 141, 142, 148)

Comment Code	Letter No.	Comment Subject
WTR-304-3	81, 109, 115	Water Treatment – Alternative IV Inadequate Detail

Comment: It was not clear to me that the Advanced Water Treatment Process (Alt. IV) is more feasible or better than the Reverse Osmosis system (Alt II). Sulfate could be a problem if the Advanced system does not remove it. Additional testing and design work seems reasonable. (81)

Response: *The Alternative IV water treatment approach would include sulfate removal to the extent necessary to comply with NPDES effluent limits incorporating a mixing zone for sulfate.* (81)

Comment: Alternatives IV and V state they to include water treatment plans that are different than the treatment plans in the Formation proposal. However, neither alternative contains a fleshed-out or explained water treatment plan. Instead, the DEIS contains several conditional statements, followed by a brief discussion of various water treatment processes that references the Water Resources Technical Report that may or may not be suitable for treating

ICP water. Neither the conditional statements, nor the discussion on water treatment processes amount to a complete water treatment system whose effects on the environment can be measured or analyzed. (109)

Response: The agencies approach to water treatment for Alternatives IV and V was to not dictate what type of water treatment equipment or processes be used, but rather let the required water treatability testing and water treatment design professionals advance a treatment plant design best suited to the project with two goals: effluent must meet NPDES effluent limits, and minimize water treatment waste. (109)

Comment: Incomplete descriptions of Alternatives IV and V Water Treatment. (115)

Response: Alternative II includes the use of RO and management of the ensuing waste brine. The Water Resources Technical Report (Hydrometrics, 2006) page 4-16 states that this stabilized waste is predicted to be between 3,114 cubic yards (FCC estimate) to 26,000 cubic yards (Hydrometrics estimate) per year. Alternative IV has been modified in the FEIS and replaces RO with ion exchange processes. Ion exchange waste solids will be handled in the same manner as the metals removal solids. Alternative IV requires FCC complete water treatability studies as part of the design process in order to confirm what treatment processes will be used to meet NPDES limits. This testing will determine final water treatment process train.

The revised description of water treatment for Alternative IV in the FEIS combined with the information established for Alternatives II and IV, provides sufficient information to evaluate the effects of water treatment and resulting waste. (115)

Comment: Water Treatment Chemicals (115)

Response: The FEIS has been reworded to more accurately describe the difference in effects between Alternatives II and IV in regards to water treatment chemicals. The chemical usage in Alternative IV would be no greater than that required for Alternative II. The risk evaluation provides the agencies with sufficient pertinent information to evaluate impacts, and is sufficient to comply with NEPA requirements. (115)

Comment: Effluent Water Quality (115)

Response: A revised description of water treatment and effluent water quality for Alternative IV is provided in the FEIS. (115)

Comment: Water Treatment Waste Disposal (115)

Response: Alternative II requires the use of RO and management of the ensuing waste brine. The Water Resources Technical Report (Hydrometrics, 2006) page 4-16 states that this stabilized waste is predicted to be between 3,114 cubic yards (FCC estimate) to 26,000 cubic yards (EIS Team estimate) per year. Alternative IV has been modified in the FEIS and replaces the RO treatment step with ion exchange (IX). The IX wastes would be handled in the same manner as the metals removal solids. (115)

Comment Code	Letter No.	Comment Subject
WTR-304-4	110	Water Treatment – Capacity

Comment: Treatment plant undersized if groundwater intercept approach is used. (110)

Response: Groundwater routed through the water treatment plant is not subject to the NSPS restriction. Based on the information presented in the baseline reports and evaluated in the DEIS, the capacity of the water treatment plant is considered adequate, even conservative. The public should understand that water treatment plants are not limited to a particular design capacity. In other words, if a water treatment plant is designed for 150 gpm, and an inflow of 175 gpm is realized, that does not mean that 25 gpm will not be processed by the treatment plant. That simply means that hydraulic residence times are reduced proportionally to the increased flow. The treatment plant operators would be aware of the plant inflow, and have the ability to modify chemical dosages and even water recycling within the plant to assure that effluent standards are met. (110)

Comment Code	Letter No.	Comment Subject
WTR-304-5	112, 121	Water Treatment – Design and Operation Considerations

Comment: Page 2-45: second full paragraph: The first sentence states that the treatment process be based on complying with New Source performance Standards. It should also be clear that the treatment system also be designed so that the discharge meets the effluent limits in the NPDES permit, which are based on meeting Idaho water quality standards in Big Deer Creek. (112)

Response: The requirement to meet discharge standards in Big Deer Creek is stated on page 2-42 of the DEIS. (112)

Comment: The water treatment process should not be limited to reverse osmosis. Any water treatment method that Formation Capital may choose should be allowed as long as discharged water meets the requirements of the applicable discharge permit. Reverse osmosis may be mandated as a last-resort barring any other treatment method meeting discharge permit requirements. (121)

Response: The agencies agree that any water treatment process that can meet effluent limits should be considered viable. However, the agencies are also concerned about the transport of chemicals required for the treatment system and the transport and disposal of water treatment waste products. To the extent that selection of a particular process can reduce the risk of spills to surface water along the transportation route or long-term operation and maintenance costs, there may be other factors that influence the selection of a preferred technology. (121)

Comment Code	Letter No.	Comment Subject
WTR-305	74, 110, 115	Stormwater Management

Comment: Permit needs to address Stormwater. (74, 110)

Response: Separate stormwater permits will be required for construction and operation of the ICP. (74, 110)

Comment: Errors and omissions in the impact discussions - Sediment section amended to include a discussion of reduction of sediment load re: Alt. II. (115)

Response: This section does say that "sediment yields will be reduced by 12 percent below baseline levels in Bucktail Creek." It goes on to say "road density in Bucktail Creek will decrease in both the short and long-term due to road reclamation during the construction and post-mining period." A statement acknowledging the upgraded road surfaces along the access route has been added to the FEIS. (115)

Comment Code	Letter No.	Comment Subject
WTR-305-1	110, 112	Stormwater Management - Design

Comment: The POO should design the facility to absorb a 1,000 year storm event during operation, reclamation, and perpetually after closure. (110)

Response: The Forest Service requirement for temporary stormwater conveyance structures upstream of the water management pond that will exist for the life of mine is to handle flow from the 25-year, 24-hour runoff event; a 100-year runoff event is required for conveyance facilities that will last beyond the life of mine. The baseline evaluations that concluded in DSM modeling used for the water management pond design used a 500-year return period, plus 2 feet freeboard (20% additional storage volume). The baseline hydrologic evaluations used as a basis for the DSM included worst-case hydrologic events including rain-on-snow events. The water storage ponds are primarily excavated, with a maximum 10 feet of fill on the downhill toe. This fill will be placed and compacted under design considerations that meet seismic loading conditions. A complete discussion of the design criteria for the water management pond can be found in Telesto 2004b. (110)

Comment: Page 2-29:... Chapter 4, environmental Consequences, barely discuss this issue (storm water management plan) and how it relates to surface water quality and sediment quality. (112)

Response: As described on page 2-29 of the DEIS, computerized soil erosion models were used to estimate sediment generation. Results of this evaluation are described on pages 4-32 and 4-33 of the DEIS in the "Sediment Yield" section for Alternative II. Other Alternatives are described on pages 4-11, 4-36, 4-41, and 4-42. Sediment chemical quality effects are described in the "Sediment quality" sections of each Alternative in Chapter 4. Effects of on sediment chemical quality of area streams is dominated by the historic Blackbird Mine impacts and improvements caused by cleanup actions. Sediment quality from the standpoint of effects to aquatic habitat is described in the Fisheries section of Chapter 4. (112)

Comment: Page 2-29: The text calls for clean water diversion channels using V-shaped channels with 1H:1V side slopes. Sideslopes this steep on an earthen diversion channel would not be stable in the long term. Side slopes no steeper than 2H:1V should be used on an earthen diversion channel. (112)

Response: The clean water diversion channels that extend beyond the life of mine are located in the Big Flat drainage, where ground slopes are not as steep as those on the Bucktail side of the project. The ditch side slope design is based on flow velocities using the 1991 COE Steep Method, as described in Telesto, 2006d. (112)

Comment Code	Letter No.	Comment Subject
WTR-305-2	112	Stormwater Management – More Detail

Comment: Page 4-27 and Page 4-35: to summarize, Table 1 indicates that reduced flows during baseflow conditions during Ram operations prior to the BT-% diversion. (112)

Response: Text and Table B-2 in the FEIS has been revised to include BMSG and EPA predictions of stream flow reductions resulting from BMSG cleanup activities. (112)

Comment Code	Letter No.	Comment Subject
WTR-306	115	Dynamic Systems Model (DSM)

Comment: Bonding does not include worst-case contingencies - re: DSM. (115)

Response: The inclusion of long term water treatment costs as part of the financial assurance calculation is not based on a “worst case” scenario. Analysis of the geochemical and hydrological characteristics of the ICP using the DSM model and other tools indicates that there is some uncertainty (see page 4-9 and 4-10 of DEIS) in predicting both chemical and hydrogeological conditions. Without collection and long term water treatment the DSM model predicts a slight and possibly measurable increase in copper concentration in Big Deer Creek following closure even under the expected case. In the 90th percentile case the DSM predicts a likely exceedance of water quality standards. The 90th percentile case is not a “worst case” or contingency condition, but a situation that is expected to occur one out of ten times and is therefore considered by the agencies in the context of risk to the environment as reasonably likely to occur. It is therefore entirely appropriate to require a bond or other financial assurance for long term water treatment until such time that it can be demonstrated that long term water treatment will not be needed. (115)

Comment Code	Letter No.	Comment Subject
WTR-306-1	16, 81	Dynamic Systems Model (DSM) - Calibration

Comment: Has there been baseline ground water monitoring done? (16)

Response: Yes, baseline groundwater monitoring is described in the Groundwater Resources section of Chapter 3 of the DEIS and in the WRTR. (16)

Comment: Company and agency proposed monitoring of groundwater will be an interesting study of the validity of the DSM model. (81)

Response: Yes, it will. (81)

Comment Code	Letter No.	Comment Subject
WTR-306-2	115, 154	Dynamic Systems Model (DSM) – Use of Model

Comment: DSM Model Results and the ICP EIS - FEIS should focus less on model results and more on project design and adaptive management. (115)

Response: We recognize that the predictions made by the ICP DSM model are exact. The fact that there is uncertainty regarding the conformance between modeled and actual behavior of the hydrologic system is why monitoring is required, why the decision preserves operational flexibility, and why contingency plans are required. The decision process followed by the EIS team did not rely solely on the results of the predictive model, though the comparative results of the model for various alternatives was one evaluation criteria. We endorse continued use of a predictive model for estimating effects in receiving waters, and anticipate that a model or models will be validated during mine operation.

This comment appears inconsistent with a subsequent comment by the commenter that “The DEIS in our opinion is over-reliant on modeling results in the analysis of potential impacts. The Final EIS should focus less on model results and more on project design and adaptive management.” We disagree that the comparison of alternatives presented in the DEIS would be better served by the aforementioned restructuring. We are aware that the DSM modeling results for Alternative II would have been different if some of the mitigation measures were applied to the proponents mine plan of operation. Additionally, the EIS team did not make an unsupported assumption that mitigation when applied to Alternative II would fail. In reality, the effects of post-closure water treatment were evaluated in an earlier version of the DSM model for Alternative II. More importantly, the decision by the EIS team to select Alternative IV was based on a decision matrix that factored many considerations other than merely the DSM model results. In truth, Alternative IV since it shares many elements with Alternative II, could be thought of as Alternative II with mitigation. So although we appreciate the difficulty in presenting the results of such a complex analysis, after having considered a number of organizational schemes for presenting the analysis, the EIS team stands by the current organization. (115)

Comment: DSM Model Results and the ICP EIS - separate DSM runs for Alt. IV. (115)

Response: Alternative IV incorporates a water capture system that includes bedrock groundwater capture wells, alluvial groundwater capture wells/trenches and Bucktail Creek surface water capture. Therefore, the DSM simulation for alternative IV assumed all components of the system would be available and functioning to accurately portray the alternative. (115)

Comment: DSM Model Results and the ICP EIS - What is "imperceptible predicted change"? (115)

Response: The DSM is very exact and in some cases calculates differences that are so exceedingly small that they cannot be shown using common conventions regarding the appropriate number of decimal places to display. The phrase was intended to convey that situation but could be misleading given the previous sentence. To clarify, the previous sentence has been revised to: “Alternative II causes insignificant, likely not measurable, direct effects to surface water quality...” (115)

Comment: A fundamental assumption in the DEIS (page 4-6) is that water quality standards in Big Deer Creek and South Fork Big Deer Creek will be consistently met during the life of the ICP as a result of the BMSG actions. No scientific basis is presented in the DEIS for this assumption. Based on the extensive site monitoring and studies conducted at the site by the BMSG, there is no valid basis for this assumption for copper. Moreover, the DEIS (Tables 4-8,

4-9, B-3g-i) appears to assume not only that the copper water quality standard will be met, but that it will be consistently maintained at 3.1 µg/L, which is actually lower than the minimum copper water quality standard of 3.5 µg/L. There is no basis presented for this assumption of a water quality “cushion.” (154)

Response: The US EPA, the Forest Service, the State of Idaho and NOAA oversee various aspects of the clean-up and restoration of the Blackbird mine site and have the authority to require the BMSG to employ additional actions to achieve the stated water quality goals. The projected water quality conditions in Big Deer Creek and in Panther Creek were the assumptions the EIS team used in the analysis. However, even if the aquatic life criteria for copper are not achieved in Big Deer Creek, the predicted copper levels for Alternative IV would be equal to or less than those under the no action alternative. This is because chemical loads are withdrawn from Bucktail Creek alluvium in Alternative IV, and a factor of safety is used to ensure that all of the loads from the mine are removed and treated. As a consequence, Alternative IV should not interfere with the attainment of clean-up goals by the BMSG, regardless of ambient water quality during the post-closure period. (154)

Comment Code	Letter No.	Comment Subject
WTR-307	74, 110, 113, 115	National Pollution Discharge Elimination Permit (NPDES)

Comment: Permit needs to address stormwater. (74)

Response: A separate stormwater permit will be required for construction and operation of the ICP. (74)

Comment: Permit fails to ensure that discharges into Big Deer Creek do not cause or contribute to violations of water quality standards for arsenic. (110)

Response: This comment is based on the assumption that the NPDES permit uses the wrong standard for arsenic. The permit accurately reflects the Idaho water quality criteria for arsenic. The permit limits will ensure compliance with the correct criteria set forth in Idaho's WQS. (110)

Comment: The draft NPDES permit violates the Zero-discharge requirement. (110)

Response: EPA does not agree. The regulations at 40 CFR §440.104(b)(2)(i) allow a volume of water equal to the difference between annual precipitation falling on the treatment facility and the drainage area contributing surface runoff to the treatment facility and annual evaporation to be discharged subject to the limitations set forth in 40 CFR §440.104(a). A complete explanation of the net precipitation calculation will be provided by EPA in the permit-specific Response to Comments, which will accompany the final NPDES permit upon issuance. (110)

Comment: Groundwater capture system is not feasible and treatment is not demonstrated. (113)

Response: Regarding the issue of the groundwater capture systems not being adequately defined in the DEIS to allow the Agencies to assess their effectiveness, this is addressed by requiring FCC to install and test the proposed bedrock groundwater capture systems and the Lower Bucktail surface water/alluvial groundwater capture system during mine development, to determine if they could adequately control contaminant migration. The only way the Lower Bucktail capture system may not effectively control contaminant migration is if one or more bedrock structures exist that could convey

contaminants from the ICP mines directly to surface waters downstream of the capture system. As described in the preceding comment response, this scenario would be evaluated and mitigated if necessary, through monitoring of mine inflows and groundwater drawdown peripheral to the mines during dewatering. If deviant flow paths were identified and contaminant migration could not be adequately controlled through grouting or placement of additional capture wells, the mine(s) could be maintained in a fully or partially dewatered condition to prevent unacceptable impacts to downgradient water quality. Therefore, the overall groundwater capture plan (as described in the 2006 WRTR and 2008 addendum) is believed to adequately assure containment of ICP-derived groundwater contaminants. It should also be noted that under Alternative IV or V, required capture efficiencies for post-mining groundwater contaminants exiting the ICP mines is less than 50% for the Ram Mine and less than 75% for the Sunshine Mine, based on a goal of maintaining post-mining copper loading to Bucktail Creek from the Ram and Sunshine orebody areas at pre-mining loading rates. The fact that the required capture efficiencies are less than 100% increases the likelihood that groundwater contaminants from the Ram and Sunshine Mine workings can be adequately controlled. The required capture efficiencies are discussed further in the 2008 Water Resources Technical Memorandum addendum. Also see Comment Response 301-1.

Regarding the comment footnote stating that "it is equally likely that some contaminants will flow into the regional groundwater system and then into Big Deer Creek," this statement is incorrect. Although the potential for groundwater flow from the ICP mines to bypass Bucktail Creek and flow straight to Big Deer Creek cannot be entirely ruled out, the likelihood of this occurring is significantly less than the likelihood of groundwater following the steep topographic gradient towards Bucktail Creek. This is due to:

1. The very steep hydraulic gradient towards Bucktail Creek as compared to the gradient towards Big Deer Creek; and
2. The lack of evidence for the existence of high permeability structures trending to the north, despite the completion of numerous wells in the area, and completion of the 6930 Tunnel through a number of these structures.

Because the groundwater flow direction is dependent on the product of the hydraulic gradient and the corresponding hydraulic conductivity (permeability), the hydraulic conductivity would have to be much greater to the north (along the trend of bedrock structures and towards Big Deer Creek), as compared to the very steep gradient towards Bucktail Creek (0.33), in order for groundwater to flow to the north. Therefore, groundwater flow IS NOT equally as likely to occur to the north as towards Bucktail Creek. Nonetheless, numerous safeguards have been incorporated into the EIS to ensure that ICP-derived groundwater contaminants do not cause unacceptable water quality changes downstream of Bucktail Creek. These safeguards include monitoring/hydrologic testing requirements and multiple approaches to post-closure groundwater containment, including the possibility of maintaining the mines in a dewatered condition after closure.

In summary, the approach in the EIS process has been to:

1. Develop a reasonably representative conceptual site model of groundwater flow which, based on bedrock properties and other site characteristics, relies on the equivalent porous media (EPM) approach;
2. Identify potential real world deviations from the conceptual model that could result in unacceptable impacts or risks to the environment (which this comment does a good job of outlining);
3. Implement monitoring/testing to evaluate the likelihood of such deviations actually occurring (to be completed during mine development and operations); and
4. Incorporate adequate safeguards/contingencies in the design and planning process to address potential deviations with a reasonably high likelihood of occurring, to ensure that unacceptable impacts to the environment do not result (i.e., multiple options for groundwater containment, including long-term mine dewatering).

This approach is consistent with bedrock groundwater characterization programs generally used at mine sites and other projects involving excavations into saturated bedrock, including the Blackbird Mine. If the commentor's contention is that groundwater cannot be adequately monitored or controlled in fracture flow systems, this would imply that development of all mines, tunnels, or any other large excavations into saturated bedrock cannot occur, which certainly is not the case. Additional detail on the appropriateness of the EPM approach at the ICP site is provided in a 2008 technical memorandum included as an addendum to the WRTR. (113)

Comment: EPA should not grant an NPDES permit. (113)

Response: EPA is developing the NPDES permit consistent with the Clean Water Act and the NPDES regulations. The permit limits will be based on the state water quality criteria. (113)

Comment: EPA should not grant an NPDES permit - Permit now, mitigate later approach is unacceptable and contrary to law. (113)

Response: The comment refers to the copper loading demonstration plan discussed on page 20 of the fact sheet. EPA is placing the requirement for a copper loading demonstration plan in the permit, so that there can be no discharge without a demonstration of a decrease or no change in the copper loading to the watershed. Regardless of the mitigation plan, copper limitations in the permit will have been calculated to meet the State's water quality standards at the end of the discharge pipe and will not cause or contribute to a violation of water quality criteria. (113)

Comment: Errors and omissions in the impact discussions - Clarify discharge rate for TWSF as average annual number. (115)

Response: The language in the DEIS matched the draft NPDES permit that was current at the time of the DEIS. This paragraph will be modified after EPA develops a new value for net precipitation based on Alternative IV, after receipt and acceptance of an updated NPDES permit application. (115)

Comment: Miscellaneous - Monitoring results turnaround to FS vs. EPA. (115)

Response: The Forest Service will require monitoring results within 10 days of the company's receipt of lab data to ensure timely response to any water quality issues. This is entirely independent from EPA's monthly reporting requirements. (115)

Comment Code	Letter No.	Comment Subject
WTR-307-1	34, 73	National Pollution Discharge Elimination Permit (NPDES) – Support Draft Permit

Comment: Please also advise the EPA that Formation Capital's NPDES (water discharge) permit application should also be approved. (34)

Comment: I support the company's proposal for a discharge permit as well. (73)

Response: The approval of the NPDES permit is dependent on the selection of an Alternative at the end of the EIS process. The Salmon-Challis National Forest and U.S. Environmental Protection Agency will take your comments into consideration during the NPDES review process. (34, 73)

Comment Code	Letter No.	Comment Subject
WTR-307-2	42	National Pollution Discharge Elimination Permit (NPDES) – Nitrogen

Comment: The proposed maximum daily limit for nitrate+nitrite . . . At outfall 001 is insufficient because it will not adequately protect cold water aquatic life in Big Deer Creek. Requests monitoring and amendment of permit. (42)

Response: This comment is still under consideration. The response will be provided in the permit-specific Response to Comments that will accompany the final permit at issuance. (42)

Comment Code	Letter No.	Comment Subject
WTR-307-3	72	National Pollution Discharge Elimination Permit (NPDES) – Flow

Comment: Realistically, flows from the TWSF should vary widely, with low flows of less than 10 gpm and high flows possibly exceeding 100 gpm. The permit should clarify that 38 gpm is an average annual flow, not a daily or other short term flow limitation. (72)

Response: EPA does not have adequate information to respond to the comment at this time. The value of 38 gpm was a modeled value representing average flows of net precipitation on an annual basis. The modeling was based on Alternative II, which was the alternative proposed in the NPDES permit application. Alternative IV was chosen as the preferred alternative in the DEIS, so FCC will be submitting a new NPDES permit application based on Alternative IV. From the new information, a new net precipitation value for the Alternative IV scenario will be developed and placed in the permit. A response to this comment and a complete explanation of the net precipitation calculation will be provided by EPA in the permit-specific Response to Comments, which will accompany the final NPDES permit upon issuance. (72)

Comment Code	Letter No.	Comment Subject
WTR-307-4	74, 108, 110	National Pollution Discharge Elimination Permit (NPDES) – Metals

Comment: It is clear that water quality standards applied in the NPDES permit for arsenic, methylmercury, and copper violates the CWA and Idaho water quality laws; agencies should revise the DEIS and NPDES permit and submit a new DEIS and new draft NPDES permit for public notice, review and comment. (108)

Comment: Permit conditions fail to ensure compliance with Idaho's water quality standard for methylmercury. We have several recommendations. (74, 110)

Comment: Request changes to NPDES permit including; fish tissue data, methylmercury criteria, mercury minimization plan, and bioaccumulation factor for mercury. (110)

Response: The Idaho Department of Environmental Quality's comments in the §401 certification, note that methylmercury is a State criteria but not recognized for NPDES purposes by EPA. The Idaho Cobalt Project will be required to comply with statewide methylmercury implementation strategy, collect fish information to compare with fish tissue standards and implement a mercury reduction plan. Copper effluent limits are consistent with Idaho WQS. In addition, comment

responses above outline additional steps to ensure WQS compliance with copper criteria. (74, 108, 110)

Comment: Permit fails to ensure that copper and arsenic levels in Big Deer Creek remain constant or decrease as required by Idaho's water quality rules. EPA needs to require demonstration of compliance with IDAPA 58.01.02.054.04. (74)

Comment: Draft NPDES permit fails to ensure that copper, sediment and pH discharges do not cause or contribute to violation of water quality standards - TMDL for Big Deer Creek has not been completed as required. (74, 110)

Response: The Western Mining Action Project's (WMA) assertion that any discharge of pollutants is prohibited in a water body that is impaired under the Idaho Water Quality Standards is not correct. In fact, IDAPA 58.01.02.054.04 allows, for high priority impaired waters bodies for which a TMDL has not yet been prepared, new or increased discharges of pollutants which have caused the water quality limited listing as long as "interim changes, such as pollutant trading or some other approach for the pollutants of concern are implemented and the total load remains constant or decreases within the watershed." The 401 certification requires that, prior to discharge, Formation must have in place a plan approved by DEQ that ensures that the copper load added by Formation's discharge is offset by copper reduction so that the total load remains constant or decreases in the watershed. Contrary to WMA's assertion, the 401 certification requirements relating to copper are consistent and ensure compliance with state Water Quality Standards applicable to impaired water bodies.

As a result of the 401 certification condition described above, Formation's discharge under the NPDES permit will not add any additional copper load to the Big Deer watershed. In addition, the copper concentration in Formation's discharge will meet state water quality criteria for copper and will be lower than the current levels of copper in Big Deer. Therefore, the discharge will not increase the concentration of copper in Big Deer. Since the discharge will not increase either the concentration or the load of copper in Big Deer, it will not cause or contribute to a violation of water quality standards for copper. WMA asserts that any discharge of copper to Big Deer will violate state and federal anti-degradation provisions. The federal Clean Water Act and Idaho law does not, however, prohibit discharges of pollutants to impaired water bodies; instead, only discharges that reduce water quality to a point that impairs existing beneficial uses are prohibited. Idaho Sporting congress v. Thoman, 137 F.3d 1146, 1153 (9th Cir. 1998); Lands Council v. Vaught 198 F.Supp2d 1211 (E.D. WA 2002). Formation's discharge will meet state water quality criteria at the end of the pipe and will not increase either the load or concentration of copper in Big Deer. There is nothing that suggests that the discharge will have any additional adverse impact on the beneficial uses of Big Deer. Therefore, the discharge of copper will not violate state or federal antidegradation provisions.

WMA next asserts that the Formation discharge will violate 40 CFR 122.4(i), which is the federal regulation that applies to discharges from new sources to impaired water bodies. But, 122.4(i) allows a new discharge of causative pollutants as long as the discharge will not cause or contribute to a violation of state Water Quality Standards. As discussed above, the ICP discharge will meet copper criteria at the end of pipe and will not increase the concentration of copper in Big Deer Creek. In addition, any small increase in the load of copper is allowed pursuant to Idaho WQS when there is an offset. Therefore, the ICP discharge will not cause or contribute to a violation of state WQS.

WMA's reliance upon Hells Canyon Preservation Council v. Haines, 2006 WL 2252554 (D. OR) is misplaced. The court in Hells Canyon did hold that an increase in sediment from mining activities to an already impaired water body violated the CWA, notwithstanding the Forest Service's claim that any increase in sediment would be offset by reductions from other measures. The court's holding, however, was the result of the court finding that the offsetting measures were planned to occur some years in the future, that there was nothing that ensured there would actually be funding for the measures, and at any rate, no showing that the measures would bring the mining activity into compliance with state water quality law.

Contrary to the situation in Hells Canyon, Formation cannot discharge copper under its NPDES permit until it first puts in place a plan to offset the addition of copper to Big Deer. In addition, the discharge will comply with state water quality standards. The concentration in the copper will meet state water quality criteria, and the small load of copper associated with the discharge will be offset, exactly as allowed under IDAPA 58.01.02.054.

*Finally, although Formation's discharge will not violate any state water quality standard or federal law that controls NPDES permits, WMAP still suggests that no new NPDES permits can be allowed in an impaired water body until a TMDL is developed. This suggestion is contrary to the U.S. Supreme Court's decision in *Arkansas v. Oklahoma*, 503 US 91, 112 S.Ct. 1046, 117 L.Ed.2d 239 (1992) where the court concluded there was nothing in the CWA that prohibited any new discharge under a NPDES permit to impaired water bodies. It is also contrary to the plain language of 40 CFR 122.4(i) that allows new source discharges to impaired water bodies when there is no TMDL. As the EAB held in *Carlota Copper*, 11 Env'tl. Admin. Decisions 692 (2004): "There is nothing in 40 CFR 122.4(i) providing that an impaired water segment needs to be restored prior to allowing new source discharges into the water body." The 9th Circuit has also recently reached this same conclusion in a review of a Forest Service logging project: "No substantive law requires such a determination and thus the district court's ruling that the Forest Service was required to await the completion of TMDLs (Total Maximum Daily Load) before implementing the Lolo Post Burn Project was without legal foundation and is therefore reversed." *Sierra Club v. USFS*, 2003 WL 22854670 (9th Cir. 2003). See also *Idaho Sportsmen's Coalition v. Browner*, No. C93-943WD, Order on Motions for Summary Judgment and Injunction in which the court denied the Plaintiffs request to prohibit all NPDES permits until TMDLs were completed for water quality limited segments in Idaho: "Plaintiffs' request for injunctive relief prohibiting EPA from approving any new point source discharges into any WQLS that lacks a TMDL is premature. The NPDES process itself involves water quality controls and it has not been shown that the issuance of any particular permit would result in a violation of water quality standards." Order at page 13.*

WMAP asserts that Formation must comply with the WQS IDAPA 58.01.02.054 with respect to pH and sediment, in addition to copper, because these are pollutants for which Big Deer is listed on the 303d list. While these pollutants are on the current 303d list, DEQ has determined they are not pollutants that violate WQS or contribute to the impairment of uses in Big Deer Creek. Idaho's 1996 303(d) list identified pH, sediment and metals as impairments to Big Deer Creek. Since that listing, the Department, EPA and the responsible parties involved in the remediation of the site have intensely monitored Big Deer Creek and have refined the pollutants impairing the water. This investigation has identified only copper as the pollutant. Both pH and sediment have been remedied and details of the corrective actions taken are summarized in the Blackbird Mine Site Record of Decision (EPA 2003). Through the construction of dams on Bucktail Creek, low pH water as well as sediment generated from run off events is captured and managed prior to reaching Big Deer Creek. Also, monitoring data demonstrate Big Deer Creek does not currently experience any violations of Idaho's pH or turbidity numeric standards. In addition, the narrative criteria for sediment impairment is also not violated. As a result, DEQ is in the process of removing these pollutants from the 303d list. (74, 110)

Comment: Permit uses wrong water quality standard for Arsenic. (74, 110)

Response: The arsenic standard reported in Table 4 of the draft NPDES permit (50 µg/L) correctly reflects the arsenic human health criteria for recreational uses set forth in the Idaho WQS at IDAPA 58.01.02.210.01. Contrary to WMAP's assertion, Idaho's 50 ug/L criteria is effective for CWA purposes. The Idaho arsenic criteria were properly adopted under the Idaho Administrative Procedures Act and were submitted to EPA for approval as required by the CWA eight years ago, in April of 1999. This was before the May 30, 2000 "Alaska ruling." CWA regulations make it clear that water quality standards adopted and submitted to EPA before May 30, 2000 are applicable WQS for

CWA purposes, unless or until EPA promulgates a more stringent standard. 40 CFR 131.21(c). Consequently, the arsenic criteria is effective for CWA purposes, including the ICP permit. (74, 110)

Comment: Permit fails to ensure that discharges into Big Deer Creek do not cause or contribute to violations of water quality standards for arsenic. (110)

Response: This comment is based on the assumption that the NPDES permit uses the wrong standard for arsenic. The permit accurately reflects the Idaho water quality criteria for arsenic. The permit limits will ensure compliance with the correct criteria set forth in Idaho's WQS. (110)

Comment Code	Letter No.	Comment Subject
WTR-307-5	108, 110, 112	National Pollution Discharge Elimination Permit (NPDES) – Mixing Zone

Comment: The Tribe strongly supports the use of end-of-pipe discharge standards in the NPDES permit, as opposed to utilizing the regulatory flexibility of a mixing zone. (108)

Comment: Pleased to see that the NPDES permit will not utilize mixing zones. (110)

Response: A mixing zone was not included in Formation Capital Corporation's (FCC) original permit application. Since the issuance of the DEIS, FCC has applied for a mixing zone for sulfate. EPA and IDEQ will consider the mixing zone application and an analysis of the effects of the mixing zone are included in the FEIS. Following a careful evaluation of this proposal the EPA will respond to this comment in the permit-specific Response to Comments that will accompany the final NPDES permit upon issuance. (108, 110)

Comment: Additional new DEIS and NPDES permit water quality/fish requirements. (110)

Response: This comment is still under consideration relative to the NPDES permit. The response will be provided in the permit-specific Response to Comments that will accompany the final permit at issuance. (110)

Comment: Page 4-38, third paragraph and page 4-40, third paragraph: The text in these paragraphs refers to a mixing zone for sulfate. It should be clear that no mixing zone has been authorized by the state. (112)

Response: A mixing zone was not requested by Formation Capital Corporation prior to the draft permit. However, the company has since requested a mixing zone for sulfate from Idaho DEQ. The proposed mixing zone is currently under consideration and EPA will respond to this comment in the permit-specific Response to Comments that will accompany the final NPDES permit upon issuance. (112)

Comment Code	Letter No.	Comment Subject
WTR-307-6	74, 110, 121	National Pollution Discharge Elimination Permit (NPDES) – SO4

Comment: Draft NPDES permit fails to ensure that copper, sediment and pH discharges do not cause or contribute to violation of water quality standards - TMDL for Big Deer Creek has not been completed as required. (110)

Response: The Western Mining Action Project's (WMA) assertion that any discharge of pollutants is prohibited in a water body that is impaired under the Idaho Water Quality Standards is not correct. In fact, IDAPA 58.01.02.054.04 allows, for high priority impaired waters bodies for which a TMDL has not yet been prepared, new or increased discharges of pollutants which have caused the water quality limited listing as long as "interim changes, such as pollutant trading or some other approach for the pollutants of concern are implemented and the total load remains constant or decreases within the watershed." The 401 certification requires that, prior to discharge, Formation must have in place a plan approved by DEQ that ensures that the copper load added by Formation's discharge is offset by copper reduction so that the total load remains constant or decreases in the watershed. Contrary to WMA's assertion, the 401 certification requirements relating to copper are consistent and ensure compliance with state Water Quality Standards applicable to impaired water bodies.

As a result of the 401 certification condition described above, Formation's discharge under the NPDES permit will not add any additional copper load to the Big Deer watershed. In addition, the copper concentration in Formation's discharge will meet state water quality criteria for copper and will be lower than the current levels of copper in Big Deer. Therefore, the discharge will not increase the concentration of copper in Big Deer. Since the discharge will not increase either the concentration or the load of copper in Big Deer, it will not cause or contribute to a violation of water quality standards for copper. WMA asserts that any discharge of copper to Big Deer will violate state and federal anti-degradation provisions. The federal Clean Water Act and Idaho law does not, however, prohibit discharges of pollutants to impaired water bodies; instead, only discharges that reduce water quality to a point that impairs existing beneficial uses are prohibited. Idaho Sporting congress v. Thoman, 137 F.3d 1146, 1153 (9th Cir. 1998); Lands Council v. Vaught 198 F.Supp2d 1211 (E.D. WA 2002). Formation's discharge will meet state water quality criteria at the end of the pipe and will not increase either the load or concentration of copper in Big Deer. There is nothing that suggests that the discharge will have any additional adverse impact on the beneficial uses of Big Deer. Therefore, the discharge of copper will not violate state or federal antidegradation provisions. Note: At the time the fact sheet was written, no mixing zones were proposed. Please see Response to Comment WTR-307-5 for a discussion of the sulfate mixing zone that is currently under consideration.

WMA next asserts that the Formation discharge will violate 40 CFR 122.4(i), which is the federal regulation that applies to discharges from new sources to impaired water bodies. But, 122.4(i) allows a new discharge of causative pollutants as long as the discharge will not cause or contribute to a violation of state Water Quality Standards. As discussed above, the ICP discharge will meet copper criteria at the end of pipe and will not increase the concentration of copper in Big Deer Creek. In addition, any small increase in the load of copper is allowed pursuant to Idaho WQS when there is an offset. Therefore, the ICP discharge will not cause or contribute to a violation of state WQS.

WMA's reliance upon Hells Canyon Preservation Council v. Haines, 2006 WL 2252554 (D. OR) is misplaced. The court in Hells Canyon did hold that an increase in sediment from mining activities to an already impaired water body violated the CWA, notwithstanding the Forest Service's claim that any increase in sediment would be offset by reductions from other measures. The court's holding, however, was the result of the court finding that the offsetting measures were planned to occur some years in the future, that there was nothing that ensured there would actually be funding for the measures, and at any rate, no showing that the measures would bring the mining activity into compliance with state water quality law.

Contrary to the situation in Hells Canyon, Formation cannot discharge copper under its NPDES permit until it first puts in place a plan to offset the addition of copper to Big Deer. In addition, the discharge will comply with state water quality standards. The concentration in the copper will meet state water quality criteria, and the small load of copper associated with the discharge will be offset, exactly as allowed under IDAPA 58.01.02.054.

Finally, although Formation's discharge will not violate any state water quality standard or federal law that controls NPDES permits, WMAP still suggests that no new NPDES permits can be allowed in an impaired water body until a TMDL is developed. This suggestion is contrary to the U.S. Supreme Court's decision in *Arkansas v. Oklahoma*, 503 US 91, 112 S.Ct. 1046, 117 L.Ed.2d 239 (1992) where the court concluded there was nothing in the CWA that prohibited any new discharge under a NPDES permit to impaired water bodies. It is also contrary to the plain language of 40 CFR 122.4(i) that allows new source discharges to impaired water bodies when there is no TMDL. As the EAB held in *Carlota Copper*, 11 Env'tl. Admin. Decisions 692 (2004): "There is nothing in 40 CFR 122.4(i) providing that an impaired water segment needs to be restored prior to allowing new source discharges into the water body." The 9th Circuit has also recently reached this same conclusion in a review of a Forest Service logging project: "No substantive law requires such a determination and thus the district court's ruling that the Forest Service was required to await the completion of TMDLs (Total Maximum Daily Load) before implementing the Lolo Post Burn Project was without legal foundation and is therefore reversed." *Sierra Club v. USFS*, 2003 WL 22854670 (9th Cir. 2003). See also *Idaho Sportsmen's Coalition v. Browner*, No. C93-943WD, Order on Motions for Summary Judgment and Injunction in which the court denied the Plaintiffs request to prohibit all NPDES permits until TMDLs were completed for water quality limited segments in Idaho: "Plaintiffs' request for injunctive relief prohibiting EPA from approving any new point source discharges into any WQLS that lacks a TMDL is premature. The NPDES process itself involves water quality controls and it has not been shown that the issuance of any particular permit would result in a violation of water quality standards." Order at page 13.

WMAP asserts that Formation must comply with the WQS IDAPA 58.01.02.054 with respect to pH and sediment, in addition to copper, because these are pollutants for which Big Deer is listed on the 303d list. While these pollutants are on the current 303d list, DEQ has determined they are not pollutants that violate WQS or contribute to the impairment of uses in Big Deer Creek. Idaho's 1996 303(d) list identified pH, sediment and metals as impairments to Big Deer Creek. Since that listing, the Department, EPA and the responsible parties involved in the remediation of the site have intensely monitored Big Deer Creek and have refined the pollutants impairing the water. This investigation has identified only copper as the pollutant. Both pH and sediment have been remedied and details of the corrective actions taken are summarized in the Blackbird Mine Site Record of Decision (EPA 2003). Through the construction of dams on Bucktail Creek, low pH water as well as sediment generated from run off events is captured and managed prior to reaching Big Deer Creek. Also, monitoring data demonstrate Big Deer Creek does not currently experience any violations of Idaho's pH or turbidity numeric standards. In addition, the narrative criteria for sediment impairment is also not violated. As a result, DEQ is in the process of removing these pollutants from the 303d list. (110)

Comment: Fact sheet does not include information on the current pollutant levels in Big Deer Creek. Of particular concern, there is no information about current levels of arsenic, and mercury in the receiving water. (74)

Comment: Permit process has failed to provide necessary information to reviewers. (110)

Response: The regulations at 40 CFR §124.8 **Fact Sheet** and §124.56 **Fact sheets** specify the information that fact sheets shall contain. Section 124.8 applies to several types of federal draft permits and contains general information requirements. Section 124.56 is specific to NPDES draft permits and requires that fact sheets contain any calculations or other necessary explanation of the derivation of specific effluent limitations and conditions as required by 40 CFR §122.4 and reasons

why they are applicable or if not, how the alternate effluent limitations were developed. The section also requires that for certain conditions in the draft permit, such as limitations to control toxic discharges, the fact sheet must contain an explanation of the reasons that such conditions are applicable.

Fact Sheet Appendix D (Calculation of WQBELs) contains explanations of the derivation of the effluent limitations. Appendix B (Basis for Effluent Limitations) contains the reasons that the permit conditions (the limits) are applicable. As explained in the fact sheet, the criteria are to be met at the end of the discharge pipe (i.e. there are no mixing zones). When there are no mixing zones, ambient pollutant levels are not factored into the development of permit limits. The permit limits are derived by using the criteria as the Wasteload Allocations (WLAs) to statistically determine maximum and average daily discharge levels that are protective of the criteria in the receiving water. Since the ambient receiving water quality was not required in the derivation of the limitations, it was not required information in the fact sheet and did not violate the public review requirements.

However, Page 10, Table 2 of the fact sheet contains water quality information for cobalt, copper and sulfate on Big Deer Creek. Receiving water information for arsenic was obtained for this response from IDEQ. Data collected by IDEQ or splits obtained from BMSG and analyzed by IDEQ on 32 dissolved arsenic samples from several sites on Big Deer Creek between 2000 through 2006 showed a maximum dissolved arsenic concentration of 5 ug/L and a mean concentration of 0.64 ug/L. Per IDEQ, there has been no true low-level mercury sampling on Big Deer Creek. EPA is requiring collection of this data in the permit. This data will become public information.

The final sulfate effluent limits might change if a mixing zone is granted. (74, 110)

Comment: The draft permit fails to incorporate groundwater monitoring. (110)

Response: The proposed permit covers the point source discharge from Outfall 001 to Big Deer Creek. EPA does not regulate groundwater in NPDES permits unless there is a discharge of pollutants from a point source via groundwater that has a relatively close hydrologic connection to surface water. This has not yet been demonstrated to be the case for the Idaho Cobalt Project. The USFS will require groundwater monitoring under its approval of the Plan of Operations for the ICP. (110)

Comment: Sulfate is a secondary drinking water constituent, the standard for which is based on color, taste and odor, not toxicity. Essentially is a standard for aesthetics. EPA itself identifies the 250 mg/l standards as recommended for drinking water aesthetics and identifies them as “non-enforceable guidelines.” The sulfate limit should be removed from the NPDES permit unless EPA and Idaho can clearly demonstrate a health reason for the limitation. (121)

Response: Effluent limits described in the DEIS match the draft NPDES permit that was current at the time of the DEIS. Limits have been modified in the FEIS to match the projected NPDES requirements of the preferred alternative. (121)

Comment Code	Letter No.	Comment Subject
WTR-307-7	74, 110, 113, 156	National Pollution Discharge Elimination Permit (NPDES) – Comments on Permit

Comment: Permit fails to integrate flow from groundwater interception wells. (74)

Response: The approval of the NPDES permit is dependent on the selection of an Alternative at the end of the EIS process. Water quality data for Big Deer Creek and groundwater inputs to surface water were considered in the analysis as displayed in the Water Resources Technical Report. The Salmon-Challis National Forest and U.S. Environmental Protection Agency will take your comments into consideration during the NPDES review process. (74)

Comment: NPDES permit as proposed violates the CWA, Idaho Water quality law, zero-discharge requirements, and effluent limitation. (110)

Response: The Department disagrees with the comment. A description of how the NPDES permit and §401 certification are consistent with WQS are outlined in responses above. (110)

Comment: Draft NPDES permit fails to ensure that copper, sediment and pH discharges do not cause or contribute to violation of water quality standards - TMDL for Big Deer Creek has not been completed as required. (110)

Response: The Western Mining Action Project's (WMA) assertion that any discharge of pollutants is prohibited in a water body that is impaired under the Idaho Water Quality Standards is not correct. In fact, IDAPA 58.01.02.054.04 allows, for high priority impaired waters bodies for which a TMDL has not yet been prepared, new or increased discharges of pollutants which have caused the water quality limited listing as long as "interim changes, such as pollutant trading or some other approach for the pollutants of concern are implemented and the total load remains constant or decreases within the watershed." The 401 certification requires that, prior to discharge, Formation must have in place a plan approved by DEQ that ensures that the copper load added by Formation's discharge is offset by copper reduction so that the total load remains constant or decreases in the watershed. Contrary to WMA's assertion, the 401 certification requirements relating to copper are consistent and ensure compliance with state Water Quality Standards applicable to impaired water bodies.

As a result of the 401 certification condition described above, Formation's discharge under the NPDES permit will not add any additional copper load to the Big Deer watershed. In addition, the copper concentration in Formation's discharge will meet state water quality criteria for copper and will be lower than the current levels of copper in Big Deer. Therefore, the discharge will not increase the concentration of copper in Big Deer. Since the discharge will not increase either the concentration or the load of copper in Big Deer, it will not cause or contribute to a violation of water quality standards for copper. WMA asserts that any discharge of copper to Big Deer will violate state and federal anti-degradation provisions. The federal Clean Water Act and Idaho law does not, however, prohibit discharges of pollutants to impaired water bodies; instead, only discharges that reduce water quality to a point that impairs existing beneficial uses are prohibited. Idaho Sporting congress v. Thoman, 137 F.3d 1146, 1153 (9th Cir. 1998); Lands Council v. Vaught 198 F.Supp2d 1211 (E.D. WA 2002). Formation's discharge will meet state water quality criteria at the end of the pipe and will not increase either the load or concentration of copper in Big Deer. There is nothing that suggests that the discharge will have any additional adverse impact on the beneficial uses of Big Deer. Therefore, the discharge of copper will not violate state or federal antidegradation provisions.

WMA next asserts that the Formation discharge will violate 40 CFR 122.4(i), which is the federal regulation that applies to discharges from new sources to impaired water bodies. But, 122.4(i) allows a new discharge of causative pollutants as long as the discharge will not cause or contribute to a

violation of state Water Quality Standards. As discussed above, the ICP discharge will meet copper criteria at the end of pipe and will not increase the concentration of copper in Big Deer Creek. In addition, any small increase in the load of copper is allowed pursuant to Idaho WQS when there is an offset. Therefore, the ICP discharge will not cause or contribute to a violation of state WQS.

WMA's reliance upon *Hells Canyon Preservation Council v. Haines*, 2006 WL 2252554 (D. OR) is misplaced. The court in *Hells Canyon* did hold that an increase in sediment from mining activities to an already impaired water body violated the CWA, notwithstanding the Forest Service's claim that any increase in sediment would be offset by reductions from other measures. The court's holding, however, was the result of the court finding that the offsetting measures were planned to occur some years in the future, that there was nothing that ensured there would actually be funding for the measures, and at any rate, no showing that the measures would bring the mining activity into compliance with state water quality law.

Contrary to the situation in *Hells Canyon*, Formation cannot discharge copper under its NPDES permit until it first puts in place a plan to offset the addition of copper to Big Deer. In addition, the discharge will comply with state water quality standards. The concentration in the copper will meet state water quality criteria, and the small load of copper associated with the discharge will be offset, exactly as allowed under IDAPA 58.01.02.054.

Finally, although Formation's discharge will not violate any state water quality standard or federal law that controls NPDES permits, WMA still suggests that no new NPDES permits can be allowed in an impaired water body until a TMDL is developed. This suggestion is contrary to the U.S. Supreme Court's decision in *Arkansas v. Oklahoma*, 503 US 91, 112 S.Ct. 1046, 117 L.Ed.2d 239 (1992) where the court concluded there was nothing in the CWA that prohibited any new discharge under a NPDES permit to impaired water bodies. It is also contrary to the plain language of 40 CFR 122.4(i) that allows new source discharges to impaired water bodies when there is no TMDL. As the EAB held in *Carlota Copper*, 11 Env'tl. Admin. Decisions 692 (2004): "There is nothing in 40 CFR 122.4(i) providing that an impaired water segment needs to be restored prior to allowing new source discharges into the water body." The 9th Circuit has also recently reached this same conclusion in a review of a Forest Service logging project: "No substantive law requires such a determination and thus the district court's ruling that the Forest Service was required to await the completion of TMDLs (Total Maximum Daily Load) before implementing the Lolo Post Burn Project was without legal foundation and is therefore reversed." *Sierra Club v. USFS*, 2003 WL 22854670 (9th Cir. 2003). See also *Idaho Sportsmen's Coalition v. Browner*, No. C93-943WD, Order on Motions for Summary Judgment and Injunction in which the court denied the Plaintiffs request to prohibit all NPDES permits until TMDLs were completed for water quality limited segments in Idaho: "Plaintiffs' request for injunctive relief prohibiting EPA from approving any new point source discharges into any WQLS that lacks a TMDL is premature. The NPDES process itself involves water quality controls and it has not been shown that the issuance of any particular permit would result in a violation of water quality standards." Order at page 13.

WMA asserts that Formation must comply with the WQS IDAPA 58.01.02.054 with respect to pH and sediment, in addition to copper, because these are pollutants for which Big Deer is listed on the 303d list. While these pollutants are on the current 303d list, DEQ has determined they are not pollutants that violate WQS or contribute to the impairment of uses in Big Deer Creek. Idaho's 1996 303(d) list identified pH, sediment and metals as impairments to Big Deer Creek. Since that listing, the Department, EPA and the responsible parties involved in the remediation of the site have intensely monitored Big Deer Creek and have refined the pollutants impairing the water. This investigation has identified only copper as the pollutant. Both pH and sediment have been remedied and details of the corrective actions taken are summarized in the Blackbird Mine Site Record of Decision (EPA 2003). Through the construction of dams on Bucktail Creek, low pH water as well as sediment generated from run off events is captured and managed prior to reaching Big Deer Creek. Also, monitoring data demonstrate Big Deer Creek does not currently experience any violations of Idaho's pH or turbidity numeric standards. In addition, the narrative criteria for sediment impairment

is also not violated. As a result, DEQ is in the process of removing these pollutants from the 303d list. (110)

Comment: IDEQ cannot issue any Certification under Section 401 of the CWA. (110)

Response: The Department assumes the commenters refer to issuing a §401 certification for discharge into an impaired waterbody. The Department has conditioned the §401 water quality certification to ensure the project complies with state water quality standards, does not add pollution to the waterbody and ensures continued improved water quality in Big Deer Creek from the restoration activities outlined above. (110)

Comment: IDEQ should not certify compliance (NPDES permit). (113)

Response: The IDEQ believes when the conditions of the §401 water certification are met, compliance with Water Quality Standards will be attained. (113)

Comment: Comparison of model results leads to the misleading conclusion that Alternative IV produces superior water quality results as compared to Alternative II. The DSM runs for Alternative II were conducted without considering the effects of mitigation, while the model runs for Alternative IV did consider the effects of mitigation. Please modify the fact sheet to include appropriate narrative so that the reader can understand the model results presented. (156)

Response: The Fact Sheet is a document detailing the development of the draft permit and thus will not be modified. Explanations or revisions to the draft permit will be contained in the Response-to-Comments document that will accompany the final permit.

Alternative II was evaluated assuming that groundwater capture and closure water treatment would be employed as needed, however a DSM simulation of this condition was not run (see discussion bottom of page 4-30 and 4-31 DEIS). Moreover, the Fact Sheet (page 11) explicitly acknowledges the potential benefits of Alternative II mitigations. However, Alternative IV mitigations are predicted to perform better than Alternative II due to the benefits of waste rock slash amendment and improved groundwater capture. (156)

Comment: By choosing these definitions for best case and worst case, the EIS has selected high values for the worst case and low values for the best case, at least in terms of metals loading. EPA should reword this section to accurately portray the meaning of the 90th percentile and 10th percentile cases. (156)

Response: As noted above, the Fact Sheet will not be revised. For purposes of the Response to Comments, the worst case is defined to be the 90th percentile case, which means there is a 90% probability that values will be lower than the predicted value, and the best case is defined to be the 10th percentile, which means there is a 10% probability that values will be lower than the predicted value. (156)

Comment Code	Letter No.	Comment Subject
WTR-307-8	157	National Pollution Discharge Elimination Permit (NPDES) – Water Balance

Comment: The Draft EIS says that only 51 gpm will be drained from the mine (43 from the Ram workings, 8 from the Sunshine workings). DEIS at 2-22. Where will the additional 24 gpm come from (75-51)? (157)

Response: The NPDES permit assumption of 75 gpm is based on the application submitted by FCC. In addition to mine water, the ICP is allowed to discharge precipitation captured by the TWSF and other facilities that is in excess of evaporation. (157)

Comment: From DEIS figure 2-8, there is water going directly from the "Tails De-watering" and some from the "Process Water" pond into the water treatment plant and then eventual discharge, with no recycling back to the mill (although from Figure 2-8. some of the water from the process pond will go back to the mill). (157)

Response: Figure 2-8 is a diagram showing water flow. The NSPS at 40 CFR 440.104 (b)(2)(i) allow process water to be discharged equal to the net precipitation, as detailed in the response to the comment immediately below. The figure shows the pathways that might be used to do this. (157)

Comment: Regarding the other water in the discharge, the 38 gpm from the TWSF is, according to Formation and the draft NPDES permit, the "net precipitation." However, the TWSF in Alternative IV is only 36 acres (and the process ponds are only 6.6 acres). How was the 38 gpm calculated? (157)

Response: The value of 38 gpm was a modeled value representing average flows of net precipitation on an annual basis that was based on the acreages in Alternative II. The TWSF in Alternative II covered 55 acres. Since Alternative IV was chosen as the preferred alternative in the DEIS, FCC will be submitting a new NPDES permit application based on Alternative IV. From the new information, a new net precipitation value for the Alternative IV scenario will be developed and placed in the permit. A complete explanation of the net precipitation calculation will be provided by EPA in the permit-specific Response to Comments, which will accompany the final NPDES permit upon issuance. (157)

Comment Code	Letter No.	Comment Subject
WTR-307-9	113	National Pollution Discharge Elimination Permit (NPDES) – 401 Certification

Comment: IDEQ's draft ICP certification is arbitrary and unlawful. (113)

Response: As the commenter should be aware, releases that have caused and continue to cause impairment to South Fork Big Deer and Big Deer Creeks are being addressed under separate CERCLA authority. The USFS will require financial assurance to cover costs of long term water treatment should ICP's mining activities have the potential to further impact the impaired stream reaches. As described in the Water Technical Report, additional metal load to the already impaired streams is not allowed under Idaho water quality regulations. The IDQ supports the development and implementation of a plan to ensure zero net loading of copper is maintained. Failure on the part of the Idaho Cobalt Project to do so will result in administrative actions under the Department's enforcement provisions. (113)

Comment Code	Letter No.	Comment Subject
WTR-308	113, 115	Wetlands and Other Waters of the U.S.

Comment: DEIS fails to provide critical information on Section 404 permit. (113)

Response: The DEIS does not specifically address a 404 permit for the ICP because no application had been filed by the project proponent. Need for a 404 permit is identified as a result of projected crossing of apparent jurisdictional wetlands by access roads and a pipeline. If a 404 permit is required, it will be the Corps of Engineer's responsibility to determine the NEPA requirements for their permit actions. (113)

Comment: Practicable alternatives that do no involve wetland filling have not been evaluated. (113)

Response: A broad range of alternatives to the proposed action including options that reduce potential impacts to both jurisdictional and non-jurisdictional wetlands and waters of the US have been considered. Alternative V would locate the water treatment facilities in Blackbird Creek drainage and access to Big Deer Creek and associated stream and wetlands crossings would be eliminated. Alternative V has been identified as the environmentally preferred alternative. The agencies have no authority to require the ICP to obtain agreement to utilize existing Blackbird site infrastructure. If BMSG has a real concern about environmental impacts to aquatic systems and would like to offer access, this should be discussed directly with FCC. One of the objectives of Alternative IV has been to minimize impacts to isolated wetlands in the vicinity of the TWSF. (113)

Comment: BMSG request to review and comment on ICP 404 application and COE proposed response. (113)

Response: The BMSG's request to comment on a 404 permit application and the Corp's response should be directed to the Corps of Engineers. (113)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, Figure 2-1 wetland mitigation cells. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives - location, water source and design of constructed wetlands for Alternatives IV and V. (115)

Response: The Forest Service has included wetlands mitigation as proposed in FCC's plan in Alternatives IV and V to provide for the potential impacts to wetlands on the Big Flat as well as indirect impacts to Ram Spring wetlands and wetlands along the pipeline route. FCC would be required to submit a final design of the wetlands mitigation as part of the revised operating plan submitted to the Forest Service prior to initiation of construction activities. (115)

Comment: Unsupported assertions - measures to protect wetlands are probably doomed. (115)

Response: The existence of the referenced wetland vegetation is evidence that soils and hydrology of the site are capable of supporting a wetland given adequate water supply. Given that the wetland persists now, seven years after the 2000 fire, strongly suggests that the water supply is currently

adequate. The EIS team believes that the water supply is unlikely to be reduced by maturation of the forest canopy to the point that the wetland will disappear prior to TWSF construction. (115)

Comment: Errors and omissions in the impact discussions - Alt. II would result in more wetlands than Alt. III. (115)

Response: The agency alternatives include the objective of trying to minimize impacts to all wetlands including isolated non-jurisdictional wetlands that provide important habitat for a number of forest species. The isolated wetlands were identified following the 2000 fire and had characteristic wetlands vegetation assemblages at that time. They have also persisted for seven years following the fire including several drought years indicating that these are not likely to be temporary artifacts of the post fire conditions. Proposed artificial wetlands may not provide equivalent services as the original and have not been demonstrated to be permanent since they would receive water from the TWSF that would be greatly diminished post closure. The current constructed wetlands design would need to be revised taking into account final TWSF size and cap design. Further the quality of the water supplied by the TWSF seepage collection system may have chemical characteristics that limit wetlands functions. (115)

Comment Code	Letter No.	Comment Subject
WTR-309	110	Federal Reserved Water Rights

Comment: Failure to protect federal reserved water rights. (110)

Response: The Public Water Reserve No. 107 (PWR 107) does not apply to the project area. PWR 107 was for stockwater on Federal Public Land administered by the Bureau of Land Management. Public lands managed by the Salmon National Forest were placed in Forest Reserves much earlier than 1926 and are not covered by this Executive Order.

Downstream of the Idaho Cobalt Project area there is a Wild and Scenic River federal reserved water right for the Main Salmon River. As part of this federal reserved right there is a Stipulation for Future Use Subordination to allow for a certain level of new water uses upstream of the Main Salmon Wild and Scenic River. The proposed water use for the Idaho Cobalt Project would become part of the Future Use Subordination and would be tracked by the Idaho Department of Water Resources (IDWR). The Stipulation directs IDWR to deduct from the subordination amounts provided for in the Partial Decree the diversion rate for any new uses that fall under the subordination provisions, such as the Idaho Cobalt Project (Fifth Judicial District of the State of Idaho, Stipulation and Joint Motion for Order Approving Stipulation and Entry of Partial Decrees-Consolidated Subcase No. 75-13316-Wild and Scenic Rivers Act Claims, August 20, 2004). (110)

Comment Code	Letter No.	Comment Subject
WTR-310	113, 155	Bedrock Fracture Characterization

Comment: Groundwater monitoring is not feasible. (113)

Response: The comment states "At the ICP and Blackbird Mine, where groundwater flows through fractures that are not identified and understood, any given well is likely to completely miss zones of high groundwater flow, located only feet away." However, a complete understanding and identification of individual fractures is virtually impossible to achieve no matter the level of study

applied to a bedrock groundwater system, nor is it necessary for an understanding and control of contaminant transport issues as long as:

- 1. The density and interconnectivity of fractures is sufficiently great that the system behaves as Adequate safeguards are available and implemented to address any uncertainties in potential an equivalent porous media, and/or;*
- 2. contaminant transport pathways.*

As described in the 2006 Water Resources Technical Report, detailed logging of drill core from the Ram and Sunshine areas show the bedrock in these areas to be highly fractured, with most fracture surfaces containing limonitic or other secondary mineral staining, indicating groundwater flow has occurred through the fractures. Based on the high fracture density, as well as the very steep hydraulic gradients from both the Ram and Sunshine Mine areas towards Bucktail Creek, the most likely scenario for groundwater flow and contaminant transport at the site is for groundwater to flow from the mines towards Bucktail Creek (as presented in the ICP conceptual model and impacts analyses). Additional detail on the appropriateness of the EPM approach at the ICP site is provided in a technical memorandum included as an addendum to the WRTR, and in Chapter 4 of the FEIS.

Equally as important, agency EIS Alternatives III, IV and V include additional monitoring provisions for improving the current level of understanding on groundwater flow through the bedrock system, including:

- Documenting the spatial and temporal distribution of groundwater inflow to the underground mine workings as they're developed. Recording the location and sustained rates of groundwater inflow to the workings would lead to a detailed understanding of potential preferential groundwater flow conduits coinciding with bedrock structures. Such structures may include the No-Name Fault which trends north-south through the Ram Mine area and could theoretically act as a conduit for groundwater flow from the Ram Mine to the north, or the Green Dyke Fault trending north-south through the Sunshine Mine area. Besides identifying potential groundwater conduits which may deviate from the general groundwater flow directions (towards Bucktail Creek), information from the mine inflow characterization program would be used to control such flows after mine closure if encountered, such as grouting of structures, placement of capture wells within conduits, or maintaining the mines in a dewatered or partially dewatered condition.*
- Placement of wells peripheral to the mines for monitoring of the groundwater level response to mine dewatering. In addition to the upgradient and downgradient wells, monitoring wells would be placed north and south of the Ram Mine and east and west of the Sunshine mine, to document the rate of groundwater level drawdown in response to mine dewatering. If the equivalent porous media model is valid, groundwater drawdown peripheral to the mines should be relatively uniform, accounting for distortion resulting from the steep hydraulic gradients. If preferential flow paths do exist along bedrock structures, drawdown should be more pronounced along the structures.*

Development of the approximately 38,000 feet of mine workings extending to 1,000 feet below ground surface at the Ram Mine, and 13,000 feet of workings extending to 750 feet below ground surface at the Sunshine Mine, provides a unique opportunity to gain detailed information on groundwater flow through the bedrock system during the 15-year mine operational phase. This information would be used to verify the validity of the equivalent porous media model, and to identify potential preferential groundwater flow paths deviating from the generalized groundwater flow patterns. If preferential flowpaths deviating from the general groundwater flow directions are identified through the operational phase monitoring, sufficient time would be available to take appropriate measures to control contaminant migration, such as grouting of structures, placement of capture wells within conduits, or maintaining the mines in a dewatered or partially dewatered condition, prior to mine reflooding. For these reasons, we believe the concerns raised in this comment have previously been identified and are adequately addressed in the EIS.

Finally, the comment notes that it is likely that contaminants in groundwater from the ICP mines will not be detected by the monitoring systems because it will flow through fractures in between the monitoring wells. This would not be the case provided an adequate number of properly located and completed monitoring wells are installed and the fracture system density and interconnectivity are great enough for the system to behave as an equivalent porous media (as expected).

Also, post-operational monitoring of contaminant loads exiting the mines via groundwater would not rely solely on downgradient groundwater monitoring. Determination of post-mine reflooding contaminant loads from the mines requires two pieces of information; the groundwater flow rate, or flux, and contaminant concentrations in the groundwater exiting the mine. The groundwater flux could be estimated as the steady state groundwater inflow rate to each mine when dewatered. For instance, if the inflow rate to the Ram Mine is 50 gpm as determined by mine pumping rates, the post-closure groundwater flux could be approximated as 50 gpm. This would overestimate the post-closure groundwater flux since inflow to the dewatered mine would be somewhat greater than the ambient groundwater flux through the mine area due to the steepened hydraulic gradients toward the workings, thus lending a level of conservatism to the flux estimate and loading calculations. Likewise, groundwater metals concentrations could be determined from monitoring wells completed within the backfilled mine workings to better record mine water, and thus downgradient groundwater concentrations. This approach, in conjunction with downgradient groundwater monitoring, can lead to reliable estimates of metals loading from the backfilled, reflooded mine workings. (113)

Comment: The release of ICP Waters to the Blackbird Mine collection and treatment systems is not acceptable. (155)

Response: The comment is correct in assuming that the estimated 5% or less of post-operational Ram Mine outflow potentially discharging to the BMSG Phase II capture system is based on a flow net analysis of the groundwater flow field between the Ram Mine and Bucktail Creek, and the percentage of the flow field area upgradient of the Phase II capture system. However, the DEIS analysis probably overestimates the potential for groundwater contaminants from the Ram Mine to mix with the BMSG Phase II capture system because the analysis assumes a uniform flow field exiting the mine. In reality, the majority of outflow from the Ram Mine will exit from the north half of the workings, due to the geometry of the workings and permeability of backfill material, with very little or no flow expected from the south portion of the workings which geographically overlap, and have the potential to mix with, the BMSG capture facilities. A more detailed description of outflow from the Ram and Sunshine Mines and potential for mixing with the BMSG capture facilities is included in the 2008 addendum to the Water Resources Technical Report.

The comment further states that the assumption that groundwater flow generally follows the topographic gradient is only valid if the groundwater system behaves as an isotropic porous media aquifer. This is only partially correct. In reality, the bedrock system need only have a sufficient fracture density and interconnectivity to act as an equivalent porous media aquifer for flow to generally follow topography. As stated in responses to other comments (see Comment Responses WTR 301-1 and WTR 310), adequate safeguards have been incorporated to ensure that contaminant migration through groundwater can be adequately controlled should contaminant pathways deviate significantly from those predicted by the equivalent porous media model. These safeguards include detailed characterization of bedrock groundwater flow through mine inflow and groundwater drawdown monitoring during the mine operational period, and the multiple approaches to groundwater containment incorporated into the plan, including bedrock groundwater pumpback wells downgradient of each mine, and/or backup groundwater capture system in Lower Bucktail drainage, or maintaining the mines in a dewatered condition if necessary. Based on these monitoring requirements and contingencies, the agencies believe that the quantity of Ram Mine-derived groundwater contaminants potentially reporting to the BMSG, if any, can be adequately quantified and controlled. (155)

BIODIVERSITY

Comment Code	Letter No.	Comment Subject
BIO-400-1	93	Wildlife Habitat – Inadequate Mitigation

Comment: Mitigation for impacts to terrestrial resources could include funds to acquire acceptable replacement habitats to compensate for habitat functionality losses incurred in the mine transportation corridor. (93)

Response: Acquiring habitat does not ensure that wildlife will benefit. Funding of habitat improvement work may be more effective than acquiring land and setting it aside for wildlife. However, the Agencies have not determined that terrestrial habitat impacts are significant and do not have the authority to require replacement habitat. (93)

Comment: We believe that the DEIS does not adequately mitigate the indirect/direct impacts (habitat effectiveness for T&E species, wild ungulates, etc.) of increased traffic to/from the project area on a year-round basis. Noise level and disturbance on the Williams Creek route will significantly increase for animals that currently use the adjacent habitat. (93)

Response: The Williams Creek Road has been an access route into the area for decades. During that period there has been traffic associated with mining, logging, recreation and other activities. Wildlife can and will adjust to ongoing activities associated with ICPs mining. If there is displacement/disturbance of wildlife it normally comes early on in development activities, not after the wildlife has had a chance to habituate. The increase in vehicular activity associated with the mining operations is not anticipated to have a detectable effect on wildlife use of habitat and, while individual wildlife mortality from vehicle collisions area expected, these mortalities are not anticipated to result in an affect on area wildlife at the population level.

The Forest Service does not have the authority to require acquiring replacement habitat and setting it aside for wildlife. Additionally, the level of impacts attributed to additional road use is not expected to have significant impacts to wildlife populations. (93)

Comment Code	Letter No.	Comment Subject
BIO-400-2	110	Wildlife Habitat – Wetlands

Comment: FS should require the creation of a substantial additional acreage of wetlands in order to assure that basic wetland functions in this will continue. (110)

Response: The wetlands that would be destroyed by the TWSF under Alternative II, or potentially by Alternative IV or V, if additional ore is discovered are non-jurisdictional (are not covered by Corps of Engineers 404 permitting requirements). The company has proposed constructed wetlands of a greater area than that impacted under their Plan of Operations as mitigation. Wetlands associated with a spring downgradient of the Ram mine are also predicted to be impacted by mine dewatering. The company proposal for a constructed wetland will be included in the plan of operations, but the Forest Service has no authority to require additional mitigation of wetlands. (110)

Comment Code	Letter No.	Comment Subject
BIO-401	115	Vegetation

Comment: Errors and omissions in the description of Alternative II. Incorrect acreage of disturbance. (115)

Response: Editorial Correction. (115)

Comment Code	Letter No.	Comment Subject
BIO-401-1	110	Vegetation - Plant Species of Special Concern, Ute Lady Tress

Comment: FS should conduct additional surveys this year when the probability of discovering the Ute Ladies' Tresses is highest. (110)

Response: The existing vegetation surveys have not identified Ute Ladies Tresses and additional survey has not been conducted. If Ute Ladies Tresses is identified within the project area in the future, the Forest Service will require ICP modify their activities to protect them. (110)

Comment Code	Letter No.	Comment Subject
BIO-401-1	16, 108, 110, 167	Vegetation- Noxious Weeds, Weed Plan

Comment: Spoke of weed concerns - we want it addressed. We believe dollars need to be set aside for prevention and treatment. (16)

Comment: This area will see dramatically increased motor vehicle use; the FS should be proactive about dealing w/noxious weeds; require noxious weed management plan and wash stations and monitoring. (108)

Comment: Comments regarding required noxious weed prevention measures for the operation. (110)

Comment: Supports project, make sure that spread of weeds is addressed. (167)

Response: The Salmon-Challis National Forest is required to manage undesirable plants on lands under their jurisdiction per the Federal Noxious Weed Act of 1974 as described in Chapter 1 of the FEIS. Under all alternatives presented in the FEIS, the ICP will prepare a weed control plan for Forest Service review and approval. The ICP shall use weed-free mulch and seed mixtures, promptly reclaim disturbed areas and control noxious weeds annually. Herbicide selection and use shall be in accordance with the approved State, county and Forest Service Weed Control Plans. (16, 108, 110, 167)

Comment: FS should require noxious weed management plan to include wash stations and monitoring. (108, 110)

The noxious weed management plan includes the requirement of annual monitoring. It is unclear what benefits would derive from wash stations as most of the common weed species are already

found both on the ICP site and along the access roads. The FS will consider the need for vehicle washdown in review of the weed management plan. (108, 110)

THREATENED AND ENDANGERED SPECIES

Comment Code	Letter No.	Comment Subject
TE-500-1	110	Terrestrial Species – Describe Effects

Comment: Agencies need to further describe the potential short and long-term effects on wildlife species, including T&E, sensitive, and MIS species. Suggest mitigation of roads to protect variety of resources. (110)

Response: Almost the entire area of direct impacts, where the mining and milling operations are located, is in an area that was severely burned in the 2000 Clear Creek fire. Nearly all proposed disturbance will be in areas of standing dead timber. Both cover and foraging habitat in these areas is generally lacking.

In time the habitat will become suitable for many species, but for the life of the mine much of the area will remain in an unsuitable condition for many species. Wildlife can and will adjust to noise and lights associated with the operations.

Vehicle collisions with wildlife always occur along highways or roads. The Plan of Operations will require that most workers be van pooled to the project area to reduce the total amount of vehicle traffic on access roads. From the Blackbird Mine gate to the project site vehicles will be required to travel at slow speeds.

Currently, habitat is generally lacking for forest carnivores in the project area. Until reestablishment of the forest habitat is further along and there is suitable prey base and cover the chances of any of these species occurring in the area are limited.

The Forest Service has complied with MIS species requirements. There are three MIS species listed by the USFS for the Salmon National Forest. All of these species are discussed in the MIS section of the EIS. Of these only the pileated woodpecker and northern spotted frog are found in the project area. The greater sage grouse is a sagebrush obligate species and there is no suitable habitat nor are any of these birds found along the access route or in the project area.

The pileated woodpecker is found in the area of the proposed operations, but suitable nesting was eliminated as a result of the 2000 Clear Creek Fire. During wildlife studies conducted for the project all pileated woodpeckers observed or heard were a mile or more from the project area. There are thousands of suitable acres of habitat for this species found well away from the project area. These birds will not be impacted by the proposed operations.

The northern spotted frog was observed in the project area. Safeguards to protect water bodies and wet areas used by these species are included in the plan of operations. The Plan of Operations will include construction of replacement wetlands for areas of wetland impacts.

As a result of the Clear Creek fire there is very little security cover for large species within the project area. New roads in the project area will not significantly adversely affect the available cover. The primary access roads Williams Creek and Panther Creek have been in existence for years and minor modifications to these corridors will have a negligible affect of habitat. The Plan of Operations will include the requirement that existing un-needed roads be closed and reclaimed. This will result in the project having a net decrease in road density both during and following mining that will provide habitat benefits and long-term protection of wildlife.

Nesting habitat in the immediate project area is lacking for raptors. The immediate project are also has limited suitable foraging habitat for raptor species. (110)

Comment Code	Letter No.	Comment Subject
TE-501	113	Aquatic/Fisheries Species

Comment: DEIS lacks serious analysis of the ICP effects on ESA-listed fish species. (113)

Response: Conceptual models were developed to encompass the hydrologic, climatic, geochemical and mine facility processes into a single, stochastic dynamic systems model (DSM). The model was used to evaluate the storage and process pond capacities and the cumulative effects of mining on water flows and water chemistry within the Panther Creek watershed. Throughout the development of this model, water quality regulatory agencies (EPA and IDEQ) have provided valuable input to the design, application, and interpretation of model results with the EIS team. Output from the model was used to predict changes in water quality such as daily copper concentration. The output expressed a range of possible results from highest to lowest to describe predicted values. This range in values included model simulations referred to as "expected case" or 50th percentile results, "best case" or 10th percentile case, and "worst case" or 90th percentile case. The results predict that surface water quality within the Panther Creek drainage will not violate cold water aquatic life standards nor will it interfere with the attainment goals of BMSG. However, the DEIS did identify copper concentrations (worst case) that with ground water capture may not be sufficiently mitigated in Alternative II. Furthermore, an NPDES permit will be required for all action alternatives. Discharge limits have been established as end-of-pipe limits (no mixing zone) and most constituents (metals) have been set for protection of cold water aquatic life standards to protect against adverse effects due to human activities (See DEIS Tables 4-4 and 4-5). (113)

The EIS acknowledges the possibility of adverse impacts associated with Alternative II especially in the 90th percentile (worst case) condition for Big Deer Creek. Text has been added in the analysis of Alternative II that states that if water quality criteria (for copper) increase that rainbow trout and westslope cutthroat trout would likely avoid Big Deer Creek near South Fork Big Deer Creek confluence. It has also been stated the should this condition develop and proposed mitigation measures cannot meet water quality standards this alternative has the potential to have an adverse direct impact on fish and Forest Service sensitive species in Big Deer Creek. (113)

Comment Code	Letter No.	Comment Subject
TE-501-1	113	Aquatic/Fisheries Species – Inadequate Analysis

Comment: DEIS lacks serious analysis of the ICP effects on ESA-listed fish species. (113)

Response: There has been considerable amount of research in evaluating potential changes to water quality as a result of the ICP alternatives (See Water Resources). Effects to fisheries resources and ESA-listed species is based on the foundation of the water resource effects that included environmental data collected by field and laboratory testing and measurement of water resource media (groundwater, surface water, climate, soils, geochemistry of mining-related rock) that are summarized in Chapter 3 and described in detail in the Water Resources Technical Report (Hydrometrics, 2006). In addition, modeling sediment dynamics (WEPP and BOISED) for the ICP project has provided input (road upgrades and BMP structures) to control sources of sediments to streams. The modeling predicts long-term beneficial effects by reducing delivery of sediment to streams. Reducing overall sediment delivery to streams is beneficial to ESA-listed fish. The NPDES permit will be required for all action alternatives. Discharge limits set forth in NPDES permit for the

outfall have been established as end-of-pipe limits (no mixing zone) and most constituents have been set for protection of “cold water aquatic life” standards, which protects against adverse effects due to human activities (See DEIS Tables 4-4 and 4-5). Cold water aquatic life would include protective measures necessary to protect ESA-listed salmonids (Chinook Salmon, Bull Trout, Steelhead, and Sockeye salmon). (113)

Comment: FS should withhold ICP approval. (113)

Comment: IDEQ's draft ICP certification is arbitrary and unlawful. (113)

Response: The Department disagrees with the comment and continues to support the development and implementation of a plan to ensure zero net loading of copper is maintained. Failure on the part of the Idaho Cobalt Project to do so will result in administrative actions under the Department's enforcement provisions. (113 for both above)

Comment: Section 7 consultation process and environmental baseline. (113)

Response: The basis for the conclusions regarding avoidance of adverse impacts is described in the EIS and the Water Resources Technical Report that is included by reference in the EIS.

Pre-ICP (i.e., current) impacts on fish are described in the Aquatic Baseline condition Technical Report (Kuzis, 2005) and the Biological Assessment (Kuzis, 2007). These impacts are summarized in pages 3-57 through 3-61 of the FEIS. (113)

Comment: After the fact approach to correcting effects to ESA-listed species. (113)

Response: As described in Item 1, top of page 4-7 FEIS, the changes in water quality in area streams, including Big Deer Creek, are not expected to be significant.

The impacts to water quality due to discharge of mine water from the ICP Alternatives II, III, and IV to Big Deer Creek during operations would be positive and would improve water quality in Big Deer Creek (see Tables 4-8 and 4-9 that show concentrations for Alternatives II, III, and IV that are lower than Alternative I No-Action). Currently, Big Deer Creek does not meet water quality standards largely due to releases of contaminants from historic Blackbird Mine disturbances. The draft NPDES Permit requires that all water discharged from the ICP meet water quality standards prior to discharge, thus the ICP would dilute contaminant concentrations from Blackbird and natural sources and improve stream water quality.

During closure, impacts to area streams are not expected to be significant under Alternatives II, III, IV, and V (see Item 1, page 4-7 FEIS).

The comment erroneously states that mitigation measures are offered as “performance-based approach to compliance assessment” and references DEIS at 2-47. Please note that the “performance-based approach to compliance assessment” on page 2-47 (under the section titled “Water Monitoring”) refers to the Alternative IV changes to the water monitoring program, not mitigation measures designed to negate chemical mass loads to Big Deer Creek.

The groundwater capture and treatment systems to mitigate potential chemical mass loads from the mine workings are described on FEIS pages 2-46 and 2-47. Note that these measures would be constructed and tested during the first year of mine operations, not after-the-fact. Further, the mine workings would remain dewatered unless monitoring data indicates that no unacceptable effects to water quality objectives or cleanup goals would result from mine flooding.

The basis for the conclusions regarding avoidance of adverse impacts is described in the DEIS and the Water Resources Technical Report that is included by reference.

Pre-ICP (i.e., current) impacts on fish are described in the Aquatic Baseline condition Technical Report (Kuzis, 2005) and the Biological Assessment (Kuzis, 2007). These impacts are summarized in pages 3-57 through 3-61 of the FEIS. (113)

Comment Code	Letter No.	Comment Subject
TE-501-2	110	Aquatic/Fisheries Species – Describe Effects

Comment: Section 7 consultation; FS should evaluate long-term biotic effects from increased heavy metal levels. (110)

Response: The agencies have undertaken extensive analysis of potential impacts to threatened and endangered species as part of the Biological Assessments for terrestrial and aquatic resources. Metals issues have also been considered in the Biological Opinion prepared to address risk of spills impacting surface waters and fisheries. (110)

Comment Code	Letter No.	Comment Subject
TE-502-1	108	Section 7 Consultation – Adverse Impact

Comment: The Tribe believes that this project has the potential to adversely affect the ESA listed species' critical habitat, while also impacting the non-listed but imperiled species habitat. (108)

Response: The potential impacts to ESA listed species are covered in the Biological Assessment completed for the ICP and submitted to the US Fish and Wildlife Service and National Marine Fisheries Service in October 2007. Impacts to terrestrial and aquatic habitats are discussed in the wildlife and fisheries technical reports and summarized in the EIS. (108)

Comment Code	Letter No.	Comment Subject
TE-502-2	112	Section 7 Consultation – More Detail

Comment: We understand that this was a draft document (BA) and therefore, we have questions regarding the accuracy of the determination and how the project area is defined. ... we recommend that these issues be addressed in the final EIS and that the final EIS include information to reflect the BA as well as NOAA and NMFS Biological Opinion. (112)

Response: BAs were submitted to USFWS and NMFS in December 2007 and the FEIS has been revised to address additional information contained in the BAs. The terms and conditions from the Biological Opinion will be included in the ROD. (112)

Comment: A conclusion of the fisheries resources section is that it is unlikely that there will be adverse impacts to fish in the area surface waters. In order to justify this conclusion, this section of the EIS should discuss the protectiveness of the criteria and cleanup goals specifically for the fish present in the streams. (112)

Response: The Biological Assessment completed in December 2007 indicates possible impacts to fish from transportation spills. The FEIS has been revised to address these potential impacts. The EPA and State of Idaho have established water quality criteria to be protective of fish and aquatic life. ICP discharges and cleanup goals for the BMSG (with the exception of Bucktail Creek) utilize these criteria in determining acceptable levels of impact to surface waters. (112)

FISHERIES

Comment Code	Letter No.	Comment Subject
FSH-600	110, 115	General Fish Species and Habitat

Comment: DEIS does not ensure that all requirements of the NFMA will be met at all times; project would violate INFISH standards MM-1, MM-2, and MM-3. (110)

Response: ICP structures/roads that fall within areas that may be considered RHCA's were associated with the pipeline to the NPDES outfall in Big Deer Creek. Page 2-71 of the DEIS summarizes the discharge location alternatives that were considered by the Forest Service. A no discharge option was dismissed due to the positive water balance at the site, and the option of using BMSG's water treatment plant is not within the jurisdiction of the Forest Service to require of FCC. This left no other option but to consider structures/roads within potential RHCA's. The structures/roads associated with the Big Deer Creek outfall have been designed to minimize impacts to the riparian area and inland native fish to the extent practicable. The DEIS analyzed the effects to riparian areas in Chapter 4 under Vegetation and Wetland Resources (page 4-49 to 4-52).

All road construction in RHCA's consists of either upgrading roads to mitigate sediment delivery to streams or tertiary site roads to be occasionally used by light vehicles.

In keeping with MM-1, practicable measures are being taken to minimize impacts to fish habitat. Sediment delivery to streams is being mitigated through road resurfacing and bussing of employees to minimize traffic.

Construction of the Project is consistent with INFISH Guideline MM-2. Access roads and site roads in RHCA's have been kept to a minimum and all existing exploration roads that are no longer useful will be obliterated during the construction of the Project. Realignment of the Project Access route to completely avoid RHCA's is infeasible.

Solid and sanitary waste facilities (i.e., the TWSF and septic system) are not located in RHCA's and therefore do not violate MM-3. The discharge pipeline for treated water is in part in a RHCA and must be in order to discharge to a stream. (110)

Comment: Road construction in RHCAs; no agency finding of no alternative to avoid. (110)

Response: Contrary to the commenter's assertion, constructing a maintenance road for the water treatment discharge pipeline would not be a violation of the roadless rule. FS roadless regulation at 36 CFR 294.12(b)(3) says a road may be constructed in inventoried roadless areas when the road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty. The General Mining Law of 1872 (17 Stat. 91, as amended) provides United States citizens a possessory right to prospect, explore and develop locatable minerals on public domain lands. This possessory right includes reasonable access to conduct locatable mineral activities. The Forest Service considers the construction of the maintenance road for the discharge pipeline as being reasonably necessary for the development of FCC's locatable mineral prospect and therefore exempt from the road prohibitions of the roadless rule. The commenter is also incorrectly infers that the DEIS rejected

alternate pipeline routes solely on the basis that they involved road construction in roadless areas. Minimizing road construction within inventoried roadless areas was only one of a number of factors considered by the FS in evaluating the best route for the discharge pipeline. (110)

Comment: Road construction in RHCAs; no agency finding of alternative to avoid - ROD violates other INFISH and Forest Plan requirements. (110)

Response: ICP structures/roads that fall within areas that may be considered RHCA's were associated with the pipeline to the NPDES outfall in Big Deer Creek. Page 2-71 of the DEIS summarizes the discharge location alternatives that were considered by the Forest Service. A no discharge option was dismissed due to the positive water balance at the site, and the option of using BMSG's water treatment plant is not within the jurisdiction of the Forest Service to require of FCC. This left no other option but to consider structures/roads within potential RHCA's. The structures/roads associated with the Big Deer Creek outfall have been designed to minimize impacts to the riparian area and inland native fish to the extent practicable. The DEIS analyzed the effects to riparian areas in Chapter 4 under Vegetation and Wetland Resources (pp. 4-49 to 4-52). (110)

Comment: Unsupported assertions - unfounded conclusion re: unavoidable adverse effect of sulfate on fisheries. (115)

Response: Sulfate was not identified in the Chapter 4 fisheries sections as an adverse impact and the sentence containing the reference to sulfate will be removed in the fisheries section under "Unavoidable Adverse Impact" (115)

Comment: Errors and omissions in the impact discussions - Correct Alt. II sediment addition statement in fisheries text. (115)

Response: Text has been revised for clarification as requested. (115)

Comment Code	Letter No.	Comment Subject
FSH-600-1	93	General Fish Species and Habitat - Sediment

Comment: Increased sedimentation is likely to occur in the Williams Creek watershed. We suggest these impacts be properly mitigated by Formation Capital Corporation. . . could include funds for onsite and offsite habitat improvement projects and/or assistance with area stream reconnection efforts. (93)

Response: Sediment control practices including BMPs described in the POO and Jersey Barriers and outsloped roads were evaluated by the Agencies. The agency evaluation concluded that maintenance issues associated with the Jersey Barriers would likely limit the effectiveness of stormwater dispersal, causing additional road erosion and stormwater management problems. Use of in-sloped roads and BMPs to control sediment is used in all alternatives to control road runoff (DEIS page 2-73). (93)

Comment Code	Letter No.	Comment Subject
FSH-600-2	108, 110, 112	General Fish Species and Habitat – Inadequate Analysis

Comment: The Tribe is not comfortable that potential impact from heavy metals has been adequately addressed in the EIS, nor adequately mitigated in the POO; potential to significantly reduce successful recruitment of fish species, potential to contaminate fish that currently reside in this area. (108)

Response: The Forest Service and EPA recognize the Tribe's position and interest with regards to fish consumption. The analysis of the ICP discharge (see Water Resources section of Chapter 4) predicts a decrease in copper and cobalt loads to the downstream fisheries during and following mining as a result of water treatment. Long-term improvements in water quality associated with the Blackbird cleanup should have a beneficial effect on fish and fish consumption.

The potential for leaching of heavy metals and ARD was one of the major concerns addressed by the EIS team. For example, in the first paragraph of Appendix B to the Water Report states: "The geochemistry of mined rock material is one of the critical characteristics of the mine that has the potential to influence the environmental impacts associated with the ICP." There is extensive analysis of the potential for elevated levels of heavy metals to exist in mine drainage or for ARD to occur. An extensive geochemical testing program (Chapter 3 & 4, Appendix B, Water Report) was designed and implemented for the DEIS. Testing concluded, for example (Page 9, Appendix B, Water Report), that "Overall, samples were very low in sulfide sulfur (Figure 9) with 50% of the samples having no detectable sulfur (< 0.01 weight %) and 75% of the samples with less than 0.1%. Sulfur concentrations were log-normally distributed. The highest sulfur levels in the Ram and Sunshine, which had similar sulfur distributions, were less than 2%. Only about 5% of the samples had more than 1% sulfur, with many of these samples representing ore zones. The ANP of ICP samples (Figure 9) was also very low with 70% of the samples having ANP values less than 3 kg/t. This level of ANP would be neutralized when about 0.1% pyritic S oxidizes. About 1% of the samples came from zones that had carbonate mineralization and yielded ANP levels in the range of 10 to 100 kg/t." Additionally, on page 18, Appendix B, the EIS team stated, "Extensive geochemical testing conducted by FCC consultants (Telesto 2004) indicated those samples with more than about 0.15% pyritic sulfur and a negative NNP are potentially acid generating (PAG). In this evaluation, a threshold pyritic sulfur level of 0.2% and a negative NNP appeared to correspond to potentially acid generating waste rock. Overall, about 17% of 239 rock samples collected from the Ram and Sunshine deposits (Figure 15) were PAG while the remaining samples were either weakly acid neutralizing (80%) or uncertain (3%). All PAG samples were very low in ANP meaning they have little ability to neutralize acidity, and could become acidic quickly if there are sufficient sulfides to create acidic conditions. Kinetic testing, however, showed that chalcopyrite and cobaltite tends to oxidize slowly under oxidizing conditions. Tailings samples were non acid-generating according to the Sobek static test results."

Despite the relatively low risk of ARD, several mitigation measures were employed to insure that release of ARD and metals were minimized. Among these measures were capture of outflow from the underground mines, perpetual water treatment (as needed base on monitoring results), commingling of tailings and waste rock, and addition of alkaline amendments to underground slash. (108)

Comment: Not only will this project likely impact recovery efforts (salmon and steelhead), the likely environmental effects have the potential to contaminate the fish that continue to currently exist in the basin, further diminishing what is left of Salmon river anadromous fish runs. (108)

Response: Information provided in the Water Resource Technical report (Hydrometrics, 2006) predicts that water quality conditions will not be adversely impact by ICP alternatives except for the potential worst case scenario for Alternative II (copper concentrations).

Evaluation of ICP alternative on ESA-listed species and critical habitat relied on predictions of water quality discussed in Water Resources (chapters 3 & 4) to determine the potential effects. Effects to ESA-listed species and their critical habitat designated in Panther Creek will not be affected by the ICP alternatives through changes in water quality, stream flow, and increased sediment delivery. Only minor changes are predicted (see Water Resource). Water quality standards through the NPDES permit will be monitored for compliance. There are also long-term benefits from upgrades to the transportation route that will decrease sediment delivery to area streams. Reduced sediment delivery to streams provides better conditions for area streams that support rearing of ESA-listed and Forest Service sensitive species. (108)

Comment: Insufficient baseline fisheries data. (110)

Response: Additional fisheries resource information has been added to Chapter 3 of the DEIS to describe the presence and abundance of salmonids in the ICP project area. We also refer readers to the more detailed information in the fisheries technical report (Kuzis, 2004), Biological Assessment (WPN, 2007), and other materials sited in fisheries section that have been collected and are part of the public record. (110)

Comment: We recommend that the final EIS section on fisheries include a more full discussion of summary information from the BA and that a summary table be included of the T&E species along with a column of potential effects among alternatives. (112)

Response: Summary tables have been created to identify the main issues/concerns (sediment, water quality, surface water flows, and hazardous spills) for fisheries resources. The tables will be inserted into the Chapter 4 fisheries section to help the reader identify the main issues. (112)

Comment Code	Letter No.	Comment Subject
FSH-600-3	164	General Fish Species and Habitat – Fish Traps

Comment: Would like to see use of satellite fish traps to ensure successful reproduction. (164)

Response: On several occasions since the 1980's, instream holding cages have been utilized to determine fish survival in lower mainstem Panther Creek waters below the confluence of Blackbird Creek. As these waters now fully support year-round populations of various trout species, efforts at documenting fish survival, abundance, and reproduction success within Panther Creek and its tributaries have shifted to snorkeling and electrofishing operations. Annual repetitions of these surveys by both Idaho Department of Fish and Game and the U.S. Forest Service fisheries survey crews allow not only determination of yearly reproduction success within these drainages, but additionally allow identification of trends in species population metrics, including population size, structure and growth, while avoiding the impacts to unhindered fish migration opportunities associated with the use of fish traps. (164)

Comment Code	Letter No.	Comment Subject
FSH-601	110, 113	Threats to Fisheries and Impacts - Spills

Comment: Revised DEIS needs to analyze threats to fisheries from spills along transportation route; FS should regulate all transportation contractors; FS should provide restrictions re: chemicals stored next to each other or transported together; transport route should be examined for particularly hazardous areas. (110)

Response: Risks to aquatic resources from hazardous material spills are addressed in the "Fisheries Resources" section in chapter 4. Hazardous materials spill prevention and response plans are in place. See "Spill Control" section under "Transportation of Personnel and Supplies" heading in Chapter 2, "Spill Control" heading in Chapter 2, "Spill Control" section under "Emergency Management, Spill Control and Fire" in Chapter 2, and "Fisheries Resources" section in Chapter 4.

Risk of a transportation related spill of hazardous materials is directly related to miles traveled. If supplies are delivered on a monthly basis instead of in logical load quantities, additional miles will be traveled and spill risks will increase. (110)

Comment: DEIS lacks serious analysis of the ICP effects on ESA-listed fish species. (113)

Response: There has been considerable amount of research in evaluating potential changes to water quality as a result of the ICP alternatives (see Water Resources). Effects to fisheries resources and ESA-listed species is based on the foundation of the water resource effects that included environmental data collected by field and laboratory testing and measurement of water resource media (groundwater, surface water, climate, soils, geochemistry of mining-related rock) that are summarized in Chapter 3 and described in detail in the Water Resources Technical Report (Hydrometrics, 2006). In addition, modeling sediment dynamics (WEPP and BOISED) for the ICP project has provided input (road upgrades and BMP structures) to control sources of sediments to streams. The modeling predicts long-term beneficial effects by reducing delivery of sediment to streams. Reducing overall sediment delivery to streams is beneficial to ESA-listed fish. The NPDES permit will be required for all action alternatives. Discharge limits set forth in NPDES permit for the outfall have been established as end-of-pipe limits (no mixing zone) and most constituents have been set for protection of "cold water aquatic life" standards, which protects against adverse effects due to human activities (See DEIS Tables 4-4 and 4-5). Cold water aquatic life would include protective measures necessary to protect ESA-listed salmonids (Chinook Salmon, Bull Trout, Steelhead, and Sockeye salmon). (113)

FOREST PLAN

Comment Code	Letter No.	Comment Subject
FPL-700	110, 115	Salmon-Challis National Forest Plan, FLPMA, Organic Act

Comment: Road construction in RHCAs; no agency finding of no alternative to avoid - ROD violates other INFISH and Forest Plan requirements. (110)

Response: ICP structures/roads that fall within areas that may be considered RHCA's were associated with the pipeline to the NPDES outfall in Big Deer Creek. Page 2-71 of the DEIS summarizes the discharge location alternatives that were considered by the Forest Service. A no discharge option was dismissed due to the positive water balance at the site, and the option of using BMSG's water treatment plant is not within the jurisdiction of the Forest Service to require of FCC.

This left no other option but to consider structures/roads within potential RHCA's. The structures/roads associated with the Big Deer Creek outfall have been designed to minimize impacts to the riparian area and inland native fish to the extent practicable. The DEIS analyzed the effects to riparian areas in Chapter 4 under Vegetation and Wetland Resources (pp. 4-49 to 4-52). (110)

Comment: Violation of Organic Act, FLPMA, and Forest Service mining and special use regulations; incorrect assumptions of mining rights. (110)

Response: The ICP will not be required to obtain a right-of-way across public land for its associated facilities. The scope of the Forest Service special use regulations at 36 CFR 251.50 apply to uses of National Forest System lands except those authorized under other Forest Service authority, such as the minerals regulations at 36 CFR 228. The regulation at 36 CFR 228.5 requires operations to be conducted in accordance with an approved plan of operations. "Operations" is defined at 36 CFR 228.3 as "all functions, work and activities in connection with...mining or processing of mineral resources, and all uses reasonably incident thereto, including roads...regardless of whether said operations take place on or off mining claims." Accordingly, the Forest Service has the authority to approve in the plan of operations all of the activities and facilities associated with mining, and is not required to grant permanent rights-of-way or easements for off-claim development. (110)

Comment: Failure to comply with FS regulation of mining. (110)

Response: The proposed plan of operations, with the changes and additions described in the selected alternative, satisfies the 36 CFR 228 requirements for approval of a plan of operations. (110)

Comment: Violation of FS duties under Organic Act and 228 regulations. (110)

Response: The proposed plan of operations, with the changes and additions described in the selected alternative, will minimize adverse environmental impacts to the extent feasible as required by the regulations. The analysis of effects in the EIS reflects that the preferred alternative is expected to reduce sedimentation to streams along the mine transportation route and otherwise have no measurable influence on the current conditions or naturally occurring processes of the area's aquatic habitat. In turn, this effect provides greater long term positive effect on fish reproduction capability, and therefore fisheries resources (DEIS; p.4-68). In addition, approved mining activity would result in a small loss of wildlife habitat, but would not result in local or regional impacts to wildlife (FEIS; page 4-56). The Biological Opinions (Appendix E, Appendix F) address fisheries impacts. (110)

Comment: Allowing discharges that pollute up to the maximum may not be a violation of the CWA, the failure to minimize adverse impacts by not requiring further actions to reduce pollution violates the agency's Organic Act and 22 regulatory duties. (110)

Response: The regulations require that mining operations be conducted to minimize adverse environmental impacts to the extent feasible. The plan of operations proposed for approval meets this requirement. The EPA is responsible for setting effluent limits in the proposed NPDES permit. (110)

Comment: Other - correct EIS/FLRMP tiering statement. (115)

Response: Editorial correction. The National Forest Management Act (NFMA) requires each National Forest Unit (Forest) to develop and implement a forest management plan. The Salmon National Forest Plan was developed through the EIS process and the preferred plan was approved in

a record of decision in 1988. The preferred plan prescribes management of Forest lands open to mineral entry as allowing “conventional exploration and development with appropriate stipulations to protect soils resources, water quality and other surface resources.” (115)

NEPA

Comment Code	Letter No.	Comment Subject
NEPA-800	113	NEPA Process and Format

Comment: BMSG request to review and comment on the BA and other evaluations under the ESA. (113)

Response: The Biological Assessment is a document available under FOIA should it be requested. The Biological Assessment forms the basis for a determination on listed species by the action agency and is submitted to the consultation agencies for their consideration. Additional information, clarification etc. is generally requested by the Consultation Agency who will issue a Concurrence or Biological Opinion on the Project. Inquiries for participation in that agencies decision should be directed to the appropriate agency. (113)

Comment: USFS, EPA, and IDEQ should revise and reissue DEIS. (113)

Response: The Agencies acknowledge that some of the required mitigation discussed in the EIS is will require detailed plans to be submitted for Forest Service approval. The NEPA process requires the environmental consequences of mitigation to be fairly evaluated, it does not require complete mitigation plans to be formulated and adopted. The EIS adequately describes the mitigation and relies upon generally accepted analytical and modeling methods to analyze their effects to ensure that environmental consequences have been fairly evaluated. For mitigation requiring submission of a detailed plan, the Forest Service (and other Agencies as appropriate) will review the plan to ensure the anticipated effects are within the range of alternatives analyzed in this EIS. If not, additional NEPA analysis would be conducted to address the specific proposal. Regardless, if the detailed plans do not reasonably demonstrate that they will accomplish the intended mitigation, the plan would not be approved and the related activity could not proceed.

The regulation 36 CFR 228.5(a)(3) directs the Forest Service to notify the operator of any changes in, or additions to, a plan of operations deemed necessary to meet the environmental protection requirements contained in §228.8. This obligates the agency to rely on mitigation measures in its decision-making process. Analysis conducted for the ICP EIS suggests that the selected alternative and its associated mitigation will satisfy the standards of the Forest Service 228A regulations to minimize adverse environmental impacts and comply with applicable Federal and State water quality standards. (113)

Comment: DEIS alternatives development and analysis is fundamentally flawed. (113)

Response: The EIS evaluates a reasonable range of alternatives that addressed the purpose and need as well as the significant issues identified through public scoping. Although the EIS considered the No Action alternative as required by 40 CFR 1502.14(d), the Forest Service is limited to selecting alternatives that satisfy its regulatory requirement to either: approve FCC’s plan of operation as proposed; or identify changes or additions to the plan needed to satisfy its regulations for environmental protection. (113)

Comment Code	Letter No.	Comment Subject
NEPA-800-1	112, 115	NEPA Process and Format – Editorial

Comment: The EIS should include a list of all of the pre-construction/pre-operational design documents that must be approved prior to mine operation start-up. (112)

Response: The FEIS contains a list of actions and documents required prior to initiation of mine construction. (112)

Comment: Figure 2-5: Reference to the water treatment plant with the mill should be made on this figure. (112)

Response: The water treatment plant is labeled on Figure 2-5. (112)

Comment: Page 3-81: Remedial Actions/last sentence: ...Since these actions are described as Contingent Actions in the ROD, this sentence should be deleted from the Remedial Actions section of the EIS. (112)

Response: Text revised as required in the FEIS. (112)

Comment: Table 4-6: Change "sulfite" to "sulfide." (112)

Response: Table 4-6 in the DEIS matches the draft NPDES permit that was current at the time of the DEIS and FEIS. Final effluent limits and monitoring requirements will be specified in the Final NPDES Permit. The Final Permit will incorporate changes as needed to address public comments on the Draft Permit and to match FCC's revised permit application. EPA will provide responses to public comments on the Draft Permit in the "Response to Comments" document that will accompany the final permit upon issuance. (112)

Comment: Prescriptive language - Mitigation Measures. (115)

Response: The Agencies recognize that the EIS does not authorize mitigation even though prescriptive language may be used in describing said mitigation. The Agencies believe it is clearly stated in the EIS and relatively well understood by the public that mitigation described in an EIS, regardless of the type of helping verbs used, is for the purpose of disclosure and only become agency direction when it is selected in the Record of Decision, and incorporated into the approved plan of operations that will implement the decision. No changes were made in the FEIS as a result of the comment. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, construction phase description missing components. (115)

Response: No changes made to FEIS. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, winter construction. (115)

Response: No changes made to FEIS. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, Table 2-1, delivery method for cement. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, Table 2-1, SWMP material transportation. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Incorrect acreage of disturbance. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives - no DEQ guidance. (115)

Response: No change to FEIS. (115)

Comment: Errors and Omissions in describing the existing environment - replace Figure 3-6 with Appendix C POO. (115)

Response: Editorial Correction. (115)

Comment: Other - correct EIS/FLRMP tiering statement. (115)

Response: Editorial Correction. (115)

Comment: Miscellaneous - Suggested wording change. (115)

Response: Editorial Correction. (115)

Comment: Miscellaneous - Vagueness of "range of possible outcomes." (115)

Response: Text has been revised to omit the phrase. (115)

Comment Code	Letter No.	Comment Subject
NEPA-800-2	10, 113	NEPA Process and Format – General

Comment: Long time awaited DEIS to the public. Eight years seems like an excessively long time for the processing of paperwork leading to the mining of such a strategically important material. My hope that any difference between the Preferred Alternative EIS and Formation Capitals Proposed Alternative can quickly be resolved so that mine operations can begin without further delay. (10)

Response: A description of activities that must be completed prior to commencement of mining operation is included in the DEIS, Chapter 1 under the heading Decisions to Be Made. (10)

Comment: USFS, EPA, and IDEQ should revise and reissue DEIS. (113)

Response: The Agencies acknowledge that some of the required mitigation discussed in the EIS is will require detailed plans to be submitted for Forest Service approval. The NEPA process requires the environmental consequences of mitigation to be fairly evaluated, it does not require complete mitigation plans to be formulated and adopted. The EIS adequately describes the mitigation and relies upon generally accepted analytical and modeling methods to analyze their effects to ensure that environmental consequences have been fairly evaluated. For mitigation requiring submission of a detailed plan, the Forest Service (and other Agencies as appropriate) will review the plan to ensure the anticipated effects are within the range of alternatives analyzed in this EIS. If not, additional NEPA analysis would be conducted to address the specific proposal. Regardless, if the detailed plans do not reasonably demonstrate that they will accomplish the intended mitigation, the plan would not be approved and the related activity could not proceed.

The regulation 36 CFR 228.5(a)(3) directs the Forest Service to notify the operator of any changes in, or additions to, a plan of operations deemed necessary to meet the environmental protection requirements contained in §228.8. This obligates the agency to rely on mitigation measures in its decision-making process. Analysis conducted for the ICP EIS suggests that the selected alternative and its associated mitigation will satisfy the standards of the Forest Service 228A regulations to minimize adverse environmental impacts and comply with applicable Federal and State water quality standards. (113)

Comment Code	Letter No.	Comment Subject
NEPA-800-3	110, 113	NEPA Process and Format – Future Studies/Design

Comment: Reliance on future mitigation plans (sediment/TSS) violates NEPA. (110)

Comment: For the critical issue of water quality, the mitigation measures for copper rely on a future, as-yet unsubmitted plan. (110)

Comment: The DEIS unreasonably postpones much of the needed analysis to future mitigation submissions. (113)

Response: The mitigation measures, final designs and detailed plans required by the Plan of Operations frequently contain a level of detail greater than that appropriate for an EIS. The POO and accompanying documents and EIS team technical reports contained in the Project Record supply additional detail on the contents of required future submittals. The NEPA analysis is based in part on agency experience with similar projects and activities and has required a sufficient level of detail for proposed mitigation measures to analyze potential impact. Submittal and agency approval of final plans and design details following completion of the EIS is consistent with the NEPA. The EIS has disclosed or described conceptual mitigation requirements in a level of detail adequate to understand the intent, components, potential problem areas and likely results. Where critical resource impacts are potentially affected, the agencies have required submittal and approval of specific plans prior to project initiation.

The Forest Service's approval of an ICP Plan of Operations is conditioned on the submittal of specific plans and designs for agency approval prior to initiating ground disturbing activities for the facilities to be constructed on the project including roads, tailings and waste rock facility, water treatment system

and other components. In addition, Quality Assurance Quality Control Plans covering construction and operational activities must be submitted to the agencies for their review and approval. The company will provide funding for independent technical review by a qualified third party for the underground backfill amendment plan, water treatment design and the model utilized to predict water quality at the end of mine life. An Interagency Task Force will be formed to administer the active operations, this concept has been used successfully by the agencies on operating mines to oversee operations and monitoring as well as implementing plan modifications for active mine operations and closure activities in Idaho.

Measures to ensure long term environmental and remediation cleanup goals are met include the posting of a bond to ensure vegetation success on the reclaimed portions of the project and a commitment for long term water treatment if necessary. (both 110 above, 113)

Comment Code	Letter No.	Comment Subject
NEPA-800-5	113	NEPA Process and Format – Assumptions Unsupported

Comment: Key assumptions have no basis in fact, are unsupported by technical analysis, and appear to be based on little more than speculation. (113)

Response: The analysis of impacts in this and any other EIS necessarily relies on a number of assumptions. The assumptions listed as unsupported are in fact discussed in detail in the Water Technical Report and in the EIS. Also see responses to comments GEO 103-2 and WTR 301-1, 301-2, 304, 306-2, 307. (113)

Comment Code	Letter No.	Comment Subject
NEPA-800-6	113	NEPA Process and Format – Violation of Requirements

Comment: DEIS does not properly consider violation of Federal or State environmental laws. (113)

Response: The agencies understand their requirements to evaluate compliance with other applicable laws and regulations and have included that evaluation in this analysis. (113)

Comment Code	Letter No.	Comment Subject
NEPA-800-7	112	NEPA Process and Format – Objectives

Comment: In describing Alternatives III, IV, and V, it is not clear in the DEIS that the agency modifications are adding operational objectives or reclamation objectives. (112)

Response: Alternatives III, IV and V include modifications to both operational and reclamation phases of the ICP. The text describing some of the operational and design components as well as mitigation measures has been modified in an attempt to clarify the differences between alternatives. (112)

Comment Code	Letter No.	Comment Subject
NEPA-801	113, 115	EIS Purpose and Need – Inadequate

Comment: Failure to discuss ICP purpose and need. (113)

Response: The Purpose and Need are discussed in Chapter 1. The need for the proposed action is specifically stated in the section referenced by the commenter: “The need for the proposed Federal actions is that the Forest Service is required to respond to a proposed plan of operations to conduct mining operations pursuant to the Mining Laws.” The FEIS has been revised to include an additional description of purpose and need as it relates to EPA’s actions. (113)

Comment: Purpose and Need - objection to DEIS description. (115)

Response: The proposed Federal action described in the DEIS is consistent with CEQ regulations (40 CFR 1508.18(b)(4)) and Forest Service guidance (FSH 1909.15.05) which dictate that the proposed action is “a proposal made by the Forest Service to authorize, recommend, or implement an action to meet a specific purpose and need.” Hence, the proposed action is for the Forest Service to approve the proposed plan of operations for construction, operation, and reclamation of a cobalt mine, and determine if changes or additions to the proposed plan are needed to meet the requirements for environmental protection set forth in regulations at 36 CFR 228 Subpart A. The recovery of metals and development of economically viable resources is the purpose of FCC’s mining proposal, not the purpose or need for the proposed Federal action, which is to review and approve the proposed plan of operations for the mine in accordance with the regulations at 36 CFR 228 Subpart A. (115)

Comment: Effect Analysis - flawed development and description of alternatives and Purpose and Need. (115)

Response: The agencies developed a reasonable range of alternatives that include design and operational components, monitoring and mitigation measures intended to reduce identified impacts or to address issues raised during scoping. FCC could have included any or all of these components in its Plan of Operations, but chose not to. The level of detail included in the Alternatives is adequate for the analysis and comparison of impacts. Assumptions made about the effectiveness of standard water treatment technologies are based in part on limited treatment testing done by FCC, on effectiveness of treatment on similar waste streams and on best professional judgment. The analysis presented is intended to provide agency decision makers adequate information to make informed choices between alternatives.

The purpose and need statement has not been revised and the alternatives developed to meet the required evaluation of FCC's Plan of Operations under 30 CFR 228A is presented in this FEIS. (115)

Comment Code	Letter No.	Comment Subject
NEPA-802	110, 113, 115	EIS Alternatives

Comment: The agencies violated NEPA by not considering a reasonable range of alternatives. (110)

Response: The proposed Federal action by the Forest Service is defined by the 1872 Mining Law, as amended, and the regulation at 36 CFR 228 Subpart A. The purpose and need for the Forest Service action are set forth in the law and regulations. The 1872 Mining Law provides FCC the right to

prospect, explore, mine, and all uses reasonably incident thereto, on its claims. The Forest Service mining regulations at 36 CFR 228A are designed to insure that surface uses incident to mining on National Forest System land are reasonably incident to mining, and are designed and carried out to minimize adverse environmental impacts to the extent feasible. As discussed on page 2-1 of the DEIS, the regulation at §228.5 does not provide for the denial of a proposed plan of operations, but instead directs the Forest Service to specify changes or additions to said plan that it deems necessary to meet the environmental protection requirements of the 228A regulations. The Forest Service and the other involved regulatory agencies have determined that the changes and additions to be incorporated into FCC's plan of operations under the selected alternative will ensure that all applicable State and Federal water quality standards will be met, and that surface uses will meet all other requirements of the regulations. (110)

Comment: Inadequate identification and analysis of an appropriate range of reasonable alternatives. (113)

Response: Bullet No. 1: The EIS analyzes the no action alternative, which would have impacts identical to an alternative that would disapprove the ICP plan of operations. The Agencies did not adopt the suggestion to discuss obtaining cobalt from an alternate source; reliance on metal recycling, or locating a cobalt mine where there are no impaired waters because these alternatives would not meet the stated purpose and need for the project.

Bullet No. 2: The Agencies are not required to consider in detail the suggested alternative because it is unreasonable. There is no regulatory requirement to support consideration of the suggested alternative and "proving" the effectiveness of site specific mitigation for a particular mining project before approval would essentially be impossible without implementing the project itself. Approval of the various permits and the plan of operations associated with the ICP is a binding commitment on FCC to implement the mitigation developed in the EIS. Should the required mitigation prove not to be effective, the Forest Service may request FCC to further modify its approved plan of operations to minimize any unforeseen environmental impacts in accordance with 36 CFR 228.4(e).

Bullet No. 3: The Agencies are not required to consider the suggested alternative because it is unreasonable and would violate existing legal agreements. The BMSG has a current legal obligation under a federal consent decree and administrative order to meet water quality requirements in the Bucktail/Big Deer drainage. Whether the BMSG should be relieved of its obligation to meet water quality requirements is a purely legal question not currently under review in any legal forum. It would be unreasonable for an EIS analysis to consider an alternative the implementation of which would be dependent upon the future occurrence of a legal outcome contrary to the current legal reality. Considering such an alternative is also not reasonable because relieving the BMSG of its obligations to meet water quality requirements would leave no mechanism for remediation of past mining effects to water quality for which the BMSG members are responsible, nor for restoration of natural resources injured as a result of past mining activities. Lastly, the EIS predicts that the preferred alternative will not jeopardize BMSG's ability to satisfy its cleanup requirements at the Blackbird mine site.

Bullet No. 4: The Agencies are not required to consider the suggested alternative for detailed study because it is speculative. Technical impracticability (TI) is one of the bases for waiving or modifying applicable and relevant or appropriate requirements (e.g. cleanup standards) under CERCLA and other environmental authorities. TI findings are made by regulatory authorities and are based upon a significant amount of data and analysis regarding the past performance of any applicable remedial systems, and upon a showing that no existing technologies can attain the relevant cleanup levels in a reasonable time period. The Agencies have no information to suggest that the regulatory authorities associated with the site have a TI proposal or inquiry under consideration with respect to the Blackbird remedy or more generally with respect to these waters, or that such would be appropriate. (If anything, the ongoing cleanup and restoration activities at the site indicate the contrary.) Therefore, it would be speculative, if not unreasonable, to consider an alternative in which Federal

and State regulatory agencies jointly declare that attainment of water quality at Bucktail and Big Deer Creeks is technically impracticable.

Bullet No. 5: The Agencies are not required to consider the suggested alternative for detailed study because it is speculative. FCC is not a party to either the 1995 Blackbird Mine Site Consent Decree or any subsequent Administrative Orders related to cleanup of the Blackbird Site. For such to occur in the future would require either an unlikely agreement on the part of FCC to bind itself in this fashion, or administrative and/or judicial action by entities seeking to impose such liability upon FCC. No such administrative or judicial action is underway. Therefore, it would be speculative for the Agencies to consider an alternative in which FCC is jointly and severally liable for Blackbird Mine compliance under the existing Consent Decree and Administrative Order related to the Blackbird Mine Site. Moreover, the Agencies do not believe that consideration of such an alternative would further the analysis of the environmental effects of the proposed action. (113)

Comment: Errors and omissions in the description of Alternative II. Summary section (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, TWSF reclamation (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, paste backfill cement addition (115)

Response: Editorial Correction. (115)

Comment: Table 4-7, include FCC proposal for use of post mine bedrock capture wells re: copper standards. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Raise existing road grade/Panther Creek. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives. Effects of Blackbird groundwater flows and fresh water. (115)

Response: Editorial Correction. (115)

Comment: Muddled application of mitigation measures to some but not all alternatives makes a comparison among each other difficult - reorganization of mitigation measures descriptions and effects. (115)

Response: Alternatives III, IV and V include modifications to both operational and reclamation phases of the ICP as compared to the company's proposal (Alternative II). The text describing some

of the operational and design components as well as mitigation measures has been modified in an attempt to clarify the differences between alternatives. (115)

Comment: Effect Analysis - flawed development and description of alternatives and Purpose and Need. (115)

Response: The agencies developed a reasonable range of alternatives that include design and operational components, monitoring and mitigation measures intended to reduce identified impacts or to address issues raised during scoping. FCC could have included any or all of these components in its Plan of Operations, but chose not to. The level of detail included in the Alternatives is adequate for the analysis and comparison of impacts. Assumptions made about the effectiveness of standard water treatment technologies are based in part on limited treatment testing done by FCC, on effectiveness of treatment on similar waste streams and on best professional judgment. The analysis presented is intended to provide agency decision makers adequate information to make informed choices between alternatives.

The purpose and need statement has not been revised and the alternatives developed to meet the required evaluation of FCC's Plan of Operations under 30 CFR 228A is presented in this FEIS. (115)

Comment: Unsupported assertions - Chapter 4, display effect of each alternative minus mitigation. (115)

Response: The agencies developed a reasonable range of alternatives that include design and operational components, monitoring and mitigation measures intended to reduce identified impacts or to address issues raised during scoping. FCC could have included any or all of these components in its Plan of Operations, but chose not to. The level of detail included in the alternatives is adequate for the analysis and comparison of impacts. Assumptions made about the effectiveness of standard water treatment technologies are based in part on limited treatment testing done by FCC, on effectiveness of treatment on similar waste streams and on best professional judgment. The analysis presented is intended to provide agency decision makers adequate information to make informed choices between alternatives. (115)

Comment: Unsupported assertions - explain why copper concentrations in groundwater below Sunshine Mine are different in alternatives. (115)

Response: Addition of alkaline amendments to slash in Alternative IV results in higher pH conditions and therefore lower predicted long-term copper levels in the Sunshine mine for Alternative IV. (115)

Comment: Errors and omissions in the impact discussions - Alt. I is no action and no Ram or Sunshine Mines to affect Bucktail Creek drainage WQ. (115)

Response: Editorial Correction. Text has been changed in the FEIS. (115)

Comment: Separation of Mitigation and Alternatives - CEQ regulations. (115)

Response: The inclusion of long term water treatment costs as part of the financial assurance calculation is not based on a "worst case" scenario. Analysis of the geochemical and hydrological characteristics of the ICP using the DSM model and other tools indicates that there is some uncertainty in predicting both chemical and hydrogeological conditions. Without collection and long term water treatment the DSM model predicts a slight and possibly measurable increase in copper concentration in Big Deer Creek following closure even under the 50% or expected case. In the 90th

percentile case the DSM predicts a likely exceedance of water quality standards. The 90th percentile case is not a "worst case" or contingency condition, but a situation that is expected to occur one out of ten times and is therefore considered by the agencies in the context of risk to the environment as reasonably likely to occur. It is therefore entirely appropriate to require a bond or other financial assurance for long term water treatment until such time that it can be demonstrated that long term water treatment will not be needed. (115)

Comment: Miscellaneous - confirmation of treatment process efficiencies. (115)

Response: The agencies approach to water treatment for Alternatives IV and V was to not dictate what type of water treatment equipment or processes be used, but rather let the required water treatability testing and water treatment design professionals advance a treatment plant design best suited to the project with two goals: effluent must meet NPDES effluent limits, and minimize water treatment waste. (115)

Comment: Miscellaneous - Colored shading add to Tables 4-8, 4-9, and all tables in Appendix B. (115)

Response: Tables have been modified. (115)

Comment: Miscellaneous - Section should be referring to Alt. III, not Alt. IV. (115)

Response: Editorial Correction. (115).

Comment Code	Letter No.	Comment Subject
NEPA-802-1	74, 108, 110, 113, 115	EIS Alternatives – Inadequate Alternatives

Comment: The DEIS fails to give a meaningful evaluation of alternatives to the proposed action. (108)

Comment: Effect Analysis - flawed development and description of alternatives and Purpose and Need. (115)

Response: The alternatives developed and analyzed in this EIS reflect not only the proponent's proposal, but scoping comments received from the public. The action alternatives analyzed represent a reasonable range of potentially viable design options for mining the identified ore body. Alternatives considered but dismissed include a broader range of options, but are generally not technically or economically feasible. Chapter 2 presents a detailed description of the alternatives and Chapter 4 contains the analysis of those alternatives.

The agencies developed a reasonable range of alternatives that include design and operational components, monitoring and mitigation measures intended to reduce identified impacts or to address issues raised during scoping. FCC could have included any or all of these components in its Plan of Operations, but chose not to. The level of detail included in the Alternatives is adequate for the analysis and comparison of impacts. Assumptions made about the effectiveness of standard water treatment technologies are based in part on limited treatment testing done by FCC, on effectiveness of treatment on similar waste streams and on best professional judgment. The analysis presented is intended to provide agency decision makers adequate information to make informed choices between alternatives.

The purpose and need statement has not been revised and the alternatives developed to meet the required evaluation of FCC's Plan of Operations under 30 CFR 228A is presented in this FEIS. (108, 115)

Comment: The DEIS has failed to consider a sufficiently broad array of alternatives including zero discharge and passive treatment. (74)

Comment: The agencies violated NEPA by not considering a reasonable range of alternatives. (110)

Response: The Forest Service believes the range of alternatives analyzed in the DEIS are compliant with NEPA's requirements in that they are reasonable, fulfill the purpose and need, and address the significant issues identified during scoping.

The 1872 Mining Law, as amended, and the regulation at 36 CFR 228.5 are the basis for the Forest Service purpose and need for proposals to explore and develop mineral deposits on unpatented mining claims. The 1872 Mining Law provides FCC the right to prospect, explore, mine, and all uses reasonably incident thereto, on its claims, subject to the Forest Service mining regulations at 36 CFR 228A. As discussed on page 2-1 of the DEIS, the regulation at §228.5 does not provide for the denial of a proposed plan of operations, but instead directs the Forest Service to specify changes or additions to said plan that it deems necessary to meet the environmental protection requirements of the 228A regulations. The Forest Service and the other involved regulatory agencies have determined that the changes and additions to be incorporated into FCC's plan of operations under the selected alternative will ensure that all applicable State and Federal water quality standards will be met.

In preparing the EIS, the Forest Service has complied with NEPA by considering a reasonable range of alternatives that fulfilled the purpose and need and addressed significant issues. Among the alternatives analyzed were a no action alternative (Alternative I), which analyzed the impact of not approving FCC's plan of operations; and utilizing the third-party Blackbird Treatment Plant to treat ICP mine water (Alternative V), which would be beyond the jurisdiction of the Forest Service to require. (74, 110)

Comment: The agencies violated NEPA by not considering a reasonable range of alternatives - should have developed an alternative for a water treatment discharge location to Panther Creek. (110)

Response: The FS considered but dismissed a discharge location to Panther Creek (see page 2-71 DEIS) due to: 1) the excessive length of the pipeline and associated costs and maintenance issues; and 2) greater impacts to Big Deer Creek due to the loss of treated water (reduced flows and higher metal concentrations).

As discussed on page 2-71 of the DEIS, a water discharge location in Panther Creek was considered but dismissed. This location was not considered because it would have required either an excessively long pipeline along an existing road, with associated cost and maintenance issues, or new access through an inventoried roadless area. In addition, it was determined that there would be less impact to area surface waters by returning treated mine waters to the basin from which it came. The commenter is incorrect in the assertion that road construction with an inventoried roadless area is illegal. The 2001 roadless area conservation rule provides seven exemptions from its road construction prohibition. The exemption at 36 CFR 294.12(b)(3) allows road construction associated with exercising of rights provided for by statute, which includes activities conducted under the 1872 Mining Law. (110)

Comment: EIS cannot justify an alternative without a specific plan. (113)

Response: The description of predicted effects of the operational and design modifications and mitigation measures that distinguish the alternatives have been discussed in sufficient detail in Chapters 2 and 4 of the EIS to ensure that environmental consequences have been fairly evaluated and disclosed. Final design level of detail is not required to illustrate alternatives under NEPA. Where submission of a detailed plan or design is required, the Forest Service will review the plan to ensure the anticipated effects are within the range of alternatives analyzed in this EIS. (113)

Comment: Inadequate identification and analysis of an appropriate range of reasonable alternatives. (113)

Response: The United States Mining Laws and Forest Service regulation at 36 CFR 228.5 form the basis for the Forest Service purpose and need for proposals to explore and develop mineral deposits on unpatented mining claims. This regulation does not provide for the denial of a proposed plan of operations, but instead directs the Forest Service to either approve the plan as proposed or specify changes or additions to said plan that it deems necessary to meet the environmental protection requirements of the 228A regulations. Consequently, the law and regulation influence the alternatives that the Forest Service analyzed in the EIS in detail. (113)

Comment: Cobalt recycle alternative to mining not evaluated. (113)

Response: An alternative to mining the Idaho Cobalt Project or substitutes for cobalt are beyond the scope of this EIS. The purpose and need for the EIS are grounded in the proposal to mine the resources identified by the project proponent. (113)

Comment: DEIS alternatives development and analysis is fundamentally flawed. (113)

Response: The EIS evaluates a reasonable range of alternatives that addressed the purpose and need as well as the significant issues identified through public scoping. Although the EIS considered the No Action alternative as required by 40 CFR 1502.14(d), the Forest Service is limited to selecting alternatives that satisfy its regulatory requirement to either: approve FCC's plan of operation as proposed; or identify changes or additions to the plan needed to satisfy its regulations for environmental protection. (113)

Comment Code	Letter No.	Comment Subject
NEPA-802-2	5, 16, 23, 47, 61, 76, 94, 105, 116, 138, 140, 143, 144, 145, 149, 152, 153	EIS Alternatives – Support Alternative II

Comment: Alternative II is stronger in terms of water quality because it has a better defined treatment system. (5)

Comment: Supports Preferred Alternative. Would like to see Formation involved in the Social-economics of Salmon. (16)

Comment: Support FCC design for pumpback wells and water treatment. (23)

Comment: I support Alternative 2 and I would encourage Formation and the Forest to exercise the proverbial bipartisan effort from both sides of the aisle to achieve a common denominator that would be beneficial to the community and to the environment. (47)

Comment: The proposed plan is superior. Some of the reasons why include: a better defined water treatment regime, properly segregating the waste rock from the tailings, a more reasonable approach to dealing with the roads to the mine . . . , planning for the future with a larger tailings and waste rock area that allows for future growth . . . (61)

Comment: Formation Capital's plan calls for the best water treatment processes. (76)

Comment: Formation Capital's plan has a very minimal above-ground footprint and manages waste rock separately to ensure it doesn't harm the environment. (94, 105)

Comment: Formation Capital's plan has a very minimal above-ground footprint and manages waste rock separately to ensure it doesn't harm the environment. Treated water will be cleaner than the natural water around it and reclamation is a main concern. (116, 143, 144)

Comment: I believe Alternative II is the better alternative for the environment as well as the economy. (138)

Comment: I support Alternative II, as the proposed action for this project, as I feel it better addresses some major environmental concerns, especially with regard to water. (140)

Comment: We believe that the superior option for the Salmon-Challis National Forest is to adopt Alternative II, as proposed by Formation Capital Corporation. (145)

Comment: I recommend that Alternative II, and the NPDES application as put forth by Formation Capital be selected and implemented. If those are not selected (If, for example, Alternative IV is chosen), I recommend you modify the Statement and Permit to be more closely aligned to the proposed action than say, Alternative IV currently does. (149)

Comment: I would like to express my support for alternative two proposed by Formation Capital which seems to be the best solution. (152)

Comment: Please move forward with permitting the Idaho Cobalt Project, preferably with Alternative II in the Draft EIS. (153)

Response: Your support for the selection of Alternative II as presented in the Draft EIS has been noted in the final review of this document and has been taken into consideration regarding the selection of the preferred alternative. (5, 16, 23, 47, 61, 76, 94, 105, 116, 138, 140, 143, 144, 145, 149, 152, 153 above)

Comment Code	Letter No.	Comment Subject
NEPA-802-3	18, 93	EIS Alternatives – Support Alternative IV

Comment: I endorse the development of the project and the alternative IV that has been selected. (18)

Response: Your support for the selection of an agency alternative as presented in the Draft EIS has been noted in the final review of this document and has been taken into consideration regarding the selection of the preferred alternative. (18)

Comment: Alternative IV and V both appear to be the best choices, as either option results in the smallest physical disturbance, would minimize the footprint and infrastructure requirements and include advanced water quality treatment. (93)

Response: Your support for Alternatives IV and V as presented in the Draft EIS has been noted in the final review of this document and has been taken into consideration regarding the selection of an appropriate alternative that meets all the goals of all parties as set forth in Chapter 1 of the DEIS. (93)

Comment Code	Letter No.	Comment Subject
NEPA-802-4	37, 110	EIS Alternatives – Support V

Comment: Supports moving forward with ICP. Supports Agency Preferred Alternative - would prefer Alt V in sense of efficiency, economics and more environmentally friendly. However, as expressed by the FS, one cannot force two parties to make one project. Cobalt is a strategic metal of growing demand and betterment of mankind. This is only known scalable deposit in North America and needs to be accessible for mining. (37)

Response: Your support for the selection of Alternative V as presented in the Draft EIS has been noted in the final review of this document and has been taken into consideration regarding the selection of the preferred alternative. (37)

Comment: The agencies violated NEPA by not considering a reasonable range of alternatives - Alt. V not viable because it requires an agreement between FCC and BMSG. (110)

Response: NEPA's implementing regulations at 40 CFR 1502.14(c) directs federal agencies to consider reasonable alternatives that are not within the jurisdiction of the lead agency. The commenter was not clear what "suggestions" were to be incorporated nor did they mention what issues were not addressed with the existing alternatives as grounds to develop an additional alternative to be selected as the environmentally preferred alternative. No additional alternatives were developed for the FEIS as a result of the comment. (110)

Comment Code	Letter No.	Comment Subject
NEPA-803	115	Cumulative Impacts

Comment: Cumulative Impacts Analysis - incomplete analysis process. (115)

Response: The cumulative effects analysis has been revised (FEIS starting on page 4-99) to include updated information and to provide additional details on past and present activities that may cumulatively affect resources also impacted by the ICP. (115)

Comment: Errors and omissions in the impact discussions - Alt. I is no action and no Ram or Sunshine Mines to affect Bucktail Creek drainage WQ. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the impact discussions - Failure to discuss traffic cumulative effects in historic terms. (115)

Response: The EIS analyzes impacts due to operation of the ICP using baseline data which documents present conditions. Baseline data on transportation is further documented in the "Idaho Cobalt Project Transportation Baseline Report and Transportation Plan" contained in the project record. The historic use of the proposed access route is not a cumulative impact. (115)

Comment Code	Letter No.	Comment Subject
NEPA-803-1	108, 110, 113	EIS Cumulative Impacts – Insufficient Analysis

Comment: The Tribe is concerned about the lack of an adequate cumulative impacts analysis. (108)

Response: The cumulative impacts of the Blackbird Mine site as well as ongoing and proposed activities in the vicinity of the ICP were addressed for each alternative in the DEIS (see pp. 4-91 to 4-103). The commenter is also referred to page 4-101 of the DEIS which specifically discusses cumulative effects to fishery resources. (108)

Comment: Difficulty in quantifying cumulative effects does not obviate the FS legal obligation. (108)

Response: The Forest Service is aware that difficulty in quantifying effects does not change any legal obligations that exist. However, qualifying the analysis presented in the EIS is an appropriate disclosure to the public that may allow for a better understanding of the document. The cumulative impacts of the proposed activities in the vicinity of the ICP were addressed for each alternative in the DEIS (see pp. 4-91 to 4-103). (108)

Comment: Failure to fully review all cumulative impacts from logging, grazing, recreation, fire, and other uses; global warming must be factored into the CE analysis. (110)

Response: Cumulative impacts are described for each resource in Chapter 4. For certain species or resources there may be no cumulative impacts with regards to one or more of the reasonably foreseeable activities identified. The cumulative impacts section has been modified in the FEIS both to bring it up to date and by adding additional details on past and present activities that may cumulatively affect resources also impacted by the ICP. The range of activities considered in the cumulative impact analysis focuses on past present and future actions that effect the same resources potentially impacted by the ICP. Past and present impacts to the environment in and around the ICP are primarily incorporated as part of the baseline conditions. While these conditions certainly vary from what they would have been without past natural and cultural influences the individual impacts to the existing environment are not evaluated in detail.

The reasonably foreseeable impacts evaluated focus on activities in nearby National Forest lands and the ongoing Blackbird mine site cleanup. Issues such as regional growth and global warming are of sufficiently different scale and extent as to be generally beyond the scope of this EIS. For example, the ICP will have a very minor cumulative impact on global warming and effects of climate change on the various resources in the vicinity of the ICP are difficult to predict both in time and in scale. (110)

Comment: DEIS doesn't adequately assess the cumulative impacts to water quality, fish populations and fishery recovery from ICP, existing Blackbird impacts, and other watershed activities. (110)

Response: The cumulative impacts of the Blackbird Mine site as well as ongoing and proposed activities in the vicinity of the ICP were addressed for each alternative in the DEIS (see pp. 4-91 to 4-103). This section of the EIS specifically discusses cumulative effects to both water quality and fishery resources. (110)

Comment: DEIS does not meet CE judicial review standard. (113)

Response: With additional detail included in the FEIS to address the combined effects of past and reasonably foreseeable actions, the FEIS satisfies NEPA's requisite "hard look" at cumulative effects. (113)

Comment Code	Letter No.	Comment Subject
NEPA-803-2	108	EIS Cumulative Impacts – Dust

Comment: Tribe is significantly concerned about transportation-related impacts; road/ sediment; accidentally spills; cumulative impacts from mine dust transportation route dust deposition. (108)

Response: The ICP proposes to resurface 10.9 miles of the Access route to mitigate sediment delivery to streams. The agencies propose under Alternatives III, IV and V to resurface the entire length of the Access route. The agencies also propose annual application of dust abatement treatments (see "Road Improvements" subsection under "Mitigation" in Chapter 2. Also see sections in Chapter 2: "Transportation of Personnel and Supplies," "Spill Control," "Other Mitigation"(bullet Enhanced emergency management capabilities..., and bullet Additional access road improvements), and "Spill Control" heading under "Emergency Management, Spill Control and Fire." (108)

Comment Code	Letter No.	Comment Subject
NEPA-803-3	108, 113	EIS Cumulative Impacts – BMSG

Comment: There is little discussion of full impacts from the nearby Blackbird Mine; details of this and other projects in the area need to be addressed. (108)

Comment: CE analysis flawed re: consideration of adjacent Blackbird Mine. (113)

Response: The past, present and future impacts of the Blackbird mine are carefully considered in the analysis of the ICP. The baseline conditions reflect both historic impacts and recent cleanup activities. Ongoing cleanup and future impacts from the Blackbird site are considered in the DSM analysis and described in the cumulative impacts section of Chapter 4. (108, 113)

Comment Code	Letter No.	Comment Subject
NEPA-804	113, 115	Mitigation Measures

Comment: Need for a specific, demonstrated, and binding mitigation plan. (113)

Response: Based on the analysis conducted for the ICP EIS, the Forest Service, EPA, and the Idaho DEQ have determined that the preferred alternative and its associated mitigation will satisfy their respective regulatory requirements. The Forest Service Record of Decision will require FCC to modify its plan of operations to incorporate the mitigation identified in the selected alternative before FCC's plan will be approved. This approach will bind FCC to perform the required mitigation before they proceed with the ICP. In addition, the selected alternative provides that the regulatory agencies and FCC will monitor effects and employ adaptive management procedures to make any needed adjustments to ensure compliance with environmental requirements. (113)

Comment: Need detail plans or solid guarantees for mitigation measures. (113)

Comment: Absence of solid, enforceable mitigation guarantees. (113)

Comment: Approval of the ICP without a specific, demonstrated and binding plan to avoid water quality and other environmental impacts would violate FS, EPA and IDEQ requirements and thus would be unlawful. (113)

Response: The various design components, monitoring and mitigation measures incorporated in the agency alternatives are intended to reduce environmental impacts and the risk of such impacts by the proposed mining operation. All design features, plans and mitigation measures included in whatever alternative is selected in the Record of Decision will be required to be incorporated into the ICP Plan of Operations. All of the components of the Plan of Operations are enforceable and must be implemented. The key design components included in the preferred alternative intended to protect water quality and to avoid adverse impacts to BMSG's activities are intended to provide multiple layers of protection. While both the backfill amendment and the groundwater capture and treatment systems may each alone be effective in achieving target water quality goals, the combination of systems is intended to assure that if one system does not function as predicted that there is a backup. Additionally, the application of the DSM modeling tool specifically looks at a range of effectiveness of key operating systems. (113 for all three above)

Comment: Muddled application of mitigation measures to some but not all alternatives makes a comparison among each other difficult - reorganization of mitigation measures descriptions and effects. (115)

Response: The FEIS has been modified to attempt to clarify mitigation components of the agency alternatives. (115)

Comment: Errors and omissions in the development of agency alternatives - unsupported alkalinity amendment to slash waste rock. (115)

Response: The Agencies are aware of a number of mining projects in which the average NNP of a waste rock facility was positive, yet the seepage from the pile was acidic. Early work with selective placement of alkaline waste rock as a mitigation measure was not always successful if the alkaline rock was placed as distinct alternating layers among acid generating waste rock. One problem with alkaline addition is that if acidic interstitial solutions form they can migrate into the alkaline rock unit and precipitate iron and aluminum oxyhydroxide precipitates on the carbonate minerals, which can reduce their reactivity. As a practical matter, acidic solutions may migrate through mixed acidic and

alkaline rock even when the overall average NNP is positive. As a consequence of concerns about the lack of success with some efforts to neutralize ARD potential, the Agencies are requiring a site-specific demonstration that the proposed style of mixing will successfully control pH. (115)

Comment: Unsupported assertions - Chapter 4, display effect of each alternative minus mitigation. (115)

Response: The agencies developed a reasonable range of alternatives that include design and operational components, monitoring and mitigation measures intended to reduce identified impacts or to address issues raised during scoping. FCC could have included any or all of these components in its Plan of Operations, but chose not to. The level of detail included in the Alternatives is adequate for the analysis and comparison of impacts. Assumptions made about the effectiveness of standard water treatment technologies are based in part on limited treatment testing done by FCC, on effectiveness of treatment on similar waste streams and on best professional judgment. The analysis presented is intended to provide agency decision makers adequate information to make informed choices between alternatives. (115)

Comment: Errors and omissions in the impact discussions - Alt. II cumulative effects re: low probability that could prevent attainment of WQ standards in Big Deer Creek. (115)

Response: As stated on page 4-95 of the DEIS, Alternative II water quality impacts have the potential to become significant. This is discussed in the Direct Effects sections on pages 4-30 and 4-31. (115)

Comment: Other - Alt II changes in WQ in Big Deer Creek are based on flawed analysis in subsequent sections. (115)

*Response: Please note that the referenced paragraph states: "It is **not** [emphasis added] likely that the model-calculated increase in copper would be measurable or would cause an exceedance of the water quality standard or cleanup goals in Panther Creek if it were to occur." There is no contradiction in this statement, contrary to what is implied by the comment.*

It is well established that the cumulative impacts of multiple pollution sources can sometimes cause an exceedance of water quality standards even though the individual sources do not. This is the basis of the federal Total Maximum Daily Load limitations. Similarly, cumulative impacts can be measurable even though individual impacts are not. (115)

Comment: Separation of Mitigation and Alternatives - CEQ regulations. (115)

Response: The inclusion of long-term water treatment costs as part of the financial assurance calculation is not based on a "worst case" scenario. Analysis of the geochemical and hydrological characteristics of the ICP using the DSM model and other tools indicates that there is some uncertainty (see pages 4-10, 4-11 FEIS) in predicting both chemical and hydrogeological conditions. Without collection and long-term water treatment the DSM model predicts that Alternative II would cause a slight and possibly measurable increase in copper concentration in Big Deer Creek following closure even under the 50% or expected case. In the 90th percentile case the DSM predicts a likely exceedance of water quality standards. The 90th percentile case is not a "worst case" or contingency condition, but a situation that is expected to occur one out of ten times and is therefore considered by the agencies in the context of risk to the environment as reasonably likely to occur. The Forest Service has determined that it is therefore entirely appropriate to require a bond or other financial assurance for long term water treatment until such time that it can be demonstrated that long term water treatment will not be needed. (115)

Comment Code	Letter No.	Comment Subject
NEPA-804-1	110	Mitigation Measures – Insufficient Detail

Comment: The DEIS relies on vague, untested, and unproven mitigation measures. (110)

Response: The mitigation measures identified for the ICP are based on agency experience with other mining operations throughout the country. The level of detail provided in the mitigation measures is appropriate for NEPA review and disclosure. Where additional detail is appropriate for the Plan of Operations, it will be required by the agencies. All components of the Plan of Operations will be covered by a bond or other financial assurance to ensure that agency requirements will be met. (110)

Comment Code	Letter No.	Comment Subject
NEPA-804-2	16, 113	Mitigation Measures – Effectiveness

Comment: I support the Project. Have the educational opportunities been explored? Working Laboratory High school students? College students? Is this type of opportunity being considered? (16)

Response: The agencies appreciate this comment which looks at opportunities potentially available through the ICP. However, the concept proposed is generally outside of the agencies authorities and would rely on the voluntary participation of FCC. The Forest Service is committed to working with the local community on this and other NFS projects and would consider participating in any educational activities associated with NFS resource development. (16)

Comment: DEIS fails to present specific plans, demonstrated effectiveness, and binding commitments to achieve the supposed effects of mitigation. (113)

Response: Approval of a Plan of Operations establishes an enforceable commitment on the ICP to achieve the stated goals and implement the Plan as described. The level of detail contained in the POO is necessarily greater than that contained in the EIS. The financial assurance required for the POO is intended to ensure the successful implementation of the Plan and accompanying mitigation measures. (113)

Comment Code	Letter No.	Comment Subject
NEPA-804-3	113	Mitigation Measures – Upfront Mitigation

Comment: Unacceptable postponement of mitigation until later stages of mine development. (113)

Response: The EIS identifies design components, mitigation measures and monitoring intended to reduce potential impacts from the ICP. The timing of implementation of these measures are specified in the Record of Decision and are intended to be protective of the environment. (113)

Comment Code	Letter No.	Comment Subject
NEPA-804-4	146	Mitigation Measures – Differentiate Alternatives

Comment: On the final EIS it would be helpful if the alternatives were stated with the facts of how they are to be carried out with out any mitigation. Mitigations measures should be separated out as a separate section for each alternative so the readers can easily differentiate between the alternatives. (146)

Comment: I found it difficult to determine what the impacts were when all of the alternatives (except for alternative II) included mitigation. There was an obvious effort in the DEIS to sway the readers opinion in favor of the Forest Service Alternative IV without any real science or evidence that the Formation Capital Alternative II would not work. There were allegations and statements, but no real scientific evidence shown in the report that proved Alternative IV was better than Alternative II. (146)

Comment: The sizing and location of the TWSF Formation Capital indicates that reserves are still open in strike and depth and there are likely several more years of reserves that have not been proven. The TWSF needs to be started in such a manner as to ensure it can easily be added to in the likely event more reserves are proven. If it is limited to only the current proven reserves, then the Forest Service is in effect creating the boom and bust outcome for the mine. (146)

Response: The FEIS has been revised in an attempt to more clearly differentiate design and operational components, monitoring and mitigation measures applied to agency alternatives. These additional Plan of Operation components are intended to address specific agency concerns and to meet the requirements of the 36 CFR 228A regulations. The level of detail provided for these additional components is intended to provide an adequate understanding of the project and to allow a decision maker to understand the benefits of the proposed modifications to the company's Plan. (146 for all above)

Comment: From an engineering standpoint the structure proposed by the Forest Service will need modification. Piles that are designed to come up to a narrow ridge or peak require a larger footprint in relation to the amount of actual tonnage you can store. Was there a stability analysis performed on this structure? (146)

Response: Yes, stability analyses were performed for the TWSF that covered both static and seismic design scenarios. (146)

Comment Code	Letter No.	Comment Subject
NEPA-804-5	109	Mitigation Measures – Remove mitigation

Comment: The DEIS contains a section called “Administration and Monitoring” beginning at DEIS 2-53. This section does not belong in an EIS. Instead of attempting to require certain processes, the EIS should simply state that the Forest Service and other agencies, as well as Formation Capital will comply with any and all legal requirements during the development and implementation of the ICP. Each agency should be free to administer its regulations and statutes in whatever way they see fit. Similarly, Formation Capital should be allowed to determine how they will comply with the applicable laws and regulations. This section of the DEIS should be removed. Also, in this other sections, the document appears to be a compliance order rather than a DEIS. NEPA is a procedural process; it is not a substantive process that requires a specific outcome. (109)

Response: The Forest Service is required by 36 CFR 228 regulations to approve the plan of operations as presented or to require changes that ensure the plan of operations complies with appropriate laws and regulations. The inclusion of plan requirements and mitigation measures that are necessary to achieve compliance with 36 CFR 228 and other federal and state requirements must be disclosed in the EIS in order to inform the applicant and the public of the changes in the company's proposal that the Forest Service feels are necessary. (109)

Comment Code	Letter No.	Comment Subject
NEPA-805	110, 111, 113, 115	Legal Authority

Comment: Perpetual water treatment needed; a violation of the Organic Act, 228 regulations and federal mining and public law. (110)

Response: Water modeling used to analyze the Project's impacts indicates the need for perpetual water treatment is a possibility, not a certainty. The Idaho Department of Environmental Quality and EPA both have concluded that the ICP can proceed in full compliance with water quality standards. No violations of law are contemplated or will be permitted. Under applicable regulations, reclamation includes isolation, removal, or control of toxic materials. Water treatment, if necessary, is an acceptable form of reclamation under the regulations. (110)

Comment: To the extent that either the USFS or EPA determines that the "legally applicable" standards for the Idaho Cobalt Project should be more stringent than an equivalent at the Blackbird Mine, then that more stringent standard would be applicable to the Blackbird Mine. (111)

Response: The 2003 Record of Decision for the Blackbird Mine Superfund Site and the supporting Administrative Record provide the technical basis and the rationale for the selected remedy for the Superfund Site. CERCLA and its implementing regulations do not apply to the review and approval process for a new mine operation nor permitting of new point source discharges under the Clean Water Act.

The USFS operating under the 36 CFR 228 regulations and required to maintain compliance with the Clean Water Act, and the Idaho Water Quality Standards and other laws and regulations has utilized the applicable standards in analysis of the Idaho Cobalt Project. (111)

Comment: FS obligation to protect the environment being severely compromised. (113)

Response: The Forest Service will only authorize a plan of operations in compliance with all applicable laws and regulations. (113)

Comment: Purpose and Need - objection to DEIS description. (115)

Response: The proposed Federal action described in the DEIS is consistent with CEQ regulations (40 CFR 1508.18(b)(4)) and Forest Service guidance (FSH 1909.15.05) which dictate that the proposed action is "a proposal made by the Forest Service to authorize, recommend, or implement an action to meet a specific purpose and need." Hence, the proposed action is for the Forest Service to approve the proposed plan of operations for construction, operation, and reclamation of a cobalt mine, and determine if changes or additions to the proposed plan are needed to meet the

requirements for environmental protection set forth in regulations at 36 CFR 228 Subpart A. The recovery of metals and development of economically viable resources is the purpose of FCC's mining proposal, not the purpose or need for the proposed Federal action, which is to review and approve the proposed plan of operations for the mine in accordance with the regulations at 36 CFR 228 Subpart A. (115)

Comment: Legal Requirements - inaccurate description of applicable law and agency jurisdiction, Table 1-1 corrections. (115)

Response: Table 1-1 has been edited in the FEIS to include many of the commenter's suggestions. However, the agencies do not agree with the commenter's assertion regarding EPA, as the EPA does have some oversight responsibility for CWA programs delegated to the State per 40 CFR Part 123, Subpart D. There is no mention of IDEQ's policy and rules with respect to mineral extraction as it would go beyond the purpose of the Table to identify needed permits, approvals, and consultations. (115)

Comment: Legal Requirements - incorrect description of decision process and application of NEPA, POO/ROD. (115)

Response: The ROD for the EIS satisfies the requirement of 40 CFR 1505.2 to document the rationale for the Forest Service decision to approve the plan of operations. The plan of operations will be executed subsequent to issuance of the ROD in order to implement the decision described in the ROD in accordance with 36 CFR 228.5. The signed plan of operations is the document, which will authorize FCC to use of National Forest System lands for mining operations. There may be some additional requirements prior to execution of the approval of the plan of operations, such as submission of required surety, revision of the Plan of Operations and submittal of certain designs or plans. Approval of subsequent supplements and modifications to the original plan of operations may require additional environmental analysis under NEPA if there are new operations proposed or new information not adequately considered in this EIS. (115)

Comment: Legal Requirements - incorporation by reference of Project Record. (115)

Response: The requirements of 40 CFR 1502.21 are satisfied as documents incorporated by reference are individually described throughout sections in the EIS where they are used. Furthermore, Appendix A provides a comprehensive list of all documents that were in the analysis of the ICP and alternatives. The page referenced by the commenter has been edited in the FEIS to reflect that while the project record includes information used in the decision-making process, not all documents in the project record are incorporated by reference. (115)

Comment: Legal Requirements - removal of "Administration and Monitoring" section from EIS. (115)

Response: We did not make any changes to the EIS as a result of the comment. Although the majority of discussion included in the referenced section is not a procedural requirement of NEPA, the Forest Service thought it appropriate to inform the public of how the regulatory agencies would interact in administering this complex project. (115)

Comment: Legal Requirements - no requirement for FS identification of an environmentally preferred Alt. (115)

Response: The commenter is correct in that the environmentally preferable alternative is only required to be identified in the Record of Decision per 40 CFR 1505.2(b). However, CEQ encourages agencies to make recommendations of the environmentally preferred alternative during EIS preparation (see Forty Most Asked Questions, Answer to Question 6b). This section has been edited in the FEIS to reflect this distinction. (115)

Comment: Legal Requirements - regulatory and legal mischaracterization of ICP waste materials. (115)

Response: The distinction between processing and beneficiating for the purposes of applying RCRA Subtitle C regulations is noted. The use of the term "processing" in the EIS is consistent with how the term was used in FCC's proposed plan of operations. The generic use of the term is adequate for the purpose of disclosing impacts in the EIS and is not meant to interpret the applicability of RCRA regulations. (115)

TRANSPORTATION

Comment Code	Letter No.	Comment Subject
ROAD-900	115	Proposed Access Route and Improvements

Comment: Access - arbitrary requirements. (115)

Response: The most recent available ADT data for the Williams Creek access route was acquired during the period of July 2003 to July 2004 (Table 3-13, DEIS). ADT during that period varied from 93 to 33 and averaged 66. Traffic associated with the ICP will add 34 ADT (Table 2-1, DEIS), increasing ADT 37% to 100% (average 52%). ADT data does not discriminate between permitted Forest road users and general public. The Forest Service and the Project will negotiate an agreement on sharing costs on specific items of Project Access route mitigation. The negotiated agreement will be included in the Project's road use permit. (115)

Comment: Access - Separate ROWs for Blackbird Mine and Cobalt townsite. (115)

Response: The agencies understand that the Project is pursuing an access agreement through the Blackbird mine site and will provide documentation of that agreement when it becomes available.

Access through rights-of-way for use by corporate entities is required to conduct commercial activities through private property. Access via the Morgan-Panther Creek route was evaluated and deemed not acceptable (See Transportation Technical Report). Using the Morgan-Panther route would require changing the Plan of Operations submitted by Formation and further analysis of the Morgan-Panther route. (115)

Comment: Access - Arbitrary and capricious requirements for project access route roads. (115)

Response: Traffic related to the ICP will constitute up to 100% higher ADT on the Williams Creek route. ICP will be the major user, and as such, the agencies have determined Formation should finance a major portion of maintaining the access route. (115)

Comment: Access - stream sediment reduction. (115)

Response: Additional resurfacing of the access route proposed by the agencies will reduce wear on the road surface and provide a safe route for mixed commercial and recreational users, as well as further mitigate sediment delivery to streams. (115)

Comment: Access - Blackbird Creek Road/turnouts. (115)

Response: Text in the DEIS is in error and has been revised in the FEIS (note that it is correctly identified on Figure 4-1). The agencies want five turnouts constructed between M.P. 38.7 and 39.0 because this section of road is too narrow for safe passing of vehicles. Increased traffic on this section of road will be entirely due to operation of the ICP and the agencies deem it reasonable for Formation to fund necessary improvements for the safety of both ICP workers and workers associated with the BMSG. (115)

Comment: Errors and omissions in the impact discussions - Failure to discuss traffic cumulative effects in historic terms. (115)

Response: The EIS analyzes impacts due to operation of the ICP using baseline data as provided in the "Idaho Cobalt Project Transportation Baseline Report and Transportation Plan." (115)

Comment Code	Letter No.	Comment Subject
ROAD-900-1	23, 81, 115	Proposed Access Route and Improvements – Upgrade

Comment: Support phased road resurfacing. (23)

Response: Road resurfacing proposed by the Project coupled with additional resurfacing proposed by the Forest Service will, over the life of the Project result in resurfacing of the entire access route. (23)

Comment: The additional miles of upgrading for the access road would be helpful but does put extra costs on the company for roads used by a variety of forest users. Within the mine site, a tram system would be great if operation can pay for the cost. A tram would reduce truck traffic between the mill and portal on a dangerously steep slope. (81)

Response: Traffic related to the ICP will constitute up to 100% higher ADT on the Williams Creek route. The ICP will be the major user, and as such, the agencies have determined the ICP should finance a major portion of maintaining the access route. The Project intends to construct and employ a tram if it will reduce operational costs. Site road engineering (i.e. slopes) accounts for the type of vehicles using the road. (81)

Comment: Access - stream sediment reduction; additional mitigation not necessary. (115)

Response: Additional resurfacing of the access route proposed by the agencies will reduce wear on the road surface and provide a safe route for mixed commercial and recreational users, as well as further mitigate sediment delivery to streams. The sediment reduction to streams along the access route would only occur after road improvements are completed and a small sediment increase is expected in the first years of the project. (115)

Comment: Access - Blackbird Creek Road/turnouts. (115)

Response: The agencies have identified the need for five turnouts to be constructed between M.P. 38.7 and 39.0 (this section was correctly shown on Figure 4-1, but incorrectly referenced as M.P. 36.6 to 38.7 in the DEIS text) because this section of road is too narrow for safe passing of vehicles. Increased traffic on this section of road will be entirely due to operation of the ICP and the agencies deem it reasonable for Formation to fund necessary improvements for the safety of both ICP workers and workers associated with the BMSG. (115)

Comment Code	Letter No.	Comment Subject
ROAD-900-2	93	Proposed Access Route and Improvements – Busing

Comment: We support the Forest's Road Use Permit proposal that at least 80% of employees be bused or van-pooled to the work site. (93)

Response: The Forest Service has identified busing as a way to reduce the traffic load on the forest road system to increase safety and reduce environmental impacts. (93)

Comment Code	Letter No.	Comment Subject
ROAD-900-3	107	Proposed Access Route and Improvements – Maintenance

Comment: We would recommend that the mining operation take over maintenance of the road from Highway 93 to the mine itself, thus allowing the County greater ability to maintain the other roads of the county, which would doubtlessly carry a greater vehicle load as a result of the population influx. (107)

Response: A Road Use Agreement between the Salmon-Challis National Forest and Formation Capital will specify maintenance responsibilities and may include payments for deferred road maintenance (such as surface, culvert or bridge replacement), and periodic maintenance (grading, cleaning culverts) for roads within the Forest based on ICP's projected road use. (107)

Comment Code	Letter No.	Comment Subject
ROAD-900-4	108, 110	Proposed Access Route and Improvements – Impacts

Comment: Nez Perce Tribe is concerned about the use of roads and facilities in riparian areas; re: compliance with INFISH standards. (108)

Response: Distance to streams from Project Access route alternatives was considered in the Project Access route selection (see "Idaho Cobalt Transportation Technical Report"). Of currently developed roads, the Williams Route has the least amount of stream within 300 feet of the road. The only Project Site roads in riparian areas are Tertiary roads, proposed for seasonal use or intermittent use. (108)

Comment: Tribe requests FS to the maximum extent possible, locate new roads, and relocate old roads to ridgetops; reduce open road density. (108)

Response: There are minimal (<1 mile) new Site roads in riparian zones. All of these are Tertiary roads, proposed for seasonal or intermittent use. Relocating existing Project Access or Site roads to ridge tops is infeasible. Road densities in the vicinity of the Project will be reduced through decommissioning of existing non-essential roads (See section "Project Site Roads" in chapter 4). A total of 40,000 feet of un-needed roads are proposed for reclamation. (108)

Comment: Large amount of new road construction will destabilize the slopes and lead to mass slope failures. (110)

Response: New road construction associated with the ICP is quantified in Table 4-13. These new roads would be required to be constructed to meet Forest Service standards. There would be a net decrease in total road miles due to reclamation of existing roads. Roads have been designed to be geotechnically stable (see Idaho Cobalt Project Transportation Baseline Report and Transportation Plan). Project access routes and site roads have been selected to provide minimal access to the Project and to Project facilities. Road density will decrease due to reclamation of approximately 4.5 miles of site roads under Alternative II or 7.6 miles under Alternatives III, IV, and V.

There are numerous examples of successfully recontoured and revegetated roads in similarly steep terrain on the Salmon-Challis National Forest. (110)

Comment Code	Letter No.	Comment Subject
ROAD-900-5	110	Proposed Access Route and Improvements – Roads Analysis

Comment: The FS should require a much greater concurrent reclamation package; FS should use a completed Roads Analysis for informed decisions. (110)

Response: The company's proposed reclamation plan contains a commitment to concurrent reclamation. In evaluating their plan the agencies identified one primary area that could speed the rate of reclamation where the TWSF would not receive final cap and revegetation to allow placement of water treatment wastes. The preferred alternative would require reclamation of the final portion of the TWSF at closure and off-site disposal of any water treatment wastes. Turkey Tracks Enterprises completed a roads analysis for the Idaho Cobalt Project (2005a). The Transportation technical report prepared by the Agencies (Hydrometrics and Smith, 2006) considered six possible Project Access routes. Analysis included proximity to streams as related to sedimentation and potential accidents related to hauling materials considered hazardous to aquatics. Analysis also considered anticipated increased and current traffic loads, road standards, road maintenance, public safety, underlying land ownership, issues with roadless areas and wild and scenic river designations and total length of the Project Access Route alternatives. (110)

Comment Code	Letter No.	Comment Subject
ROAD-900-6	110	Proposed Access Route and Improvements – Safety Standards

Comment: Non-negotiable road closure safety standards needed. (110)

Response: The Forest Service administers all Project Access and site roads on National Forest System Lands. On National Forest System Lands the Project will be subject to Forest Service road use restrictions, including closures due to storms and other hazardous travel conditions. (110)

Comment Code	Letter No.	Comment Subject
ROAD-900-7	23, 121	Proposed Access Route and Improvements – Switchback Modifications

Comment: Oppose Williams Creek road switchback modification. (23)

Comment: Mitigation measures beyond those that mitigate for direct impacts from the mine project should be removed. An example being the reconstruction of the Williams Creek road between mile posts 7.1 and 8.1; this work is expensive, does not enhance safety in any proportionate way to cost, drastically alters the view-shed, and might even be called a “pork project” as the USFS already has a new road designed and has been looking to fund its construction for years. One small portion of this entire road-segment, a particular switch-back, has been labeled as a “safety concern.” This particular switch-back turn could use an additional length of culvert and some fill to reduce the risk of large semi trucks from becoming stuck here as they occasionally did in the past while freighting hundreds of loads to the Beartrack Mine. The as-is switchback should be labeled as more of an obstruction, as little property damage and no injury ever occurred from stuck semi-trucks at this location: they simply needed to be pulled out. (121)

Response: The Forest Service considers the switchback section of the Williams Creek Road to be hazardous, especially for larger vehicle traffic. Past accidents, particularly involving large trucks, provide evidence of the hazard risk in this section. Reducing hazardous sections of road, especially sections within 300 feet of a stream, will further mitigate potential for hazardous spills reaching a stream during transport of mine related reagents, chemicals, and operating supplies. The preliminary design has been completed as part of the ICP analysis and funding for construction will be done in conjunction with the ICP project. (23, 121)

Comment Code	Letter No.	Comment Subject
ROAD-901	113, 115	Access Route through Blackbird Mine Site

Comment: Objections: ICP access to Noranda's property and use and reclamation of roads used to access BMSG facilities. (113)

Response: The Forest Service has no authority to require BMSG to grant FCC easements of any kind. The EIS assumes that if the ICP is going to go forward that they will have obtained agreements with BMSG. The FEIS and ROD attempt to clarify this issue by indicating that obtaining these access agreements is required prior to approval of ICP's Plan of Operations. (113)

Comment: Access - Separate ROWs for Blackbird Mine and Cobalt townsite. (115)

Response: The agencies understand that the ICP is pursuing access through the Blackbird mine site and will provide documentation of that agreement when it becomes available.

No right of way currently exists for the existing road through the Cobalt Townsite. If ICP obtains a ROW they shall convey the ROW to the FS. (115)

Comment Code	Letter No.	Comment Subject
ROAD-901-1	115, 155	Access Route through Blackbird Mine Site – Impacts to BMSG

Comment: Errors and omissions in the development of agency alternatives - include description of additional road closure and reclamation re: effects on Blackbird Mine cleanup and other activities in drainage. (115)

Response: Specific road segments to be reclaimed at the inception of project construction are shown on Figure 6-3 in the "Idaho Cobalt Project Transportation Technical Report." The inventory of roads to be reclaimed was developed in consultation with the BMSG and the FS to facilitate ongoing and future BMSG cleanup activities and site administration. (115)

Comment: No analysis of BMSG impeded access to Blackbird Mine site and ability to comply with Consent Decree in the event of obstruction to traffic due to increased traffic, accidents or road obstruction on access roads. (155)

Response: The possibility of an accident temporarily impeding access on the narrow mountain roads is a realistic scenario. The increased traffic, particularly large truck traffic, associated with the ICP will increase the likelihood of accidents. However, the likelihood that a vehicle accident would have a significant or long term effect on access to the BMSG or would materially affect the BMSG's ability to comply with requirements of their Consent Decree and UAO are remote. Additionally, the majority of the access roads that would be utilized by the ICP are public facilities and not maintained for the sole convenience of the BMSG. (155)

Comment: Use of the Blackbird Creek road by the ICP would increase access and reduce security at the Blackbird Mine. (155)

Response: The gate at the entrance to the Blackbird mine site has been observed to often be left unlocked, potentially leaving the site unsecured. Frequent traffic by other authorized users will be just as likely to provide a higher level of security as it would to reduce security. If the BMSG requires additional security measures due to implementation of the Project, those measures can be part of the road use permit agreed upon by the Project, BMSG, and FS. (155)

Comment: ICP would adversely impact Transportation Routes and Power Lines used for the Blackbird Mine site remedial actions. (155)

Response: The Forest Service cannot require that agreements be reached for access and power supply; however, these are the assumptions provided in FCC's Plan of Operations and analyzed in the EIS and would be included in any approved Plan of Operations. Alternative access and powerline routes were evaluated but dismissed. (155)

Comment: The proposed use and/or closures of site roads are not acceptable to the BMSG. (155)

Response: The inventory of roads to be closed was determined in consultation with the agencies and a representative of the BMSG. The segment of road in question below the Ram Portal is considered by the agencies to be an over-steep shortcut that is unnecessary for access to BMSG facilities. The agencies consider the road to be left in place to be adequate in providing access to the same destination(s) as the road segment to be reclaimed. The realignment of the road to the Bucktail drainage is shown on Figure 2-11. (155)

Comment: Many collection and conveyance structures, such as diversion and collection ditches, collection sumps and drops structures, and pipelines are located adjacent to or within the roadways. Along portions of Blackbird Creek and Meadow Creek, the primary access roadway is constructed directly over a low-permeability cover and collection systems for contaminated groundwater. Excursions of vehicles or equipment off the roadway, either intentional or accidental, can impact the integrity of the cover. (155)

Response: The BMSG and EPA would have to agree to use of or any design changes to access roads through BMSG property. The EIS assumes that ICP use and maintenance of the access route could be designed and conducted in a manner that does not pose an unacceptable risk of damage to the existing infrastructure. If that were not the case, it is assumed that BMSG and EPA would not allow access. (155)

Comment Code	Letter No.	Comment Subject
ROAD-902-1	5, 14, 16, 41, 49, 50, 53, 114, 117, 118, 119, 120, 143, 160, 161	Morgan Creek Road/Alternative Access Routes – Support Morgan Creek Route

Comment: Alternative II is more reasonable with regards to surfacing the road from Salmon toward the mine. Please also give proper consideration to allowing worker traffic to the mine from Challis as well as Salmon. Doing so will reduce traffic on the road from Salmon as well as traffic on Highway 93, making for safer travel all the way around. (5)

Comment: Believes the Morgan Creek Road should be considered an approved route to the project year-round. It could boost local economy in the Challis area if workers and supplies had access by this route. (14)

Comment: I'm in support of the Cobalt Project. How will the environmental community "rock-throwers" delay or hinder the process? (16)

Comment: Any transportation access upgrades through Morgan Creek? (16)

Comment: Morgan Creek Road on the Custer County side should be included . . . Safe and accessible way for job opportunities. (41)

Comment: I would like the Morgan Creek road to be open so the community of Challis is able to utilize it the same as Salmon can utilize Williams Creek. (49)

Comment: I totally support this project. We have an empty school building we need Morgan Creek open. I would appreciate if you would look at that heavily like you just discussed because we need access. (50)

Comment: We believe that both the Morgan Creek access and the Williams Creek access would be beneficial to all parties concerned. Having two accesses provides safety to the mine and its employees in the event of an emergency response or evacuation from the mine site. Opening two accesses would reduce the biological and environmental impact on the area by diverting road traffic in two directions as opposed to over-utilizing one sole corridor. (53)

Comment: I also support the idea of having the Morgan Creek Summit plowed in the winter so that miners coming from Challis can have a shorter commute to work during the winter. (114, 117, 118, 119, 120)

Comment: Additionally, please consider allowing a transportation corridor to the mine from Challis. This would alleviate traffic through Salmon and allow residents of Challis the ability to hold a steady job from Formation Capital's mine as well. The Morgan Creek road thus should be improved by the Forest Service and cost should not be charged against costs allocated to the mining project. (143)

Comment: Support mine, wants Morgan Ck road access for Challis workers. (160)

Comment: Wants Morgan Ck road open for Challis workers. (161)

Response: The EIS analyzes the use of the Morgan Creek road and concludes that using the Williams route has fewer impacts than using the Morgan route. The Morgan route would experience significant increases in traffic, especially in the winter, leading to potential increases in sediment delivery to streams. There are more streams proximate (within 300 feet) of the Morgan route than the Williams route. The Morgan route would require extensive upgrades to accommodate vehicles delivering materials to the mine site. It is anticipated that most mine workers will be coming from the Salmon area and the Morgan route would be a much longer commute for them. The Morgan route would have to be maintained year-around increasing maintenance costs.

Potential mine workers residing in the Challis area would be able to use the Morgan Creek access route while it is accessible. The Project, and Alternatives considered in the EIS, require extensive upgrades to the Williams Creek access route to enhance safety, mitigate sediment delivery to streams, and provide emergency response protocols for potential hazardous material releases. Using the Morgan Creek access route year-round would require similar upgrades to comply with Forest Service requirements, especially for transportation of reagents, chemicals, and other operating supplies. These upgrades would be the Project's responsibility. (5, 14, 16, 41, 49, 50, 53, 114, 117, 118, 119, 120, 143, 160, 161)

Comment Code	Letter No.	Comment Subject
ROAD-902-2	42, 93	Morgan Creek Road/Alternative Access Routes – Impacts

Comment: DEIS should specify how increased traffic on Morgan Creek will be documented and how the effects of increased traffic will be mitigated. (42)

Comment: Permitting alternative routes (e.g. Morgan Creek Summit) will unnecessarily spread the direct/indirect impacts of increased vehicle traffic over the landscape and decrease the potential of many other aquatic and terrestrial habitats. (93)

Response: Traffic on the Morgan Creek route may consist of light vehicles occupied by mine workers from the Challis area. These workers will be encouraged to ride employee buses from Salmon, which will be the only way into the Project during the winter. Traffic and mitigation of traffic on the Morgan

Creek route are not proposed to be part of the Project road use permit. All reagents and operating supplies will be transported via the Williams Creek access route. Use of the Morgan-Panther Creek route was evaluated and deemed not acceptable as a primary access route (See Transportation Technical Report). Using the Morgan-Panther for other than individual employee seasonal access would require changing the Plan of Operations submitted by Formation and further analysis of the Morgan-Panther route. (42, 93)

Comment Code	Letter No.	Comment Subject
ROAD-902-3	65	Morgan Creek Road/Alternative Access Routes – Oppose MC Route

Comment: I don't believe Morgan Creek Road would be a good alternative for employee travel in the winter as Morgan Creek Summit on the north slope will take a major amount of upgrade to make it safe in slick conditions. (65)

Response: The Morgan Creek road was considered as a Project Access route and rejected, in part, because of the need for major upgrades and winter access. (65)

Comment Code	Letter No.	Comment Subject
ROAD-902-4	155	Morgan Creek Road/Alternative Access Routes – Inadequate Analysis

Comment: No adequate analysis of alternative access routes provided in DEIS. (155)

Response: Access routes via Big Deer Creek, Little Deer Creek, the Salmon River, Morgan Creek and Moccasin-Napias Creeks were considered in more detail in the Transportation Technical report prepared for the EIS. The Moccasin-Napias route was dismissed because this route would require extensive upgrades to handle proposed traffic loads (currently an objective ML2 road), the route is proximate (<300 ft) to streams along much of it's length, grades are too steep for loaded truck traffic, and the route is not maintained in the winter. The Salmon River route was dismissed as an alternative because portions of this route experience a large amount of recreational traffic and would require extensive upgrades for safety and stream proximity issues. The Salmon River route has the most miles of stream proximate to roads when compared to the other alternatives, and therefore the greatest risk associated with spills, and Project traffic along this route is not considered compatible with the Wild and Scenic River classification for the Salmon River. The Little Deer Creek alternative was dismissed as an alternative because it would require building a major new bridge across Panther Creek adversely affecting the creek's eligibility as a Wild and Scenic river and would require approximately 8 miles of new road in an area managed under a Roadless classification. Big Deer Creek was dismissed as an alternative because developing this route would require two new major bridges, one over Panther Creek and one over Big Deer Creek. The bridge over Panther Creek would affect the creek's eligibility as a Wild and Scenic river. The Big Deer route would require upgrading 5.5 miles of primitive access, four miles of which would be within riparian habitat conservation area, and 3 miles would be within a roadless area. There are also Native American Cultural resources along the Big Deer route. Analysis of the Morgan Creek route, when compared to the Williams Route, found that the Morgan Creek route had more proximate stream miles, 41 miles versus 26 miles, thereby increasing the risk from spills. Additionally, the Morgan Creek route would also require more additional maintenance since it currently is not kept open in the winter. The Williams Creek route was selected as the better alternative when considering stream proximity and additional maintenance issues. The Williams Creek route is also shorter (about 6 miles) than the Morgan Creek route (assuming the preponderance of traffic is expected to emanate from Salmon). (155)

Comment Code	Letter No.	Comment Subject
ROAD-903	115	Road Reclamation

Comment: Access - agency identified additional site road's reclamation during construction phase. (115)

Response: The agencies deem it appropriate that all unnecessary roads in the Project area be reclaimed as part of the ICP. Additional road reclamation will further mitigate impacts from the Project. Additional roads identified by the agencies for reclamation were selected in consultation with a representative of the BMSG and will not interfere with BMSG's continued CERCLA activities. (115)

Comment Code	Letter No.	Comment Subject
ROAD-903-1	115	Road Reclamation – Switchbacks

Comment: Access - new section of road to replace switchbacks on Williams Creek road not adequately analyzed. (115)

Response: The section of Williams Creek road proposed to be relocated is intended to improve public safety and reduce the risk of mine related traffic from having an accident. (115)

Comment Code	Letter No.	Comment Subject
ROAD-903-2	67, 93, 110	Road Reclamation – Reclaim Old Roads

Comment: Concerned about the large volume of exploration roads in the project area and the cumulative effects of these former exploration activities and the new exploration proposal. The Forest Service should examine the environmental effects of the overall road density and road density within Riparian Habitat Conservation Areas, including Total Soil Resource Commitment and Detrimental Disturbance. The Forest Service should evaluate the condition of Forest Service roads in the area and need for maintenance, reconstruction, realignment, or reclamation as part of this project. (67)

Response: There will be a net decrease of exploration roads (site roads) when the Project is constructed. Any additional roads constructed for exploration during the mine life will be reclaimed when they are deemed no longer useful. Reduction in bonding for exploration roads is contingent on successful reclamation. The condition of Forest Service roads to be used for Project access has been assessed and mitigation for impacts to these roads are included in the agency alternatives. (67)

Comment: We recommend that all newly constructed roads be decommissioned and obliterated at the end of the mining project. The exception would be those absolutely necessary to maintain water treatment efforts and for administrative purposes. FCC proposes reclamation of 23,000 feet of road. Agencies identified and additional 17,000 feet of roads for reclamation . . We support reclamation of the additional 17,000 feet of roads. (93)

Response: As you have noted, the Company's proposal calls for the reclamation of approximately 23,000 feet of substandard and non-essential roads during the construction phase of the Project. Under the preferred alternative the Company will reclaim, during the construction phase, the additional 17,000 feet of site roads that has been identified by the Agencies. In addition, all new roads that are constructed under all alternatives will be reclaimed at closure, except those identified

as roads to be used for administrative purposes. Your support for the reclamation as detailed for the alternatives has been noted. (93)

Comment: Suggest mitigation of roads to protect variety of resources. (110)

Response: Vehicle collisions with wildlife always occur along highways or roads. The Plan of Operations will require that most workers be van pooled to the project area to reduce the total amount of vehicle traffic on access roads. From the Blackbird Mine gate to the project site vehicles will be required to travel at slow speeds. (110)

Comment Code	Letter No.	Comment Subject
ROAD-904-1	110	Exploration Roads – Include Analysis

Comment: Additional exploration, drilling, access road construction, or development needs to be disclosed and analyzed as part of the revised DEIS. (110)

Response: Formation has proposed approximately, 20,000 feet of exploration access over the course of the mine life within the claim block. Site specific analysis of these plans will be conducted upon submission of the plans and will entail, low impact, full bench and full reclamation of all activities upon completion. The estimated disturbance and potential impact of future exploration activities is addressed in the cumulative effects analysis. (110)

POWERLINE AND PIPELINES

Comment Code	Letter No.	Comment Subject
PP-1000	113, 155	Power Transmission Line and Pipelines

Comment: Objections: ICP access to Noranda's property and use of the power line for existing mine treatment plant and Noranda property. (113)

Comment: The BMSG does not agree to any new uses that could interfere with consistent and reliable supply of power to the remedy. (155)

Response: The DEIS did not intend to imply that the ICP would use any of BMSG's power supply facilities without BMSG's consent or that modifications to the power supply system would not be required. The intent of the analysis was to identify an appropriate route for bringing power to the ICP site. It will be up to the ICP and Idaho Power to determine the line and substation requirements necessary to supply the ICP. It will also be up to BMSG to agree or deny ICP use of any of the power supply system that BMSG owns. The intent of the statement indicating a need for an agreement between ICP and BMSG was to indicate that use of these lines would be subject to BMSG's agreement. Sections of the FEIS describing the power supply system have been modified to clarify this.

An agreement between the Project and the BMSG will be required to upgrade the existing power line to accommodate the Project's power requirements. (113, 155)

Comment: ICP would adversely impact Transportation Routes and Power Lines used for the Blackbird Mine site remedial actions. (155)

Response: The Forest Service can not require that agreements be reached for access and power supply; however, these are the assumptions provided in FCC's Plan of Operations and analyzed in the EIS. Alternative access routes were evaluated but dismissed. Agency analysis has determined that with appropriate upgrades there would be no significant impacts to BMSG associated with the use of the proposed access route and power line; however, it will be up to the ICP to obtain approval to utilize any private property. Specific concerns on road access in the vicinity of the 7000 dam have been addressed by rerouting the road access to the Bucktail drainage. The design and improvement of the power line and substation to adequately service both BMSG and the ICP is up to those two private parties and Idaho Power Company. (155)

RECREATION

Comment Code	Letter No.	Comment Subject
REC-1100	110	Recreation - Mitigation

Comment: Appreciate that workers will not be allowed to carry firearms, and request that this condition be extended to fishing equipment and OHVs as well; FS should review and design a series of trails to accommodate increased use and include in NEPA analysis; adverse effect on hunting and fishing opportunities. (110)

Response: Workers will be transported by vans to and from the work site by FCC for the sole purpose of work employment. Possession and use of fishing equipment and OHVs by mine workers being transported to and from the mine site by FCC is not relevant to the FCC's mine worker transportation situation.

Based on the recreational use increase experienced involving existing FS trails associated with the previous construction and operation/closure of the nearby Beartrack Mine in the same general area and transportation route, and involving a similar number of mine employees, there is no reasonable expectation that the FS will need to design a series of trails to accommodate increased use of the area by FCC mine employees and their families. (110)

WILDERNESS AND ROADLESS AREAS

Comment Code	Letter No.	Comment Subject
WLD-1200	115	Frank Church River of No Return Wilderness Area

Comment: Errors and Omissions in describing the existing environment - show cobalt mining Special Management Zone on Figure 3-17. (115)

Response: Information regarding the Congressional Reservation of a portion of the Frank Church River of No Return Wilderness Area for cobalt mining has been added to the FEIS text. (115)

Comment Code	Letter No.	Comment Subject
WLD-1201	54	Roadless Areas

Comment: Designate each of the following areas as wilderness: Panther Creek (41000 acres) and South Panther Creek (7800 acres). (54)

Response: Thank you, but your comment is outside the scope of this EIS. Wilderness areas can only be designated by a Congressional Act. (54)

Comment Code	Letter No.	Comment Subject
WLD-1201-1	110	Roadless Areas – No Impacts to Roadless

Comment: The proposed pipeline maintenance road and the Deer Creek pipeline are in violation of Roadless Use, 66 Fed. Reg. 3244. (110)

Response: Roadless Rule 66 Fed. Reg. 3244 doesn't preclude building new roads in designated roadless areas. Additionally, activities under the 1872 Mining Law constitute a preexisting right under law that would allow roads to be constructed within inventoried roadless areas. See sections on "Land Use-Summary," and "Land Use" in Chapter 4. Roads and pipelines associated with the Project are required to "access the claims." Claims include mineral rights and access to those minerals. In this case access to the minerals requires, or may require, a pipeline and road(s) in order to comply with other regulations. (110)

Comment: Road construction in RHCAs; no agency finding of no alternative to avoid. (110)

Response: Contrary to the commenter's assertion, constructing a maintenance road for the water treatment discharge pipeline would not be a violation of the roadless rule. FS roadless regulation at 36 CFR 294.12(b)(3) says a road may be constructed in inventoried roadless areas when the road is needed pursuant to reserved or outstanding rights, or as provided for by statute or treaty. The General Mining Law of 1872 (17 Stat. 91, as amended) provides United States citizens a possessory right to prospect, explore and develop locatable minerals on public domain lands. This possessory right includes reasonable access to conduct locatable mineral activities. The Forest Service considers the construction of the maintenance road for the discharge pipeline as being reasonably necessary for the development of FCC's locatable mineral prospect and therefore exempt from the road prohibitions of the roadless rule. The commenter is also incorrectly infers that the DEIS rejected alternate pipeline routes solely on the basis that they involved road construction in roadless areas. Minimizing road construction within inventoried roadless areas was only one of a number of factors considered by the FS in evaluating the best route for the discharge pipeline. (110)

SCENIC RESOURCES

Comment Code	Letter No.	Comment Subject
SCR-1300-1	110	Scenic Resources - Light

Comment: Concerns about visual effects for visitors and recreationists; night sky view adverse effects. (110)

Response: Lights from the ICP would be visible from limited areas within the Wilderness, including along Trail #29 and from Indian Peak and Gant Ridge along the eastern wilderness boundary. These

areas get relatively little use, but wilderness users that observe the ICP lights may find that it detracts from their feeling of isolation and overall wilderness experience. (110)

CULTURAL/TRIBAL

Comment Code	Letter No.	Comment Subject
CUL-1400	112	Cultural/Historic Resources – Impacts to Tribes

Comment: In Chapter 4 it is unclear what the potential impacts to Tribes would be. (112)

Response: Potential impacts to the Tribes are not expected to be significant. Although the Idaho-Cobalt analysis area is within the ancestral homeland of the Shoshone – Bannock and the Nez Perce, prehistoric Native American use of the proposed area does not appear to have been substantial. Inspection of the area of potential effect for the mine operation indicated the presence of one prehistoric site eligible for the National Register of Historic Places. The water discharge pipeline route was re-engineered in order to avoid the site. Thus, project effects are not anticipated. Access to this area is currently restricted because of on-going clean-up activities at the Black Bird Mine. Given safety considerations, access to the FCC mine area of operations will continue to be restricted. However, access by tribal members to Forest Service land immediately adjacent to the mine will still be available. During Government-to-Government consultation, the Tribes did not identify specific resources within the area of operation that they would like access. If the Tribes identify such resources at a later date, access accommodation will be made while maintaining a safe working environment. (112)

Comment Code	Letter No.	Comment Subject
CUL-1401	108	Native American Rights – Consider Native American Rights

Comment: The Tribe is formally opposed to this project, and hopes that the FS will take into consideration the agency's trust responsibility to protect Nez Perce treaty reserved resources when making a decision whether to approve this project. (108)

Response: Protection of treaty reserved resources is mandated by federal law (NHPA, ARPA, Executive Order 13084, etc.). These laws require federal agencies to consult with potentially affected tribes. The Salmon-Challis National Forest conducted Government-to-Government consultation with the Nez Perce Tribe on June 19, 2007. In addition, staff level coordination meetings between the Forest and the Tribe occurred during EIS development. As a result, environmental conditions and requirements as outlined in the EIS will be imposed on the project proponent. In addition, the large bond imposed on the project proponent should ensure full attention to environmental issues including those related to tribal trust responsibilities. (108)

Comment Code	Letter No.	Comment Subject
CUL-1402	108, 112	Tribal Consultation

Comment: The Tribe requests formal consultation between the SCNF and the Nez Perce Tribal Executive Committee on this project regarding Tribe's concerns about additional mining in the Salmon River basin, and FS duty to seek highest levels of protection for the Tribe's Treaty Resources. (108)

Response: The Forest Service met with the Nez Perce Tribal Council on June 19, 2007 to discuss the ICP and the status of the EIS. The Agencies have carefully considered and appreciate the Tribe's participation in the analysis process and detailed comments on the DEIS. (108)

Comment: The EIS discusses consultation with the Shoshone/Bannock and Nez Perce Tribes and describes the consultation that has occurred. We recommend discussing the current status and schedule for ongoing consultation. (112)

Response: Recent Government-to-Government consultation with the Shoshone-Bannock Tribes occurred on September 19, 2007 when representatives of the Salmon-Challis National Forest and the Shoshone-Bannock Tribes met in Fort Hall, Idaho. During this meeting several issues were discussed including a desire on the part of the Tribes to have a tribal staff member present to monitor construction of the water discharge pipeline adjacent to the known archaeological site. The Forest indicated that tribal staff participation would be welcome. The Tribes also indicated that an ethnographic study was needed and that the study should be conducted by someone approved by the Tribes. The Forest will work with the Tribes to develop an ethnographic overview as part of future Forest planning. This overview will include the Idaho-Cobalt study area as well as an analysis of the larger regional landscape. The Forest requested that the Tribes provide a letter detailing their issues and concerns regarding the Idaho Cobalt project. Staff level telephone conversations subsequent to the Government-to-Government consultation meeting indicates that a letter from the Tribes is being drafted. The Forest will respond to the written concerns and Government-to-Government consultation will continue throughout the remainder of the EIS process as appropriate. (112)

AIR/CLIMATE

Comment Code	Letter No.	Comment Subject
AIR-1500	110	Air Quality – Inadequate Analysis

Comment: Revised DEIS must analyze the amount of diesel fuel exhaust, sediment, and fugitive dust delivered to surface water and airsheds; FS needs to quantify when suppression activities will be employed for particulates/volume and define the work area. (110)

Response: The amounts of diesel fuel exhaust and fugitive dust were analyzed in the Air Quality Technical Report (REF) used for the development of the Air Quality section of the DEIS. The impacts of operating a mill were analyzed and described in the Air Quality section of the DEIS. The neighboring area and transportation corridor was also analyzed and described in the Air Quality section of the DEIS. Quantification of suppression activities for particulates will be a part of the Air Quality Operating Permit that will be issued by IDEQ for the project. Air quality standards and requirements will be met within an IDEQ issued Air Quality Operating Permit for the project, including assessment and compliance with PSD increments and rules. (110)

HEALTH AND SAFETY

Comment Code	Letter No.	Comment Subject
HS-1600	108	Public Health – Fish Consumption

Comment: The Nez Perce Tribe, and other fishing tribes, are in a uniquely threatened position because of the prevalence of heavy metals and other toxin in salmon, steelhead, lamprey and sturgeon (that are consumed in large quantities). (108)

Comment: The Tribe is not comfortable that potential impact from heavy metals has been adequately addressed in the EIS, nor adequately mitigated in the POO; potential to significantly reduce successful recruitment of fish species, potential to contaminate fish that currently reside in this area. (108)

Response: The Forest Service and EPA recognize the Tribe's position and interest with regards to fish consumption. The analysis of the ICP discharge (see Water Resources section of Chapter 4) predicts a decrease in copper and cobalt chemical mass loads to the downstream fisheries during and following mining as a result of water treatment. Long-term improvements in water quality associated with the Blackbird cleanup should have a beneficial effect on fish and fish consumption.

The potential for leaching of heavy metals and ARD was one of the major concerns addressed by the EIS team. For example, in the first paragraph of Appendix B to the Water Report states: "The geochemistry of mined rock material is one of the critical characteristics of the mine that has the potential to influence the environmental impacts associated with the ICP." There is extensive analysis of the potential for elevated levels of heavy metals to exist in mine drainage or for ARD to occur. An extensive geochemical testing program (Chapter 3 & 4, Appendix B, Water Report) was designed and implemented for the DEIS. Testing concluded, for example (Page 9, Appendix B, Water Report), that "Overall, samples were very low in sulfide sulfur (Figure 9) with 50% of the samples having no detectable sulfur (< 0.01 weight %) and 75% of the samples with less than 0.1%. Sulfur concentrations were log-normally distributed. The highest sulfur levels in the Ram and Sunshine, which had similar sulfur distributions, were less than 2%. Only about 5 % of the samples had more than 1% sulfur, with many of these samples representing ore zones. The ANP of ICP samples (Figure 9) was also very low with 70% of the samples having ANP values less than 3 kg/t. This level of ANP would be neutralized when about 0.1% pyritic S oxidizes. About 1% of the samples came from zones that had carbonate mineralization and yielded ANP levels in the range of 10 to 100 kg/t." Additionally, on page 18, Appendix B, the EIS team stated, "Extensive geochemical testing conducted by FCC consultants (Telesto 2004) indicated those samples with more than about 0.15% pyritic sulfur and a negative NNP are potentially acid generating (PAG). In this evaluation, a threshold pyritic sulfur level of 0.2% and a negative NNP appeared to correspond to potentially acid generating waste rock. Overall, about 17% of 239 rock samples collected from the Ram and Sunshine deposits (Figure 15) were PAG while the remaining samples were either weakly acid neutralizing (80%) or uncertain (3%). All PAG samples were very low in ANP meaning they have little ability to neutralize acidity, and could become acidic quickly if there are sufficient sulfides to create acidic conditions. Kinetic testing, however, showed that chalcopyrite and cobaltite tends to oxidize slowly under oxidizing conditions. Tailings samples were non acid-generating according to the Sobek static test results."

Despite the relatively low risk of ARD, several mitigation measures were employed to insure that release of ARD and metals were minimized. Among these measures were capture of outflow from the underground mines, perpetual water treatment (as needed base on monitoring results), commingling of tailings and waste rock, and addition of alkaline amendments to underground slash. (108 for both above)

Comment Code	Letter No.	Comment Subject
HS-1601	110	Forest Fires – Safety

Comment: It is reasonable to expect that the reforested TWSF will burn at some point; concern for a burn during working life of mine or closure period; critical safety and water protection mechanisms could be compromised. (110)

Comment: All aspects of the project should be designed to withstand a stand-replacing fire event; bond should include periodic reducing fire fuels. (110)

Response: Fire is an inevitable component of the forest ecosystem in this part of Idaho. Stand replacing fire events can be expected to reoccur at frequencies every several hundred years or less. The 2000 Clear Creek fire was such an event in much of the area surrounding the ICP. ICP facilities, including buildings, TWSF and mine support sites at the mine portals will have buffer zones and access roads kept clear of trees. However, it is possible that fire could damage ICP facilities or more likely infrastructure such as the power line. The Forest Service does not have authority to require design to withstand a particular fire event or to bond for such an event. However, the ICP would have a backup generator and the bond would cover maintenance and replacement of the generator in the event of damage so that water capture and water treatment could continue despite line power disruption. (110 for both above)

Comment Code	Letter No.	Comment Subject
HS-1602	115	Materials/Chemicals/Concentrate Transport and Storage

Comment: Water Treatment Chemicals. (115)

Response: The FEIS has been reworded to more accurately describe the difference in effects between Alternatives II and IV in regards to water treatment chemicals. The chemical usage in Alternative IV would be no greater than that required for Alternative II. The risk evaluation provides the agencies with sufficient pertinent information to evaluate impacts, and is sufficient to comply with NEPA requirements. (115)

Comment: Access – arbitrary requirements - new section of Williams Creek Road. (115)

Response: A primary reason for modifying the switchback section and moving the road further from Williams Creek is to reduce the risk of accidents and the risk that a resulting spill could reach the creek. (115)

Comment Code	Letter No.	Comment Subject
HS-1602-1	108, 110	Materials/Chemicals/Concentrate Transport and Storage – Spills

Comment: Tribe is significantly concerned about transportation-related impacts; including accidental spills. (108)

Response: The ICP proposes to resurface 10.9 miles of the Access route to mitigate sediment delivery to streams. The agencies propose under Alternatives III, IV and V to resurface the entire length of the Access route. The agencies also propose annual application of dust abatement treatments (see “Road Improvements” subsection under “Mitigation” in Chapter 2. Also see sections in Chapter 2: “Transportation of Personnel and Supplies,” “Spill Control,” “Other Mitigation”(bullet Enhanced emergency management capabilities..., and bullet Additional access road improvements), and “Spill Control” heading under “Emergency Management, Spill Control and Fire.” (108)

Comment: A hazardous materials spill prevention plan needs to be in place. (110)

Response: Hazardous materials spill prevention and response plans are include in the Plan of Operations. See sections in chapter 2 titled "Transportation of Personnel and Supplies," "Spill Control," "Spill Control" section under "Emergency Management, Spill Control and Fire," and section on Fisheries Resources in Chapter 4. The spill prevention and response plans will be incorporated into the final project permits. (110)

Comment Code	Letter No.	Comment Subject
HS-1602-2	110	Materials/Chemicals/Concentrate Transport and Storage – Relocate Roads

Comment: Relocate roads out of riparian zones to reduce risk for transportation spill reaching surface water. (110)

Response: Distance to streams from Project Access route alternatives was considered in the Project Access route selection. See "Idaho Cobalt Transportation Technical Report". Of currently developed roads, the Williams Route has the least amount of stream within 300 feet of the road. Relocating most sections of road within Riparian Habitat Conservation Areas would require constructing an entire new access route which is infeasible. A section of the Williams Creek road at MP 7.1 to 8.1 is proposed to be relocated to eliminate a switchback and move the road further from the creek. (110)

Comment Code	Letter No.	Comment Subject
HS-1602-3	110	Materials/Chemicals/Concentrate Transport and Storage – Fuel Storage

Comment: Concern for stockpiling large amounts of diesel fuel at the summit; recommend INFISH style 300' buffers. (110)

Response: To reduce the potential for adverse impacts from fuel leaks, all fuel storage at the mine site will be stored in lined and bermed containment areas. The fuel storage will meet INFISH requirements and be greater than 300 feet from surface water. All containment areas will have the capacity for 1½ times the volume of stored fuel. (110)

Comment Code	Letter No.	Comment Subject
HS-1602-4	110	Materials/Chemicals/Concentrate Transport and Storage – Ore Transport

Comment: The DEIS does not state how enriched ore will be secured to ensure spill-proof delivery for processing off FS lands. (110)

Response: Concentrate will be secured in steel roll off containers and transported off site on single frame trucks, which will be subject to plans regarding transportation of materials and supplies. See sections in Chapter 2 "Transportation of Personnel and Supplies," "Spill Control," "Other Mitigation" (bullet Enhanced emergency management capabilities), and "Spill Control" section under "Emergency Management, Spill Control and Fire." (110)

Comment Code	Letter No.	Comment Subject
HS-1603	115	Public/Mine Traffic Conflicts

Comment: Access – new section of Williams Creek Road. (115)

Response: The section of Williams Creek road proposed to be relocated is intended to improve public safety and reduce the risk of mine related traffic from having an accident. (115)

Comment Code	Letter No.	Comment Subject
HS-1604-1	90, 110	Spill Prevention and Response Plan – Need Plan

Comment: Finally, are there contingency plans for accidents related to fuel and chemical spills? What if there is a massive fuel spill on the way to the mine site? How will that be handled and how much pollution will that cause to the watershed and Williams Creek and then the Salmon River? (90)

Response: Formation Capital Corporation (FCC) has prepared a spill control plan that addresses management of hazardous materials during shipping and storage. Their plan includes notification of the ICP facility prior to transport of fuels or chemicals, use of closed trucks, travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport (Chapter 2, Alternative II). The plan would be revised to address any changes in the plan of operations, reviewed and approved by the agencies prior to initiation of construction activities. Alternatives III, IV and V require road improvements in addition to those proposed by FCC to improve traffic safety, to reduce sediment production and reduce risks of spill of transported materials. (90)

Comment: A hazardous materials spill prevention plan needs to be in place. (110)

Response: Hazardous materials spill prevention and response plans are include in the Plan of Operations. See sections in Chapter 2 titled “Transportation of Personnel and Supplies,” “Spill Control,” “Spill Control” section under “Emergency Management, Spill Control and Fire,” and section on Fisheries Resources in Chapter 4. The spill prevention and response plans will be incorporated into the final Plan of Operations. (110)

Comment Code	Letter No.	Comment Subject
HS-1604-2	110	Spill Prevention and Response Plan – Plan Components

Comment: Revised DEIS needs to analyze threats to fisheries from spills along transportation route; FS should regulate all transportation contractors; FS should provide restrictions re: chemicals stored next to each other or transported together; transport route should examined for particularly hazardous areas. (110)

Response: The DEIS (Fisheries Section in Chapter 4) addresses potential impacts on fisheries resulting from spills along the transportation route. Table 4-12 summarizes evaluation of hazardous effects from a spill based on types and amounts of hazardous materials to be transported and anticipated frequencies of a spill effecting fish and fishery habitat. The ICP will be accessed by FS roads and all FS regulations pertaining to transport of hazardous material, load limits, etc will be applicable to ICP related traffic. Proposed upgrades to the Williams Creek access route will mitigate transportation related hazards. Specific regulations regarding transportation of personnel and supplies are included in the ICP Plan of Operations and will be incorporated into the final permits

along with additional regulations deemed appropriate by the agencies. (See sections in Chapter 2: "Transportation of Personnel and Supplies," "Spill Control," "Other Mitigation"(bullet Enhanced emergency management capabilities..., and bullet Additional access road improvements), and "Spill Control" heading under "Emergency Management, Spill Control and Fire." (110)

SOCIOECONOMICS

Comment Code	Letter No.	Comment Subject
ECON-1700-1	1, 3, 4, 8, 9, 12, 13, 16, 19, 20, 21, 22, 25, 28, 29, 30, 31, 32, 33, 34, 36, 38, 39, 40, 41, 44, 46, 49, 51, 53, 57, 58, 59, 60, 62, 63, 66, 68, 69, 70, 76, 79, 80, 83, 84, 85, 86, 87, 88, 89, 94, 95, 105, 114, 116, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 162, 164, 168, 173	Employment and Local Economy – Job & Benefit to Area

Comment: The Idaho Cobalt Project is a great Asset not only to the USA but Lemhi County's Economic Development. We can only hope that the process will proceed forward in a timely manner. (1)

Comment: The Idaho Cobalt Project is a good fit and a good economic project for Idaho. This project will provide good jobs for the Salmon, Idaho and Kellogg, Idaho areas. (3)

Comment: More jobs for the Valley. (4)

Comment: Idaho needs the jobs and tax revenues. (8)

Comment: Mine will have a very small foot print and the science has been done to ensure very little if any negative affect will occur in an area that already has been mined. The financial and civil effects that it will have on the Salmon/Challis area are not only greatly needed and important to this area but come with little if any downside. (9)

Comment: High pay mining job with benefits good for families and counties. Need more jobs in Shoshone County. (12)

Comment: Need Idaho jobs - Work in mining industry and would be interested in work at Salmon Cobalt Mine. (13)

Comment: Worked on Blackbird remediation in the 1980's. Projected 160 jobs at \$15-25\$/hr. Annual payroll - \$11 million/year. Local contractors, local supplies. (16)

Comment: The project would be of great value to the economic circumstances of Lemhi and Custer Counties, by providing good-paying jobs and opportunities. (19)

Comment: Jobs & benefits to Lemhi Co and Idaho; ICP would supply domestic cobalt, a strategic metal. (20)

Comment: Custer and Lemhi Counties will benefit for many years from the employment opportunities at the project as well as the secondary employment demands created by commerce of the project in these counties. (21)

Comment: Jobs & benefits to Lemhi Co and Idaho; ICP would supply domestic cobalt, a strategic metal. (22)

Comment: Community will benefit from the \$477,000 local tax dollars and \$1.8 million in state taxes. Support FCC's TWSF plan, don't limit tailings facility size. (25)

Comment: Support the Idaho Cobalt Project, mine will provide jobs and economic benefits to Lemhi County and the State of Idaho while supplying the United States with cobalt, a strategic metal. (28 - 32)

Comment: Jobs and good wages contribute to local economy FCC economically viable company in Lemhi County. Good paying jobs. (33)

Comment: It puts jobs out there for a mining town. It is important for many uses, such as being a component in batteries for hybrid cars. (34)

Comment: I think this will be great for Idaho because it will add much needed employment opportunities for Idaho State residents. (36)

Comment: It should do quite a bit to perk up the economy of the Salmon-Challis area without any undue environmental risks. (38)

Comment: This project is needed in this area and would definitely add to the economies of both Custer and Lemhi Counties. The jobs at the mine would be a nice boost to our local economies as well as the trickle down effect of many more jobs added to the local businesses. (39)

Comment: It will also help the local economy with jobs, and help the local tax base. (40)

Comment: They need to start producing cobalt . . . To provide jobs that will benefit our local economy in many ways. (41)

Comment: Will provide many high-paying jobs which in turn will increase spending in the local economy. (44)

Comment: The ICP will employ more than 150 people . . . Which will generate about 8 million dollars in taxes each year. (46)

Comment: I am completely for this, I think it will help our economy. (49)

Comment: I believe this would be a really good project for both Lemhi and Custer County. I know it will do a lot for this community here. (51)

Comment: The proposed project would provide a tremendous economic boost to the City of Challis, to Custer County as well as the City of Salmon and Lemhi County. . . this project would dynamically increase the population in our region as well as decrease the unemployment rate. (53)

Comment: The ICP will employ more than 150 people . . . Which will generate about 8 million dollars in taxes each year. (57, 59, 60, 63)

Comment: I believe this project should go forward for the good of the people of this town, county, state, and country. (58)

Comment: Formation Capital's plan is a good one that will benefit our state greatly. (62)

Comment: With today's advanced methods and the past mishandled mining endeavors as teaching aids we feel this mine will be a plus for the towns of Salmon and Challis, the counties of Lemhi and Custer, and to the North American continent. (66)

Comment: The ICP will employ more than 150 people . . . And over \$470,000 local tax dollars each year. . . the taxes paid by Formation Capital would allow for increased enrollment in our schools and improvements for our roads. (68, 69, 70)

Comment: The Idaho Cobalt Project is a well-designed project that would bring much-needed domestic supply of cobalt to our nation while giving the state of Idaho and its local communities an economic boost by providing steady jobs and tax dollars to the area. (76)

Comment: The ICP will employ more than 150 people . . . And significant tax dollars to the state and local economies for the duration of the mine's productivity. (79)

Comment: The ICP will bring 150 good-paying jobs to Salmon and Challis. . . And will generate about \$8 million in taxes each year. (80)

Comment: The ICP will employ more than 150 people . . . And over \$470,000 local tax dollars each year. . . the taxes paid by Formation Capital would allow for increased enrollment in our schools and improvements for our roads. (83)

Comment: The planned cobalt mine would bring more than 150 much needed long-term high-paying jobs to this area. Not only would the mine help struggling families in this, bring new families back to our area, and increase enrollments in our schools, but the taxes paid by Formation Capital would bring more money to our schools and hospital, improve our roads, and benefit the struggling businesses in our community. (84)

Comment: FCC's mine will provide many great economic benefits to our nation, the state, and especially the local economies. The mine would provide nearly 160 good-paying jobs for the duration of the mine's productivity and add millions of tax dollars to the economy. (85)

Comment: The economic benefits the Idaho Cobalt Project will bring to the State of Idaho and the little impact it will have on our environment presents a winning decision for all parties that are involved. (86)

Comment: I would like to express my total support for the mine. I believe they will leave it better than it is now, and it would add another base for income to the valley, even if only for 10 years, it is worth while. (87)

Comment: The Cobalt Projects would be very good for people and the economy of Challis. (88)

Comment: I am sure that you are already made aware that cobalt is an essential metal in today's society and will strengthen local economies in the Salmon-Challis area. Employment opportunity in Idaho's small, rural communities is important to the tax base of local government, local schools, and the economic health of the state. (89)

Comment: The proposed mine will provide jobs and economic benefits to Lemhi County and the State of Idaho, while supplying the United States with a constant supply of cobalt, a strategic metal of great and growing importance to the United States. (94, 105)

Comment: The City welcomes the employment opportunities and renewed resource industry for the local economy. (95)

Comment: Bring a much-needed economic boost to our community by providing steady jobs and tax dollars to the area. (114)

Comment: The proposed mine will provide jobs and economic benefits to Lemhi County. (116)

Comment: This project will bring a lot of very good things to Lemhi County, including stable, steady jobs and tax dollars from Formation Capital. Challis and Salmon could certainly use both of these things! Our unemployment rates will go down and our community will benefit from the \$477,000 local tax dollars and \$1.8 million in state taxes that Formation will pay. (122, 123, 124, 125, 126, 127, 128)

Comment: Importantly for this area, the Idaho Cobalt Project will employ more than 150 people with good, family-wage jobs, bringing a yearly payroll of about 9.5 million dollars, and will generate about 8 million dollars in taxes each year. (129, 130, 131, 132, 134)

Comment: Some of the economic assets would include tax dollars from Formation Capital and many much-needed steady jobs. Local unemployment rates will go down and communities will benefit from the local tax dollars and state taxes that will fortify and improve vital community services. (133)

Comment: The increased jobs and the increase in the local tax base will help our schools and infrastructure. (135)

Comment: The proposed mine would bring over 150 long-term jobs to the region and more than \$475,000 local tax dollars annually during the 15-20 years it is projected to operate. Lemhi County has been struggling economically and many people in the region would appreciate the opportunity to hold a long-term, steady job. Not only would the mine help struggling families by providing constant jobs and a decent income, but the taxes paid by Formation Capital would also allow for improved roads, schools and other essential community services. (136)

Comment: As the owner of a small business, River Mountain Roasts, as well as being a one-woman temporary service as a means of making my wages, I can see that having more money in the Valley will benefit many small businesses. (139)

Comment: I have observed that when there is an operating mine near our community, businesses had additional cash flow. Also, you didn't see many empty houses with 'For Sale' signs, hence improved tax revenues, leading to healthier funds available for local schools and services. As substitute teacher, I can see where any additional funds for our schools and our kids will be highly beneficial as well. (139)

Comment: This natural reserve is not only a national resource, but also a local resource that will be an industry that will produce jobs, local tax base and stability to the economics of this county and the state of Idaho. (140)

Comment: The planned cobalt mine would bring more than 150 long-term jobs to the area and over \$470,000 local tax dollars each year during the projected operations period of 15-20 years. Lemhi County has been struggling economically and many people in our region would appreciate the opportunity to hold a long-term, steady job. Not only would the mine-help struggling families by providing constant jobs and a decent-income; but the taxes paid by

Formation Capital would also allow for increased enrollment in our schools and improvements for our roads. (141, 142)

Comment: The proposed mine will provide jobs and economic benefits to Lemhi County. (143, 144)

Comment: The Idaho Cobalt Project will bring 150 jobs with excellent pay to Lemhi and Custer Counties, as well as substantial tax revenues and increased commerce locally. Montana, too will benefit, as residents of those counties do much of their shopping and other business in Butte and Missoula, not to mention Dillon, Hamilton etc. (145)

Comment: The planned cobalt mine will provide several good paying jobs that could last well into the future as more exploration proves out more reserves. The mine will provide more than 150 long-term jobs to the area and over \$470,000 local tax dollars each year during the projected operations period of 15-20 years. Many local businesses will also benefit from not only the extra cash flow in the community, but also from supporting the needs of the mine. Additionally, Formation Capital is working with the local community to ensure that the "boom and bust" nature of mining does not negatively impact the community. (146)

Comment: I appreciate having the chance to comment on the Idaho Cobalt Project and to let you know I support this environmentally sound mining project. I've seen what the mines do in this valley and I fully support the cobalt project because of economic benefits that it brings to this valley. I haven't seen any negative effects from these projects so I would be fully in favor of this project. (147)

Comment: The proposed cobalt mine would bring more than 150 long-term jobs to the region for the duration of the mine's production. In addition, it would provide over \$475,000 local tax dollars annually during the 15-20 years it is scheduled to operate. Lemhi County could use the economic boost and many people in the region would appreciate the opportunity to hold a steady job. Not only would the mine help families by providing constant jobs and a decent income, but the taxes paid by Formation Capital would also allow for improved roads and other essential community services. (148)

Comment: The economies of Lemhi and Custer Counties are relatively dependent on seasonal and government jobs. The tax base is not overly strong. Having 150 good-paying jobs in the area for 10 or more years would be a substantial boon with an 'n' but not a boom that would lead to a bust. There are many local people who are more than capable of working at the mine, and there are several people from the area who are currently working at mines in Montana, Nevada and the like who would return to live near their families. This would bolster the local economy and social structure without creating a strain on local services, housing stocks and the like. This modest increase in local employment, plus the attendant boost in local commerce would be a substantial benefit with minimal downside. (149)

Comment: The Idaho Cobalt Project is a well-planned project that will have benefits for the region, state, and nation. (150)

Comment: The mine will also provide over 150 steady jobs and bring in considerable tax dollars to the state and local economies during the mine's production years. (150)

Comment: I feel we need an economic boost in this county. So many of our young people are having to leave to find good-paying jobs, and so many of the jobs here are low-paying. Many people here would like to see their college grads be able to return home. The mine will provide 150 good paying jobs with good benefits, and will also bolster the local tax base. This will also benefit our schools and community infrastructure. (151)

Comment: The sooner these permits are issued the better it will be for the local economy which is in need of more job stability and income producing employment. There is potential for around 150 jobs which would be of great benefit to all concerned. (152)

Comment: Support mine; it will be good for region. (162)

Comment: Mayor of Salmon. Support the mine. (164)

Comment: Economic benefits from mine. (168)

Comment: Supports mine, jobs for local kids. (173)

Response: Your comments regarding the economic benefits of this project are appreciated and have been considered in the preparation of the FEIS. (all comments above)

Comment Code	Letter No.	Comment Subject
ECON-1700-2	5, 6, 7, 11, 14, 16, 43, 45, 48, 52, 55, 95, 104, 106, 160, 163, 167, 171, 174, 175	Employment and Local Economy – Support Project

Comment: It sounds like it would be very good for the people who live here for jobs. (5)

Comment: The extensive studies done show mining can be done in environmentally sound way. . . No logical reason for the project not to move forward. Every aspect been reviewed, every question answered. . . Should move forward to benefit community, state, county. (6)

Comment: Support mine, jobs. (7, 11, 43, 45, 163)

Comment: Favors the project moving forward and believes that through the appropriate approval process, a viable project will come forth. (14)

Comment: Up from the phosphate belt. In support of Project, we are going through our own EIS and we know it's not easy. I'm all for it. Mother Nature probably put more pollutants than anything. I'm an original Cobalt Brat. 2nd through 8th grade. It will bring economy here. ICP is one of the best designed projects I've seen in my years of experience. I'm anxious to see the project go. I have never seen a project more environmentally friendly than this one. How long before they can actually mine? We need the jobs so our kids don't move away. Formation has worked very hard for a long time to do a good job. I'm in Support. Does Formation Capital have any thoughts on job training for the young people of Lemhi County? Worked on Blackbird remediation in the 1980's Projected 160 jobs \$15-25/hr Annual payroll - \$11 Million/yr Local Contractors/Local Supplies. (16)

Comment: I think it's a really good project. (48)

Comment: I am very heavily in favor of this project. I invested in some of the stock because I knew it would be good for me in the long run and good for the people around here too. (52)

Comment: You have my full support. It will be welcomed in many ways. I wish all a good, safe and environmentally sound year for your new endeavor! (55)

Comment: The City welcomes the employment opportunities and renewed resource industry for the local economy. While appreciating the employment benefits and property tax contribution to Lemhi County, the proposed project is predicted to have a fiscal impact to

services provided by the City of Salmon . . .mitigate operational and capital impacts. We also recognize that there will be additional impacts to other community services including the Salmon School District, Lemhi County, and Lemhi County Economic Development Association. (95)

Comment: I am writing to express my support for the proposed Idaho Cobalt Project and for the issuance of a favorable Record of Decision. It appears that the project has been well-planned and will be conducted in a manner that is protective of human health and the environment. (104)

Comment: I believe this project is a good project for the people, it is well-planned and I believe the Formation Capital Company will do a good job if taking care of the land for us. (106)

Comment: Support mine, wants Morgan Ck road access for Challis workers. (160)

Comment: Supports project, make sure that spread of weeds is addressed. (167)

Comment: Supports project. (171, 174, 175)

Response: Thank you for your comments; the agencies have considered local support and economic impacts in analysis of the ICP. Chapter 1 of the EIS explains management direction and laws and regulations that guide the SCNF analysis of Formation Capital Corporation's (FCC) Plan of Operations. Formation Capital Corporation's proposed action and alternatives are reviewed to determine if changes or additions to the Plan of Operations are required to meet the requirements of the regulations for environmental protection set forth in 36 CFR 228.8. (5, 6, 7, 11, 14, 16, 43, 45, 48, 52, 55, 95, 104, 106, 160, 163, 167, 171, 174, 175)

Comment Code	Letter No.	Comment Subject
ECON-1701	16, 96, 97, 98, 99, 100, 101, 102, 138, 153, 169, 172	Community Services – Training

Comment: The planned cobalt mine would bring more than 150 long-term jobs to the area and over \$470,000 local tax dollars each year during the projected operations period of 15-20 years. . . .the taxes paid by Formation Capital would also allow for increased enrollment in our schools and improvements to our roads. (96, 97, 98, 99, 100, 101, 102)

Response: Your comments pertaining to the potential benefits to the Salmon/Challis area workforce have been acknowledged in the review process and will be considered in the final analysis. Chapter 4, Social and Economic Resources, of the DEIS has described the benefits and drawbacks of the proposed mining development. A technical report presenting a more detailed description of the socioeconomic environment also was prepared and is on file at the Salmon-Challis National Forest office in Salmon, Idaho (Northwest Resource Consultants, 2005). (96, 97, 98, 99, 100, 101, 102)

Comment: Mines provide a variety of training opportunities for their employees, ranging from safety to equipment training and industrial training. These are transferable skills that benefit the community as well as the individual. (138)

Comment: The Idaho Cobalt Project, when permitted, will afford many people like me with the opportunity to return home to Salmon, where we have family. The project will also have good-paying jobs in an area that could benefit from a boost to the economy. In addition to people

like me who are currently working elsewhere in the mining industry, I know of many people in Lemhi and Custer Counties who could, through the extensive training mines provide, will be able to work at the Idaho Cobalt Project. Thus, there will be a modest influx of people due to the mine, and many of those will actually be people returning to the area, to their home and families. (153)

Comment: Mining company employees tend to be active members of their communities, coaching Little League Baseball teams, being involved in local clubs and civic projects. Also, miners are well known for volunteering as EMT's, Search and Rescue. Due to the outstanding training that mines provide, they are well equipped to handle a variety of emergencies and fulfill other needs. (153)

Response: The Forest Service recognizes the benefits that the mine will offer to the local workforce in Salmon and Challis Idaho. Evaluation of the benefits have been weighed along with other impacts as discussed in Chapter 4, specifically 4-83 and 4-103. Your additional comments pertaining to benefits to the workforce as well as civic returns have been noted in the review process. (138 and both 153 above)

Comment: Does FCC have any thoughts on job training for the young people of Lemhi County? (16)

Comment: Are there any job training opportunities from the mine? (169)

Comment: Supports project, has educational opportunity been considered? (172)

Response: The mine would provide some job training opportunities, but has made no specific commitments. FCC has not included any plans regarding training of mine personnel in their Plan of Operations submitted to the Forest Service. The idea of ICP providing an educational opportunity, as a working laboratory, has not been considered in the EIS process. (16, 169, 172)

Comment Code	Letter No.	Comment Subject
ECON-1701-2	53, 75, 164	Community Services – Schools

Comment: Both Salmon and Challis would greatly benefit from the opening of two accesses, it would allow for the impact of this project on our community infrastructures to compliment one another (i.e., Salmon schools are experiencing over crowding, while Challis Schools are experiencing low enrollment). (53)

Response: Your comments pertaining to the potential benefits of opening both the Morgan Creek and William Creek accesses have been acknowledged in the review process and will be considered in the final analysis. (53)

Comment: If the Cobalt project develops and the school bond passes, we would expect some relief on our building bond corresponding to the actual impact on school population. Alternately, in the short term, if a bond does not pass before mining-related population increases, we would expect a provision of portable or modular classrooms and concomitant maintenance and operations costs. (75)

Response: FCC intends to hire qualified workers from the local Salmon/Challis area workforce; therefore, negative impacts, as a result of a large influx of people moving into the area, were not

anticipated to be significant. Mitigation of socioeconomic resources, such as entering into a Good Neighbor Agreement, is not a NEPA requirement. (75)

Comment: Would like to have Economic Development Program involved. Schools in Salmon currently at capacity. (164)

Response: Thank you for your comment on the involvement of the Economic Development Program. At the time that socioeconomic data were collected, Salmon Public Schools were not at capacity; however, it was noted that enrollment was expected to increase due to upcoming large class sizes (DEIS, page 3-70). Your comment will be considered in the final analysis. (164)

Comment Code	Letter No.	Comment Subject
ECON-1701-3	95	Community Services – Regional Impacts

Comment: Impacts from increased population on City of Salmon services are projected to be on the order of \$2 million. (95)

Response: Thank you for your comments on the positive impacts of the proposed project as well as your in-depth analysis of potential fiscal impacts, both direct and indirect. The analysis you provided was based on the influx of 60 construction workers and 130 operation employees and their families into the Salmon area and the previous experience of the City of Salmon with the Beartrack Mine. FCC intends to hire qualified workers from the local Salmon/Challis area workforce; therefore, negative impacts, as a result of a large influx of people moving into the area, were not anticipated to be significant. Mitigation of socioeconomic resources, such as entering into a Good Neighbor Agreement, is not a NEPA requirement. (95)

Comment Code	Letter No.	Comment Subject
ECON-1701-4	107	Community Services – Law Enforcement

Comment: We feel that an agreement could be reached by which the mining operation would help fund the extra needed law enforcement personnel. (107)

Response: The EIS team will take your comment into consideration during the final review and selection of alternatives. Any agreement between the company and state or local law enforcement is outside of the Forest Service's authority. (107)

Comment Code	Letter No.	Comment Subject
ECON-1701-5	23	Community Services – Request Contribution to Impacted Services

Comment: There will be impacts to Lemhi County services and suggest participation in LCEDA. (23)

Response: Thank you for your comments and willingness to be included in the Idaho Cobalt Interagency Team. Your comments have been acknowledged in the review process and will be considered in the final analysis. Chapter 4, Social and Economic Resources, of the DEIS has described the benefits and disadvantages of the proposed mining development. A technical report

presenting a more detailed description of the socioeconomic environment also was prepared and is on file at the Salmon-Challis National Forest office in Salmon, Idaho (Northwest Resource Consultants, 2005). (23)

Comment Code	Letter No.	Comment Subject
ECON-1702	113	Cost/Benefit

Comment: Social and Economic costs and benefits is unbalanced, inadequate and biased on economic benefits of mining. (113)

Response: Evaluation of potential positive and negative effects on socioeconomic resources in the study area have been described in a technical report (Northwest Resource Consultants, 2005), Chapter 3 of the DEIS, pages 3-68 - 3-73, and summarized in Chapter 4, specifically pages 4-83 and 4-103. Your comments have been acknowledged in the review process and will be considered in the final analysis. (113)

Comment Code	Letter No.	Comment Subject
ECON-1702-1	65	Cost/Benefit – Project Economics

Comment: I can't see any investor out there who has a dime in this project not wanting to back it without a profit: the question is: Can it? (65)

Response: Thank you for acknowledging the positive impacts of the proposed mine and your concern about investors making a profit on their investments. Prior to entering the EIS process, FCC conducted extensive research on potential profit and loss of the mine. Your comments will be considered in the final analysis. (65)

Comment Code	Letter No.	Comment Subject
ECON-1702-2	90	Cost/Benefit – Post Mine Bust

Comment: Secondly, is that the real economic benefit will not really happen in Challis but more in Salmon. With the main road leading to the mine site via Williams Creek and the fact that Morgan Creek road is closed at least six months of the year, Challis will not benefit from this mine. The mine is not going to buy fuel in Challis and truck it up over Morgan Creek with the road in the shape it is at this time. The schools in Challis will not fill up, but the already over-populated school in Salmon will feel the stress. When the mine closes, the families will move away from the area, what will happen then to the economy of Salmon? (90)

Response: The DEIS recognizes the benefits that the mine will offer to the local workforce in Salmon and Challis Idaho. Evaluation of the benefits have been weighed against drawbacks in the socioeconomic resources technical report (Northwest Resource Consultants, 2005), Chapter 3 of the DEIS, p. 3-68 - 3-73, and summarized in Chapter 4 specifically 4-83 and 4-103. Chapter 3 points to the diversification of the Salmon economy over the past five to ten years, and the continued efforts to reduce dependence on one primary industry, as a buffer to help reduce the after-mining bust. (90)

Comment Code	Letter No.	Comment Subject
ECON-1702-3	113	Cost/Benefit – Not Balanced

Comment: Social and Economic costs and benefits is unbalanced, inadequate and biased on economic benefits of mining. (113)

Response: Evaluation of potential positive and negative effects on socioeconomic resources in the study area have been described in a technical report (Northwest Resource Consultants, 2005), Chapter 3 of the DEIS, pages 3-68 - 3-73, and summarized in Chapter 4, specifically pages 4-83 and 4-103. Your comments have been acknowledged in the review process and will be considered in the final analysis. (113)

RECLAMATION BOND

Comment Code	Letter No.	Comment Subject
RCL-1800	110	Reclamation Bond Calculation

Comment: Bonding amounts should include regular maintenance work every few decades as needed to repair degraded liners and water treatment facilities. (110)

Response: The financial assurance calculated for the ICP includes long-term capital contribution as well as operations and maintenance funding for water treatment facilities. Funding for post-closure inspection and maintenance of caps and liners is also included, but assumes that this will only be required for five years. No long-term capital replacement costs are assumed for the waste storage facility. (110)

Comment Code	Letter No.	Comment Subject
RCL-1800-1	65, 109, 115	Reclamation Bond Calculation – Excessive

Comment: I also believe the 13 million dollar reclamation bond is extreme for an underground project and should be cut in half. (65)

Response: Prior to approval of a plan, the SCNF will ensure that ICP provides financial assurance, or a reclamation bond, to ensure that the lands involved with the mining operation are reclaimed in accordance with the approved plan of operation and reclamation requirements (CFR 228.8 and 228.13). The bond will be calculated using the USDA Forest Service Training Guide for Reclamation Bond Estimation and Administration For Mineral Plans of Operation authorized and administered under 36 CFR 228A (2004). (65)

Comment: Contrary to the discussion of bond calculations in the DEIS, the Forest Service's "Training Guide for Reclamation Bond Estimation and Administration for Mineral Plans of Operation Authorized and Administered under 36 CFR 228A" (USDA – Forest Service, April 2004), makes it very clear that bond calculations are not to be based on worst case scenarios. Regarding water treatment, the Guide specifically states "[t]he need for water treatment should be based on impacts that are predicted to occur not a worst case assumption." Guide, Summary of Comments, p. 2. (109)

Comment: Bonding does not include worst-case contingencies - bond calculations based on worst case scenario. (115)

Response: The inclusion of long-term water treatment costs as part of the financial assurance calculation is not based on a "worst case" scenario. Analysis of the geochemical and hydrological characteristics of the ICP using the DSM model and other tools indicates that there is some uncertainty (see page 4-8 through 4-11 DEIS) in predicting both chemical and hydrogeological conditions. Without collection and long-term water treatment the DSM model predicts that Alternative II would cause a slight and possibly measurable increase in copper concentration in Big Deer Creek following closure even under the 50% or expected case. In the 90th percentile case the DSM predicts a likely exceedance of water quality standards. The 90th percentile case is not a "worst case" or contingency condition, but a situation that is expected to occur one out of ten times and is therefore considered by the agencies in the context of risk to the environment as reasonably likely to occur. It is therefore entirely appropriate to require a bond or other financial assurance for long-term water treatment until such time that it can be demonstrated that long-term water treatment will not be needed. (109, 115)

Comment Code	Letter No.	Comment Subject
RCL-1800-2	27, 90, 93, 103, 104, 108, 110, 113	Reclamation Bond Calculation – Need Large Bond

Comment: Financial assurance is inadequate. (113)

Response: As the commenter should be aware, releases that have caused and continue to cause impairment to South Fork Big Deer and Big Deer Creeks are being addressed under separate CERCLA authority. The USFS will ensure that financial assurance be in place to cover costs of long-term water treatment should ICP's mining activities have the potential to further impact the impaired stream reaches. As described in IDEQ's draft 401 certification letter (December 1, 2006), additional metal load to the already impaired streams is not allowed under Idaho water quality regulations. The draft MPDES permit includes a stipulation that FCC demonstrate compliance with this requirement prior to discharge. (113)

Comment: Water treatment operation and maintenance costs are severely underestimated, capital costs for construction of a water treatment plant are not included. (113)

Response: The estimated annual operating costs are based on the actual 2006 annual labor cost and power requirements of a mine water treatment facility having very similar operating requirements as the water treatment process proposed by the DEIS, vendor pricing for water treatment chemicals, actual electric rates provided by the local power company, and actual sludge disposal rates quoted by the Lemhi County Landfill. The water treatment system used as the labor cost basis is leased by a mine in northern Nevada, and operated on a contract basis by a private water treatment company. The annual operating costs are therefore current, and based on an actual case example. The flow rates and water treatment equipment hydraulic capacity are based on the water treatment flow capacity requirements used in the DEIS. The bond estimate includes a component to cover equipment replacement, which will be adequate for the type of equipment used in the treatment process.

The water treatment plant will be built by, and costs incurred by, FCC in order to start mining and milling activities. Therefore the capital cost of the water treatment plant is not included in the reclamation bond calculation. (113)

Comment: Have arsenic and iron components of ore been accounted for? Must assume that ARD will be produced. Need to bond for operational and long term water treatment. (27)

Response: Geochemistry and acid-generation characteristics of ore were determined through geochemical testing as described in the Geochemistry section of Chapter 3 of the EIS and the Water Resources Technical Report. Geochemical testing characterized the arsenic and iron contents of ore. All alternatives address the potential for ARD through a variety of control and mitigation measures including operational and long-term water capture and treatment. Bonding for all aspects of mine reclamation and closure would be required. (27)

Comment: Thirdly is the cost of clean-up will not scratch the surface for the amount of damage the mine will do to the environment. Formation Capital proposes \$13 million to cover the cost of returning this land to its natural habitat. . . . the Forest Service wants \$43 million for reclamation costs. Do you honestly believe that even 1 billion dollars will clean up the mess that they will be making up in our beautiful forests? (90)

Comment: We strongly encourage the Forest to require adequate bonding to ensure that, in a worst case scenario, there are adequate financial resources to treat and deal with any unexpected post-closure mine impacts. (93)

Comment: If, in spite of good common sense, the project is permitted, there should be a very large bond amount required. (103)

Comment: I am pleased to know that the Forest Service will require ICP to post a financial assurance to support post-closure activities and ensure the site is returned to a stable and acceptable condition. (104)

Comment: The proposed \$13 million reclamation bond is inadequate; the FS should require that the operation post the \$43 million reclamation bond that was originally estimated. (108)

Response: The Forest Service will ensure that adequate financial assurance is in place. Methodology for calculating a financial assurance amount is outlined by guidance manual for reclamation bond estimation for mineral Plans of Operation authorized and administered under 36 CFR 228A as referenced in the DEIS (USDA Forest Service, 2004). (90, 93, 103, 104, 108)

Comment: Tribe is particularly concerned about reclamation costs given the almost certain need to treat wastewater and contaminated groundwater for the long-term; inaccurate predictions of water quality impacts is the rule, not the exception with hardrock mining. (108)

Response: The financial assurance amount calculated by the Forest Service and included in the Forest Services ROD conforms to Forest Service guidance (USDA Forest Service, 2004) and includes costs to remove structures, regrade and recontour the surface, replace soil and revegetate the reclaimed land. The financial assurance also includes necessary administrative and overhead costs to complete the reclamation if the company were unable or unwilling to do so and costs for long-term water treatment, if such treatment is needed to meet water quality requirements. Long-term water treatment costs are the largest component of the calculated financial assurance. Although it is not certain that long-term water treatment will be required following closure of the ICP, there is a reasonable likelihood that it will, which is why the Forest Service is including costs for long-term water treatment in the financial assurance. Monitoring data gathered during mining and the years following closure may provide sufficient data to better predict the need and scope of post-closure water treatment. As additional information becomes available the financial assurance amount may be modified during the annual project review. (108)

Comment: Final reclamation bond should be adjusted to reflect additional mitigation measures. (110)

Comment: The revised DEIS should confirm that financial assurances will be set aside as part of the reclamation bond. (110)

Comment: The bond must be substantive enough to cover potential impacts to water quality and impacts to the sensitive nature of this site and listed species inhabiting the area. (110)

Response: The financial assurance calculation includes the additional design components and mitigation measures included in the preferred alternative in the FEIS. A final financial assurance (bond) amount will be calculated for the project as approved in the ROD. (110 for all three above)

Comment Code	Letter No.	Comment Subject
RCL-1800-3	73, 110, 149	Reclamation Bond Calculation – Balance Bond Amount

Comment: It would indeed be a shame if the interests of the old way of mining were able to delay jobs coming to Idaho residents, jobs working at a clean modern mine. It is important that the bond is large enough, but it is equally important that you don't over-react to the interests of BMSG and environmental groups and set the bond at a level which makes the project too expensive. (73)

Comment: The agencies should be commended for not misleading the public by publishing premature bond calculations in the Draft EIS. There are two fundamental reasons why bond calculations should not be included: 1) it's not in compliance with federal regulation or policy, and 2) doing so pre-supposes an outcome, gutting the very purpose of the EIS process. The bond for the Idaho Cobalt Project must be adequate and sufficient, and should not cover for the old Blackbird Mine. That calculation can only be made after you have made your decisions have been made on the Alternative or mix of alternatives. (149)

Response: The EIS team appreciates your comments regarding bond calculation. As discussed in the Draft EIS under the heading of Financial Assurance on page 4-109, there is a certain level of uncertainty in terms of costs of reclamation for all Alternatives. Once the evaluation of alternatives to the proposed action are complete and the Plan of Operations reflects the decision of the agencies, a bond will be calculated using the Forest Service guidance manual for reclamation bond estimation for mineral Plans of Operation authorized and administered under 36 CFR 228A as referenced in the DEIS (USDA Forest Service, 2004). (73, 149)

Comment: List of items bonding should take into account. (110)

Response: The financial assurance calculation included in the ROD includes components addressing capture and treatment of water, containment and reclamation of mine wastes, road reclamation and sediment control. The agencies do not have authority to require ICP to fund fish recolonization efforts in historically impacted streams. (110)

Comment Code	Letter No.	Comment Subject
RCL-1800-4	108	Reclamation Bond Calculation – Roads

Comment: Obliteration and recontouring of all roads used for the project should be built into the reclamation bond. (108)

Response: As described under the Transportation Mitigation heading in the Monitoring and Mitigation Measures Included in Agency Alternatives section (page 2-67, DEIS), all roads on National Forest lands not required for access to post-closure facilities or required for access to the Blackbird Mine Site Group facilities will be regraded and revegetated. This would result in approximately 40,000 feet of existing roads being reclaimed as part of the ICP operations, resulting in a net reduction of sediment yield to areas streams. Prior to approval of the Plan of Operations, the SCNF would require a reclamation bond to ensure that all reclamation is completed in accordance with the approved Plan of Operation (CFR 228.8 and 228.13). (108)

Comment Code	Letter No.	Comment Subject
RCL-1800-5	110	Reclamation Bond Calculation – Fire

Comment: All aspects of the project should be designed to withstand a stand-replacing fire event; bond should include periodic reducing fire fuels. (110)

Response: Fire is an inevitable component of the forest ecosystem in this part of Idaho. Stand replacing fire events can be expected to reoccur at frequencies every several hundred years or less. The 2000 Clear Creek fire was such an event in much of the area surrounding the ICP. ICP facilities, including buildings, TWSF and mine support sites at the mine portals will have buffer zones and access roads kept clear of trees. However, it is possible that fire could damage ICP facilities or more likely infrastructure such as the power line. The Forest Service does not have authority to require design to withstand a particular fire event or to bond for such an event. However, the ICP would have a backup generator and the bond would cover maintenance and replacement of the generator in the event of damage so that water capture and water treatment could continue despite power line disruption. (110)

Comment Code	Letter No.	Comment Subject
RCL-1800-6	112	Reclamation Bond Calculation – Include Bond Details in FEIS

Comment: Financial assurance. (112)

Comment: The DEIS makes no clear association of each mitigation measure that would require financial assurance, what the cost or range of costs each measure may require, and the assumptions and basis for the estimates. (112)

Comment: We also request that the FEIS include the estimate of the financial assurance amount and the financial assurance vehicle, particularly the portion that would guarantee implementation of anticipated long-term water management and treatment tasks. (112)

Response: A detailed description of the components included in the financial assurance calculations is included in the ROD.

Forest Service regulations (36 CFR 228.13, FSM 2817.24 and the Forest Service Handbook FSH 6509.11K establish the financial instruments that can be accepted as financial assurance for projects on Forest Service lands. Cash, surety bonds and a variety of other financial instruments are considered acceptable. Not until the company provides an approved financial assurance will work on the ICP be allowed to begin. (112 for all above)

Comment Code	Letter No.	Comment Subject
RCL-1801	115	Reclamation Methods

Comment: Other - TWSF closure cap, soil balance showing quantities needed and source is needed. (115)

Response: Soil material for the TWSF closure cap is expected to be available from within the TWSF footprint as proposed for the FCC cap design. ICP will be required to submit a revised design of the TWSF in the Plan of Operations that identifies the source of cap material. (115)

Comment Code	Letter No.	Comment Subject
RCL-1801-1	84, 94, 105, 108, 110	Reclamation Methods – Adequate Reclamation a Primary Concern

Comment: The treated water will be cleaner than natural water around it and reclamation is a main concern. (84, 94, 105)

Response: The Forest Service recognized the importance of reclamation of disturbance to public lands under its jurisdiction and a comprehensive reclamation plan is included within the company's Plan of Operations and is described in the Alternative II Reclamation section of Chapter 2 (pages 2-32 through 2-36, FEIS). Water treatment would be required to achieve specific effluent limits set by the NPDES permit, but would not necessarily treat water to be cleaner than natural or background conditions (see Water Treatment section in Chapter 2 pages 2-26 – 2-29, FEIS). The agencies agree that successful reclamation is a primary objective and the reclamation objectives and methods are described in Chapter II of the FEIS and agency additions to the reclamation plan described in the preferred alternative (FEIS pages 2-51 to 2-74). (84, 94, 105)

Comment: The Tribe wonders whether the site will ever actually be truly reclaimed, if not, violation of FS requirements. (108)

Response: The Forest Service and the mining industry both have considerable experience with the physical regrading, soil replacement and revegetation aspects of reclamation similar to that proposed for the ICP. This experience indicates that reestablishment of a viable and sustainable vegetation community at a site such as the ICP can successfully be accomplished using methods and materials as proposed. Loss of productivity during operations and in the early years following reclamation is expected. However, in the long-term (tens of years) it is expected that the disturbed areas will support sustainable natural vegetation communities. (108)

Comment: Reclamation should include restoring soils, the original vegetation types and >15" course woody debris for nutrient cycling and wildlife. (110)

Response: Reclamation under the preferred alternative would utilize native species and ultimately result in forest types that are similar to natural conditions (recall that the current condition following

the 2000 fire is early stage serial lodgepole pine regeneration). As discussed in the soil section of Chapter 4, there will be unavoidable impacts to soils as a result of salvage, storage and redistribution. Although soil productivity will be temporarily lost and will be reduced following reclamation, the overall productivity of the generally young and shallow soil that would be affected by the ICP will only be slightly diminished. Addition of coarse woody debris to the reclamation surface could add diversity and contribute to long-term nutrient cycling. Selective salvage and use of woody debris in the reclamation process has been added to the reclamation plan. (110)

Comment Code	Letter No.	Comment Subject
RCL-1801-2	27, 108	Reclamation Methods – Fish

Comment: Have arsenic and iron components of ore been accounted for? Must assume that ARD will be produced. Need to bond for operational and long-term water treatment. (27)

Response: Geochemistry and acid-generation characteristics of ore was determined through geochemical testing as described in the Geochemistry section of Chapter 3 of the DEIS. Geochemical testing characterized the arsenic and iron contents of ore. All alternatives address the potential for ARD through a variety of control and mitigation measures including operational and long-term water capture and treatment. All aspects of mine reclamation and closure would be accounted for in calculation of a financial assurance amount. (27)

Comment: The project needs to take fish restoration into account in the design of reclamation activities, as well as operational changes and mitigation actions. (108)

Response: No impacts to fish are predicted although a risk to fish as a result of a potential spill of hazardous materials is acknowledged and evaluated in more detail in the Biological Analysis (BA) submitted to USFWS and NMFS in October 2007. (108)

Comment Code	Letter No.	Comment Subject
RCL-1801-3	146	Reclamation Methods – Use Native Species

Comment: From my past experience the native species can take a little longer to get fully established. The nonnative species grow faster and help to stabilize the soil quicker. Are there native species that are quicker growing that can perform as well as the nonnative species? Could a small tree and shrub nursery be established in the near vicinity to grow native trees and shrubs? There is a better survival rate if trees are grown at the same elevation and in the same environment. Native trees that are coming back from the fires could be thinned and transplanted onto the reclaimed areas. Additionally these transplants have some of the natural vegetation around the root ball when they are transplanted which helps to spread the native grasses and shrubs. (146)

Response: There are several advantages to using native species including that they are generally part of a balanced ecosystem. Non-native species may not have natural checks and may be able to out-compete natural vegetation. Although non-natives can quickly establish, which is a benefit to erosion control, they may not provide suitable habitat or forage for native wildlife. Forest Service policy directs use of native vegetation to the extent possible. As the commenter notes, there are a number of advantages to using native species that are adapted to site specific conditions, and use of local seed or transplant stock is a way to maximize the potential for successful revegetation. (146)

Comment Code	Letter No.	Comment Subject
RCL-1802	110	Concurrent Reclamation – Emphasize Concurrent Reclamation

Comment: The FS should require a much greater concurrent reclamation package; FS should use a completed Roads Analysis for informed decisions. (110)

Response: The company's proposed reclamation plan contains a commitment to concurrent reclamation. In evaluating their plan the agencies identified one primary area that could speed the rate of reclamation where the TWSF would not receive final cap and revegetation to allow placement of water treatment wastes. The preferred alternative would require reclamation of the final portion of the TWSF at closure and off-site disposal of any water treatment wastes. (110)

TAILING WASTE ROCK STORAGE FACILITY

Comment Code	Letter No.	Comment Subject
TWSF-1900	112, 115	TWSF Capacity

Comment: The modifications to the FCC proposal in Alternatives III thru V should therefore indicate method used to achieve design compaction. (112)

Response: The EIS team determined that the required compaction can be accomplished using the methods described in the DEIS. As stated in the DEIS, snow would be removed from the active disposal areas prior to placing waste rock or tailings in the TWSF. The snow would be stockpiled in a designated area within the facility. This will allow for proper compaction to occur. (112)

Comment: Page 2-20 and Page 2-21: There is an inconsistency in terms of compaction level for tailings disposed of in the TWSF. (112)

Response: The agencies were not able to identify an inconsistency. Both paragraphs state 90 percent compaction. (112)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, no slurry transport proposed. (115)

Response: Editorial Correction. (115)

Comment: Other - FS acknowledgement of geologic probability that ore reserves will be expanded and additional waste disposal capacity needed. (115)

Response: Although the likelihood of finding additional cobalt/copper mineralization in the area of ICP's claims is high, the economics of mining those reserves are difficult to predict. The selection of a smaller TWSF facility in Agency Alternatives IV and V is intended to provide the required range of alternatives considered in the NEPA analysis. The alternatives are presented in such a fashion that selection of another option for the TWSF size would be possible in the Record of Decision. (115)

Comment Code	Letter No.	Comment Subject
TWSF-1900-1	3, 5, 8, 23, 24, 25, 26, 34, 46, 57, 62, 63, 76, 77, 79, 80, 81, 84, 85, 106, 109, 114, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 129, 130, 131, 132, 133, 134, 135, 137, 139, 145, 149, 150	TWSF Capacity – Permit Larger TWSF

Comment: The mine would be most productive with a larger tailings and waste facility. (3)

Comment: Alternative II is more forward-thinking because it calls for an adequate facility for storing waste rock and tailings, and is more than adequate in projecting the amount of cement needed to neutralize tailings. (5)

Comment: Formation's plan does present some advantages. It doesn't make sense to limit the tailings and overburden area to ten years of capacity. It is better to "over-permit" now rather than waiting until later. (8)

Comment: Support FCC tailings design. (23)

Comment: Concerned that limiting the volume of the proposed tailings facility limits production and reduces operator flexibility. Unreasonable conditions imposed upon the proponent will likely have a negative value on the feasibility of developing this, one of a few cobalt deposits within the United States. (24)

Comment: Community will benefit from the \$477,000 local tax dollars and \$1.8 million in state taxes. Support FCC's TWSF plan, don't limit tailings facility size. (25)

Comment: Concerned that limiting the volume of the proposed tailings facility limits production and reduces operator flexibility. (26)

Comment: The environment and the economy is better off with the larger waste rock storage facility as proposed by the company. (34)

Comment: Formation Capital's . . . Proposal to have a larger waste rock storage facility is the better option, both economically and for the environment. (46, 57, 63)

Comment: Approve the whole TWSF footprint. The Forest Service's proposed TWSF footprint is a good phase I for the TWSF, but it would be shortsighted not to plan for growth. (62)

Comment: Formation Capital's plan calls for the best water treatment processes and waste storage facilities that will hold more than ten years of tailings and waste. I urge you to permit the larger facility. Failing to do so will limit the mine's productivity and disrupt jobs down the road. (76)

Comment: Limiting the productivity of the mine by not building a large enough waste facility is a waste of time and tax dollars. Allow the mine to produce at full capacity for the longest period of time by building a storage facility that does not require an interruption of jobs and mine productivity. (77)

Comment: Formation Capital's plan calls for the best water treatment processes and waste storage facilities. (79)

Comment: Alternative II provides for a larger waste rock and tailings facility that will not limit the mine's productivity. Alternative II also provides for the separation of waste rock before it

is stored. I believe this will prove to be the better option in case we decide we need to treat the waste rock and tailings separately in the future. (80)

Comment: Reducing the size capacity of the tailings/waste rock storage facility (TWSF) as recommended in Alternative IV seems unwise -- a false economy. The capacity requested in Alternative II is only 35% greater than the known reserves/production estimate. Given the geology, there is excellent potential for finding that 35%. Having a second permit for such a small increase involves extra costs and delays for the mine -- costs which would be better spend on reclamation. (81)

Comment: I believe the proposal for a larger waste rock storage facility is a good option. It would allow room in case there is more material than expected. This would allow for a longer mine life, would not stop production, and would not interrupt jobs in order to re-permit the facility. (84)

Comment: Alternative II also offers a more comprehensive tailings and waste facility that allows mining production to continue uninterrupted beyond ten years. The Forest Service's alternative needlessly constrains production. (85)

Comment: Formation Capital's plan for waste storage is better than the Forest Service's plan which limits the life of the project. (106)

Comment: Formation Capital's mining plan offers a comprehensive tailings and waste facility that will allow for mining production to continue uninterrupted beyond ten years. The Forest Service's alternative constrains cobalt production by limiting the waste facility's capacity to ten years. The Forest Service should approve and permit the larger waste facility. Limiting the size of the TWSF may seem like an environmental protection now, but even with this larger facility, the environmental impact will still be minimal- the total footprint of the mine will be less than 150 acres. Having the larger facility from the start will benefit the environment and the local economies. (109)

Comment: Limiting the productivity of the mine by not building a large enough waste facility is a waste of time and tax dollars. Allow the mine to produce at full capacity for the longest period of time by building a storage facility that does not require an interruption of jobs and mine productivity. (114)

Comment: The Idaho Cobalt project is a well-planned project that would bring a much-needed economic boost to the community by providing steady jobs and tax dollars to the area. Failing to permit the larger facility will limit the mine's productivity and disrupt jobs down the road. (117, 118, 119, 120)

Comment: Formation Capital has planned for the best water treatment processes and waste storage facilities that will accommodate tailings and waste beyond ten years of production. (117, 118, 119, 120)

Comment: Rejecting the extra capacity of the tailings impoundment is poor planning. If the USFS is concerned that the footprint will not be necessary, allow for expansion at a later date when the extra capacity is needed. (121)

Comment: It makes more sense to plan a waste storage facility that will hold 35% more waste than what would be produced by from current production estimates, which Formation has done. The Forest Service's alternative only provides for waste beyond ten years of productivity, which means that if the mine is productive beyond ten years, under the Forest Service's plan, we would be forced to stop production and interrupt jobs in order to re-permit the facility. We should not limit our economy with something as impractical as not building a large enough storage facility. It is important to consider this possibility and for this reason, I

support Formation Capital's plan of operations over the Forest Service's alternatives. (122, 123, 124, 125, 126, 127)

Comment: The mining company's proposal to have a larger waste rock storage facility is the better option, both economically and for the environment. The company wants to permit some excess capacity for this storage facility, which would allow room in case there is more material than expected during the 10-year life of this permit, and would also allow for a longer mine life if additional ore is found. Since it is likely more ore will be located, it makes sense to permit the larger storage area. That would be better not only for the company, but also for the community and regional economy. It also is a sound proposal for the environment. (129, 130, 131, 132)

Comment: The Idaho Cobalt Project would be most productive with a larger tailings and waste facility permitted from the beginning of the plan. This larger facility would leave room for the possibility of increased ore reserves and avoid unnecessary interruptions in employment. Mining is criticized for being a boom-and-bust industry - permitting the larger waste facility will help reduce that being likelihood. (133)

Comment: Some of the economic assets would include tax dollars from Formation Capital and many much-needed steady jobs. Local unemployment rates will go down and communities will benefit from the local tax dollars and state taxes that will fortify and improve vital community services. (134)

Comment: Under Alternative II the mine would be afforded a larger tailings and waste facility. That leaves room for an increase in future ore reserves, which makes more long-term sense for permitting. (135)

Comment: The Idaho Cobalt Project would be most productive with a larger tailings and waste facility permitted from the beginning of the plan. This larger facility would leave room for the possibility of increased ore reserves and avoid unnecessary interruptions in employment. Mining is criticized for being a boom-and-bust industry - permitting the larger waste facility will help reduce the chance of that occurring. (137)

Comment: Formation Capital's Alternative II is a far superior plan to the other alternative of the draft EIS, particularly the added size of the tailings and waste rock storage facility being able to allow additional future reserves. Limiting the mine to 10 years doesn't make any sense, particularly if there is ore available to operate longer. (139)

Comment: Various aspects of the Draft contain language that is unnecessarily confining, such as the agency recommendation to have a smaller tailings and waste rock storage facility (TWSF in the EIS) than is proposed by the company. Such restrictions will bring no additional environmental protection and could actually limit the mine's operating life, which in turn has negative social and economic effects. As you move forward with the Final EIS, please consider the ramifications of such confinements. We stress we are not talking about loosening environmental protections or regulations, but rather placing undue restrictions that don't bring a corresponding benefit. (145)

Comment: Formation's proposed Facility is the better option. Environmentally, it makes more sense to permit the larger facility, so as not to come up short in 10 or 12 years. From an economics standpoint, it also is preferable for nearly the same reason. And from a pure logic standpoint, it only makes sense to not potentially constrain the entire operation down the road with an artificial limitation that doesn't benefit the environment or the economy. (149)

Comment: The Forest Service's alternative will limit the production of the mine by restricting the capacity of the waste facility to ten years. Even with a larger facility, the total footprint of the mine will be less than 150 acres. Having the larger facility from the start will benefit the

environment, as well as the local economies by allowing the mine's production to continue uninterrupted. (150)

Comment: Formation Capital has planned for the best water treatment processes and waste storage facilities that will accommodate tailings and waste beyond ten years of production. (150)

Response: Proposed modifications to the company's proposal, as described in Chapter 2 Alternatives III, IV and V, have been developed in response to issues and potential impacts identified during the scoping and Idaho Joint Review Process (JRP) used by the EIS team to develop Issues, Concerns, and Opportunities (ICOs) for the ICP and during the impact analysis. A summary of advantages and disadvantages considered in regards to the TWSF facility is provided on page 2-70 to 2-71 of the DEIS. Your comment in support of maintaining a 35 percent buffer above current production estimates has been noted in the review process. (3, 5, 8, 23, 24, 25, 26, 34, 46, 57, 62, 63, 76, 77, 79, 80, 81, 84, 85, 106, 109, 114, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 129, 130, 131, 132, 133, 134, 135, 137, 139, 145, 149, 150)

Comment Code	Letter No.	Comment Subject
TWSF-1901	115	TWSF Design

Comment: Errors and omissions in the description of Alternative II. Chapter 2, TWSF reclamation (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, Figure 2-1 wetland mitigation cells. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, TWSF reclamation. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives - unsubstantiated commingle tailings and waste in TWSF as mitigation measure. (115)

Response: Many times there is a subtle distinction between a component of an alternative and a mitigation action. In this case, the distinction is unimportant because the merits of tailings and waste rock commingling were considered by the DEIS analysis, and on balance commingling was thought to be a superior approach. To clarify this conclusion, however, by "commingling" does not necessarily envision a homogeneous mixture of tailings and waste rock. Encapsulation of waste rock by layers of tailings that will further reduce the oxygen diffusion into waste rock zones is the anticipated plan. Commingling is an added measure that supplements the environmental protection afforded by the geomembrane liner and cover system. The protective tailings shell will provide the only means of reducing oxygen flux during the operating life of the mine. The requirement for encapsulation of waste rock by tailings does not rule out use of a separate waste rock placement cell. (115)

Comment: Errors and omissions in the impact discussions - failure to analyze phased construction of TWSF. (115)

Response: FCC's proposed phased construction of the TWSF begins with a toe berm and would destroy the existing isolated wetlands in the first year of construction. Alternative IV was designed to avoid the wetlands impacts entirely (if the identified ore reserves were all that were ever mined) or to postpone the impacts to the wetlands until additional ore reserves were identified indicating a need for the larger disturbance area. (115)

Comment: Other - TWSF closure cap, soil balance showing quantities needed and source is needed. (115)

Response: Although the likelihood of finding additional cobalt/copper mineralization in the area of ICP's claims is high, the economics of mining those reserves are difficult to predict. The selection of a smaller TWSF facility in Agency Alternatives IV and V is intended to provide the required range of alternatives considered in the NEPA analysis. The alternatives are presented in such a fashion that selection of another option for the TWSF size would be possible in the Record of Decision. (115)

Comment Code	Letter No.	Comment Subject
TWSF-1901-1	3, 26, 81, 85, 109, 121, 146, 149, 150	TWSF Design - Commingling

Comment: Commingling of tailings and waste is a flawed concept. Dissimilar materials should be located in the TWSF so they can be managed separately in the long run. (3)

Comment: Commingling of material in TWSF will provide an increased level of operating complexity that is not justified based on available data. (26)

Comment: In regard to commingling versus separating the tails from the waste rock . . I know that fine material does generally reduce permeability and it may inhibit oxygen from entering as well. If the tails are indeed non acid-generating, this may work. (81)

Comment: Lastly, tailings and waste should not be commingled. Alternative II, which provides for different waste materials to be managed separately, is the better choice. (85)

Comment: In addition, Formation's plan calls for amending tailing cement to neutralize all sulfides. Lastly, tailings and waste should not be commingled. Formation's plan provides for different waste materials to be managed separately and for that reason is the best choice. Allowing for proper management of tailings and waste will allow the option of treating the waste separately in the future, in the unlikely event that is deemed necessary. (109)

Comment: Unsupported assertions - TWSF, unsupported assertions re: co-disposal. (115)

Comment: Mill tailings should not be commingled with waste-rock unless the benefit from such an action is clearly demonstrated. It is assumed that attenuation would be the goal of the commingling strategy; if so, the attenuating capacity of the mill tailings should be relatively easy to determine. If there isn't significantly more attenuating capacity in the mill-tailings than acid-forming potential of the waste-rock, the commingling strategy should be abandoned. Otherwise the potential for leaching even more constituents from the mill-tailings might be the result. Oxygen-limiting schemes briefly described in the DEIS often only slow the progress of sulfide oxidation. Changes in barometric pressure and convection have in other locations caused oxygen diffusion despite substantial engineering efforts to prevent it. In short,

keeping the two piles separate at least provides the ability to manage each pile's unique effluent in an appropriate manner, if there turns out to be an effluent over the long-term. Adjustment of the bonding calculation could also be made if there is a definitely measurable difference in risk between the two options. (121)

Comment: The tailing and the waste should remain segregated in the TWSF. From an environmental standpoint it would be easier to monitor and know exactly where the material of greatest concern is located with out spreading it out through out other material of lesser concern. Dilution of the waste material does not remedy the concerns of ARD. The tails are predicted to have low levels of sulfide or metals bearing materials and should not be contaminated with materials of a possible higher sulfide or metals content. The impermeable layer that covers the TWSF will control the water and air permeating through the material. Does the FS have data or testing that proves their claim that the tailings and waste commingled is a better plan? The tailings and the waste will likely both be porous materials so commingling the two will just spread the waste out and reduce the ability to control the situation. (146)

Comment: There has to be sufficient room to be able to maintain two separate bodies of material (tailings and waste) in the same storage facility. The design as presented in Alternative IV doesn't allow for separation of materials. (146)

Comment: I'm also puzzled by the Draft EIS's proposed method and ratio of commingling tailings and waste. It seems Formation's proposal is the sounder, more environmentally friendly approach, and I recommend you re-consider it. (149)

Comment: Formation's waste storage plan calls for waste rock to be segregated, in case the rock and tailings need to be treated separately in the future, which I believe is a better alternative. (150)

Response: Commingling of tailings and waste rock disposed of in the TWSF as proposed in Alternatives III, IV and V is intended to reduce the oxidation rate of the higher permeability waste rock component and reduce long-term risk to the environment of metals release as described in more detail on page 2-56 of the DEIS. The FEIS includes the requirement that the ICP provide a plan for commingling of tailings and waste rock with the intent to reduce oxidation and metals leaching from waste rock. Public support for the selection of Formation Capital's proposal that maintains the separation of waste materials will be taken into consideration during the final evaluation of alternatives. (3, 26, 81, 85, 109, 121, 146, 149, 150)

Comment Code	Letter No.	Comment Subject
TWSF-1901-2	110	TWSF Design - Footprint

Comment: Reduce TWSF footprint by completely backfilling underground mine workings. (110)

Response: If the mine were completely backfilled, the access ramps would be filled during the closure phase. Material used for backfilling the ramps would be taken from the top of the TWSF in order to maintain the structural integrity of the pile. Backfilling the entire mine will not utilize the entire amount of material in the TWSF. Therefore, the footprint of the remaining material would not be reduced, rather the pile would be lower in height. (110)

Comment Code	Letter No.	Comment Subject
TWSF-1901-3	26, 146	TWSF Design – Cap

Comment: Oppose additional cap material on TWSF due to cost/benefit. (26)

Comment: The 4 feet soil cover will significantly increase costs to cover the TWSF. Where will this amount of subsoil come from without creating more disturbances? Is there scientific justification for 4 feet vs 3 feet? (146)

Response: Alternatives III through V require the ICP to submit a revised design of the TWSF cap for Forest Service approval. The TWSF closure cap would be modified to include a minimum of 4 feet of soil cover material composed of three feet of subsoil and one foot of topsoil. Four foot of soil cover (versus three feet in Alternative II) will provide a thicker cover capable of supporting the growth and long term sustainability of native forest tree species that will eventually revegetate the site without damage to the impermeable liner system. (26 and 146)

MINE

Comment Code	Letter No.	Comment Subject
MINE-2000-1	112, 115	Underground Mine Backfilling

Comment: Page 2-11 (backfilling 4th paragraph): The modifications to the FCC proposal in Alternatives III thru V should indicate that backfilling in 10 feet lifts is not appropriate and that the backfilling procedures should be modified to provide lifts of no greater than 2 feet. (112)

Response: Backfill lifts: mine backfill is a cemented paste, not soil. The paste gains strength as the cement hardens, not through compaction. A 10-foot lift is appropriate for this type of backfill. (112)

Comment: Errors and omissions in the description of Alternative II. Summary section (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, paste backfill cement addition (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, dewatering at Ram. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Chapter 2, dry backfill. (115)

Response: Editorial Correction. (115)

Comment Code	Letter No.	Comment Subject
MINE-2000-2	62, 81, 115, 146	Underground Mine Backfilling – Slash Amendment

Comment: Mixing tailings and waste is not a recommended method of storage. The proposed slash amendment is an unnecessary expense. The large tonnage of cement that will be in the stopes will have more than enough excess neutralizing capacity to counter any potentially acid generating material in the slash. (62)

Comment: Underground paste backfill and extra lime addition to slash (waste rock) is helpful. (81)

Comment: Tailings will be made into a paste with cement (page 2-11). Cement is limestone. Is there a need to add more limestone? (146)

Response: Metals leaching and acid drainage is a potential concern for the TWSF and post-closure mine discharge. A brief summary of the Geochemistry contributing to these concerns is found on page 4-13 of the DEIS. The agency alternatives propose to address this concern through the amendment of waste rock (slash) left underground in the Ram and Sunshine mines with lime or cement to provide alkalinity to reduce potential for metals leaching. (62, 81, 146)

Comment: Miscellaneous - Underground tailing placement - adding limestone is not necessary. (115)

Comment: Errors and omissions in the development of agency alternatives - unsupported alkalinity amendment to slash waste rock. (115)

Response: The EIS team is aware of a number of mining projects in which the average NNP of a waste rock facility was positive, yet the seepage from the pile was acidic. Early work with selective placement of alkaline waste rock as a mitigation measure was not always successful if the alkaline rock was placed as distinct alternating layers among acid generating waste rock. One problem with alkaline addition is that if acidic interstitial solutions form they can migrate into the alkaline rock unit and precipitate iron and aluminum oxyhydroxide precipitates on the carbonate minerals, which can reduce their reactivity. As a practical matter, acidic solutions may migrate through mixed acidic and alkaline rock even when the overall average NNP is positive. As a consequence of concerns about the lack of success with some efforts to neutralize ARD potential, the EIS team is requiring site-specific demonstration that the proposed style of mixing will successfully control pH. (115 for both above)

Comment Code	Letter No.	Comment Subject
MINE-2000-3	108, 110	Underground Mine Backfilling – Complete or Maximize Backfill

Comment: Waste rock and mine tailings should be used to completely backfill the mine shafts; waste rock should be mixed with concrete so that potential groundwater contamination (acid mine drainage) is minimized. (108)

Response: In the agency alternatives II, IV and V (see Chapter 2 DEIS), the risk of ARD from waste rock is reduced through: 1) ongoing geochemical characterization program; 2) amendment of waste rock with alkaline materials (e.g. lime, limestone, cement) as needed to ensure long-term acid control; and 3) encapsulation of waste rock within low permeability tailings in the TWSF. (108)

Comment: Encourage additional backfilling of mine workings. (110)

Response: ICP has proposed backfilling mine stopes as part of the mining process. Their plan would leave open access ramps and drifts (tunnels) from the ramps to access ore zones at the end of mining. The volume of openings left unfilled is estimated to be approximately 30 percent and 95 percent of the total mine volume for the Ram and Sunshine Mines, respectively. Complete backfilling would occur following the end of mining and would require removing tailings from the TWSF and reconstituting them as a paste to pump underground. The backfilling of the ramps and drifts would not significantly affect the post-closure chemical load contributed to groundwater because the majority of metals load is anticipated to come from the slash. Alternatives Considered But Dismissed, located in the final EIS, Chapter 2, provides a description of the additional backfill and a discussion of its feasibility and rationale for its dismissal. NEPA requires the analysis of a reasonable range of alternatives which address identified issues. Although additional backfilling may address some of the issues, the Agencies found that it was not reasonable or practical and did not provide significant environmental benefits. Additionally, it would not eliminate the need for a surface tailings storage site that would be slightly smaller in acreage and height of that proposed. Please refer to Chapter 2 for more details. (110)

Comment Code	Letter No.	Comment Subject
MINE-2001	115	Surface Disturbance

Comment: Errors and omissions in the description of Alternative II. The Proposed Action (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the description of Alternative II. Incorrect acreage of disturbance. (115)

Response: Editorial Correction. (115)

Comment: Errors and omissions in the development of agency alternatives - provide infiltration gallery conceptual design information. (115)

Response: The infiltration gallery alternative has been dismissed in the FEIS and Alternative IV has been revised to include a discharge pipeline and in-stream diffuser. Rationale for dismissal of the infiltration gallery option is provided in Chapter 2 of the FEIS. (115)

Comment: Errors and omissions in the impact discussions - Alt. III disturbance area doesn't match Table 2-3. (115)

Response: Acreages for Alternative II in the DEIS had not been updated per the June 2006 Plan of Operations. Text for Alternative III has been updated in the FEIS. Acreages in Wetland and Vegetation Resources sections are, in some cases, a subset of the acreages in Table 2-3 and will not always exactly concur with acreages in Table 2-3. (115)

Comment: Errors and omissions in the impact discussions - Alt. II would result in more wetlands than Alt. III. (115)

Response: The agency alternatives include the objective of trying to minimize impacts to all wetlands including isolated non-jurisdictional wetlands that provide important habitat for a number of forest species. The isolated wetlands were identified following the 2000 fire and had characteristic wetlands vegetation assemblages at that time. They have also persisted for seven years following the fire including several drought years indicating that these are not likely to be temporary artifacts of the post-fire conditions. Proposed artificial wetlands may not provide equivalent services as the original and have not been demonstrated to be permanent since they would receive water from the TWSF that would be greatly diminished post-closure. The current constructed wetlands design would need to be revised taking into account final TWSF size and cap design. Further the quality of the water supplied by the TWSF seepage collection system may have chemical characteristics that limit wetlands functions. (115)

Comment: Miscellaneous - Adherence to regraded slope standards in Bucktail drainage. (115)

Response: Editorial. (115)

Comment Code	Letter No.	Comment Subject
MINE-2002	110	Agency Project Administration – Agency Capability to Manage

Comment: Deeply concerned about the ability of the State and Federal land management and regulatory agencies to properly supervise and monitor FCC exploration, development, operations, closure, and post -closure activities. (110)

Response: A Forest Service administrator is assigned to FCC's exploration plans and monitors construction activities prior to activity, documents, final reclamation, well plugging etc., and has performed this role since permitted activities commenced on the site. Page 2-55 of the DEIS requires the formation of an Interagency Task Force to provide oversight of this project. This concept has been in practice for mine operations on the Salmon-Challis for over a decade and has been comprised of representatives from the Forest Service, Idaho Department of Water Resources, Idaho Division of Environmental Quality, Idaho Depart of Lands, Environmental Protection Agency, Fish and Wildlife Service, Idaho Fish and Game, National Marine Fisheries Service, and the Army Corp of Engineers. Review of Operations, Reclamation Bond, Monitoring results, planned activities for the coming year etc. are quarterly reviewed by this group. Inspections throughout the year are conducted by the Forest Service. (110)

Comment: Operations should be suspended under certain weather or environmental conditions; the FS needs to define and set standard for qualified operators; FCC needs to submit a full emergency system guideline for all potential problems at the facility. (110)

Response: As outlined in the Emergency Management, Spill Control and Fire subsection of the Operational and Design Components, Monitoring and Mitigation section of Chapter 2, the Operating Permit will be conditioned with requirements to have a Spill Prevention Control and Countermeasure Plan, a Spill Response Plan, additional fire response items and specific emergency management planning and implementation components. These items are intended to address a range of emergency conditions that would put the operations, personnel or the environment at risk. The Forest Service does not have authority to set standards for "operators" at the mine. (110)

Comment Code	Letter No.	Comment Subject
MINE-2003	110	Project Infrastructure

Comment: The revised DEIS should describe anticipated infrastructure needs. (110)

Response: A revised DEIS has not been prepared. Infrastructure associated with the proposed ICP is described in detail in Chapter 2 under Alternative II and modified as appropriate under the other alternatives. (110)

Comment Code	Letter No.	Comment Subject
MINE-2004	110, 112	Geomembrane Liners

Comment: FS should disclose track record and failure rate of geomembrane liners and describe consequences; trigger levels for detection system, etc. (110)

Comment: Pond needs to be double lined w/leak detection and removal system; concern for geostability of pond. (110)

Response: The Forest Service has determined that geomembrane liners are an acceptable form of liner for the TWSF installation. The TWSF will have either a 60-mil PVC liner overlying a compacted clay liner, or a 40-mil PVC liner overlying a geosynthetic clay liner. The water management pond liner consists of a primary 80-mil HDPE liner over a secondary 40-mil HDPE liner with a HDPE geo-net leak collection system in between the two liners. Water collected in the geo-net membrane reports to a sump where it can be monitored and removed. The Forest Service is confident in the liner design of both the TWSF and the water management pond, and the construction quality control and inspection plan that will ensure the liners are properly constructed.

Monitoring of the leak detection system as proposed by FCC includes determining the presence of water in the sump using an electronic moisture probe. If water is present, the sump will be pumped and the volume of water will be measured to determine the leakage rate. If the leakage rate is determined to be greater than a generally accepted de minimus liner system rate, agencies will be notified within 10 working days and FCC will submit a specific response plan, with a schedule for implementation within 15 days. (110 for both above)

Comment: Page 2-24 and Figure 2-9: The modifications to the FCC proposal in Alternatives III thru V should indicate that the HPDE pond liners would be covered with a soil or gravel layer to protect the liners from ice puncturing. A soil or gravel cover provides an additional benefit of reducing the risk of liner uplift during high wind events if the ponds are not full of water. (112)

Response: Ice damage is most likely to occur in the pond corners. This is based on experience at nearby mine sites. The most practical method of protecting against ice damage is to provide a sacrificial sheet of liner material in the pond corners. If damaged, this sheet can be replaced during the life of mine. As part of Alternatives II-V, ICP will be required to submit a design for Forest Service approval to protect pond liners from potential ice damage. (112)

Comment Code	Letter No.	Comment Subject
MINE-2005	110	Noise

Comment: The FS needs to describe the volume and regularity of noise from blasting and other mining activities and analyze how visitors to and wildlife using FCRONR Wilderness will be affected. (110)

Response: Table 4-11 in the FEIS describes the anticipated volume (decibels) of various mining construction, operation, and reclamation activities associated with the Proposed Action based upon the distance of the receptor from the noise source. The Noise section of Chapter 4 also discusses the anticipated Proposed Action noise impact on visitors, wildlife and recreationists within the general project area and along the proposed transportation route. The boundary of the Frank Church River of No Return Wilderness area nearest to the proposed Idaho Cobalt Mine project area is approximately 4 miles to the west. Mine-associated initial surface and near-surface blasting noise would be the most likely to be audible in this area of the FCRONR Wilderness Area. Although blasting noise associated with surface and near-surface development of the mine portals would be potentially audible for several miles, it would be short-term for surface blasting (approximately two weeks), and be significantly reduced as the mine development-related blasting continued to proceed further underground. Portions of trail # 029 are located within the area that would be impacted by blasting noise. This FS trail is lightly used by recreationists as an access route to the FCRONR Wilderness. Use of this trail is primarily associated with hunter access during the local big game hunting season. Other mine related noise is expected to be attenuated to near background levels within the Wilderness Area. Wildlife in the wilderness area are not expected to be affected by noise associated with the operations. (110)

Comment Code	Letter No.	Comment Subject
MINE-2006	110, 113	Closure and Long-Term Maintenance - Management

Comment: The FS should consider the reliability of these systems (reclaimed facilities) over the long-term (500+ years) and require testing and maintenance as needed. (110)

Response: The agencies appreciate your concern for the long-term management of mine wastes upon closure. Critical facilities such as the TWSF have been evaluated for long-term geotechnical stability. The financial assurance is also intended to provide long-term financing for post closure water treatment (over 100-years). The EIS has not specifically evaluated 500+ year design standards, but the agencies feel that the facility designs identified in the preferred alternative are adequate for long-term function. (110)

Comment: DEIS does not evaluate the environmental impacts of an interim mine shutdown for economic reasons. (113)

Response: The FEIS has been modified (see 2-33) to describe the Interim Shutdown Plan included in the Plan of Operations. The Interim Shutdown Plan addresses continued operations, maintenance, monitoring and reporting necessary to minimize risk of adverse environmental impacts during a shutdown period. (113)

BLACKBIRD MINE SITE

Comment Code	Letter No.	Comment Subject
BMS-2100	115	Adjacent CERCLA Concerns

Comment: Blackbird Related Issues - Need for explanation of cleanup schedule, etc. for Blackbird Mine. (115)

Response: The Chapter 3 discussion of Blackbird Mine site activities is adequate to describe the area affected by the alternatives under consideration in the EIS. A detailed discussion of the cleanup standards for the Blackbird Mine site can be found in EPA's 2003 Record of Decision for the Blackbird Mine site. The schedule for cleanup activities can be found in the Unilateral Administrative Order for Remedial Design and Remedial Action, effective date August 10, 2003, as amended. The cleanup schedule is subject to change as it is updated at least annually.

The United States is not considered a "responsible party" in the Blackbird Mine site cleanup efforts. To the contrary, the United States District Court for the District of Idaho found in 1994 that the United States was not liable under CERCLA as an owner, operator, or arranger with respect to the Blackbird Mine. Order Granting United States' Motion to Dismiss and Denying the M.A. Hanna Company's Motion for Partial Summary Judgment, State of Idaho v. The M.A. Hanna Company et al., and consolidated case, CV 83-4179(R) (December 12, 1994). The mining companies filed an appeal of that order with the Ninth Circuit Court of Appeals and the United States entered into a 1997 Settlement Agreement with the companies to avoid incurring further fees and expenses that would come from such litigation. Under the Agreement, the United States agreed to pay a small percentage of the BMSG's costs associated with complying with the 1995 Consent Decree. That Agreement was entered into with absolutely no United States admission of liability or fault regarding the Blackbird mine site contamination. Changes were made in the FEIS as a result of the comment. (115)

Comment Code	Letter No.	Comment Subject
BMS-2100-1	110, 113, 115, 155	Adjacent CERCLA Concerns – Don't Impact CERCLA Cleanup

Comment: ICP would add to the pollution load of Blackbird CERCLA site. (110)

Response: The various design components, monitoring, and mitigation measures incorporated into the agency alternatives are intended to reduce the environmental impacts of the proposed mining operations. Point source discharges and non-point sources cannot cause or contribute to exceedances of water quality standards. The proposed Idaho Cobalt Project is not authorized to release hazardous substances, and it is not authorized to interfere with achieving and maintaining the performance standards for the Superfund cleanup at the Blackbird Mine Site. If the ICP releases or poses a potential threat of a release of a hazardous substance to the Blackbird Mine Superfund Site, the owner and operator of the new mine could become a potentially responsible party jointly and severally liable for response costs for the Superfund Site. If there are loadings from the new mines that are not captured and treated by Formation Capital Corporation, there would be potential for releases to the Superfund Site. Formation Capital should consider entering into an agreement with EPA and the other potentially responsible parties for the Superfund Site to address how the parties will work together in the event of a release from the ICP. (110)

Comment: Concern about potential hydrologic connection between ICP and Blackbird groundwater. What are implications of groundwater capture by BMSG and increased treatment loads. Notes potential need for an agreement with BMSG to handle increased loads from ICP. (110)

Response: As noted in the DEIS, and described in Section 4.3.2.1 of the Water Resources Technical Report, an analysis was performed specifically to address the potential for dewatering of the Ram and Sunshine mines to induce inflow from the Blackbird Mine workings. Results of the analysis do not suggest that such a scenario would occur. Nonetheless, additional monitoring wells are proposed between both ICP mines (Ram and Sunshine) and the Blackbird mine workings to monitor for the potential encroachment of Blackbird mine water into either of the ICP mines. In addition, monitoring of the distribution and quality of groundwater inflow to the ICP mines underground workings during dewatering would be used to evaluate the potential influx of Blackbird mine water.

If operational phase monitoring did indicate that Blackbird mine water was being drawn into the Ram or Sunshine Mines, possible remedies include grouting of structures/fracture zones acting as conduits between the mines, placement of capture/pumpback wells between the mines, treatment of the Blackbird mine water in ICP's process circuit, or cessation of mining and allowing the ICP mines to reflood. (110)

Comment: BMSG unlikely to meet water quality standards in Bucktail Creek; capture of ICP load by BMSG collection system not required by CERCLA. (113)

Response: It is the FS understanding that BMSG is not currently required to achieve compliance with water quality standards in Bucktail Creek as a Use Attainability Assessment (IDEQ, 2002) was conducted and approved by IDEQ and EPA (see footnote 3, Tables 4-8 and 4-9, DEIS). The DEIS makes no assumptions that Bucktail Creek will achieve compliance with water quality standards.

It is the FS and EPA understanding that BMSG is conducting additional remediation actions that are expected to further reduce copper loadings in Bucktail Creek so that water quality standards may be met, as required by the Unilateral Administrative Order, in South Fork Big Deer Creek, Big Deer Creek and Panther Creek. As summarized in the DEIS (page 4-9) and described in the Water Resources Technical Report (pages 4-2 through 4-4), the DSM assumed a future water quality condition based on the completion of the Blackbird Cleanup. These conditions include reductions in Blackbird loads to Bucktail Creek, the BT-5 pipeline, and compliance with water quality standards per the UAO. However, in no case did the DSM or the water quality effects evaluation assume any capture and treatment of ICP chemical mass loads by BMSG. Any loads predicted to be released from the ICP were assumed to report to Big Deer Creek and Panther Creek. Thus, the DEIS does not assume capture and treatment of ICP loads by BMSG in order to meet water quality standards. (113)

Comment: If ICP is approved, BMSG should be relieved of its consent Decree obligations. (113)

Response: The Forest Service and Environmental Protection Agency RODs for the ICP EIS will not unilaterally impose an additional burden on the BMSG to collect and treat the discharge of metals from the ICP. The preferred alternative contains enhancements to the ICP water monitoring program to detect, identify, and allocate the effects of mining so that FCC's cleanup responsibility can be established. FCC will be required to treat mine discharge from the Ram mine and Sunshine mine. For FCC mine water predicted to be captured and treated by BMSG, FCC must either: 1) take action, such as continual dewatering, to prevent FCC mine waters from commingling with water being treated by BMSG; or 2) obtain needed agreements (with BMSG) and permits (from regulatory agencies) to allow FCC's mine water to be treated at BMSG's existing Blackbird water treatment plant. Approval of the ICP alone; however, does not provide a basis for relieving the responsible parties for the Blackbird Mine CERCLA site of its CERCLA liability or its contractual commitments. (113)

Comment: If ICP is approved, BMSG should be relieved of its obligations to meet water quality standards in the Bucktail drainage, and the Agencies should be responsible for the consequences. (113)

Response: The commenter refers to meeting water quality standards in the Bucktail Creek drainage. However, Bucktail Creek itself does not currently have water quality standards because the State of Idaho determined through a Use Attainability Analysis that achieving water quality standards in Bucktail Creek is not technically feasible. The following response therefore assumes that the use of the term "Bucktail drainage" includes other downstream impaired waterbodies that may be considered a part of the drainage because, Bucktail Creek flows into or otherwise contributes to them. The BMSG's historic mining operations resulted in significant releases of hazardous substances to the Bucktail drainage. Such releases significantly degraded and impaired surface waters in the Bucktail drainage, the Blackbird/Meadow Creek drainage, and the Panther Creek drainage. The ROD for the Blackbird Mine CERCLA Site requires that the ongoing releases to groundwater and surface water be reduced to levels that will result in the cleanup levels established in the CERCLA ROD being met. The operation and maintenance of the remedy will also continue in perpetuity. There is no basis for relieving the BMSG from its obligations to meet water quality standards in surface waters in the drainage, other than Bucktail Creek. The Forest Service Record of Decision for the ICP requires that all future designs, analyses, and mitigation measures assure that no point or non-point pollutant loadings will cause or contribute to water quality standards violations. EPA expects all dischargers to comply with their NPDES permit. The proposed ICP is not authorized to release hazardous substances that will interfere with achieving and maintaining the performance standards for the Blackbird Mine Site cleanup. If the proposed ICP releases or is a potential threat of a release of a hazardous substance to surface waters within the Blackbird Mine Superfund Site that requires response action or that results in the incurrence of response costs, the owner and operator of the ICP could incur liability under applicable environmental laws, including but not limited to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). (113)

Comment: Blackbird Related Issues - Description of "Upper Bucktail Creek Alluvium." (115)

Response: The Upper Bucktail alluvium area refers to that portion of Bucktail Creek where groundwater seepage from the Sunshine Mine would recharge Bucktail Creek. This could occur over a considerable length of Upper Bucktail Creek, but predominantly upstream of BMSG's Phase II capture system. Table 4-7 footer has been revised in the FEIS to more clearly state this.

This is an area where water quality could be affected by both ICP and BMSG facilities. The purpose of this analysis is to show what effect the Sunshine Mine could have on the quality of water that ultimately could be captured by the BMSG Phase 2 capture system. As stated in the last paragraph on page 4-24 DEIS, post-flooding mass loads from the Sunshine Mine are predicted to increase copper loads in the Bucktail headwaters alluvium by about 0.15 lb/day, or by 10% to 50%. Thus, this is the incremental impact associated with the Sunshine Mine as illustrated by the color coding for the Alt. II closure (year 5) copper concentration in Upper Bucktail Alluvium. A more detailed description of the impacts to Upper Bucktail alluvium groundwater quality from the Sunshine Mine is presented in Table 4-7 of the Water Resources Technical Report and the 2008 Technical Report addendum. (115)

Comment: Blackbird Related Issues - Point of evaluation for Bucktail alluvium is not appropriate. (115)

Response: The purpose of the Upper Bucktail alluvium groundwater quality evaluation was to determine what impact the ICP operations could have on alluvial groundwater that may ultimately be captured by BMSG. Therefore, the evaluation focuses on the area upgradient of the BMSG Phase II capture system where outflow from the Sunshine Mine may report, which is upgradient of the influence of the Ram Mine. This is the appropriate area of interest for the evaluation objective since any water bypassing the Ram Mine capture system would primarily or entirely enter Bucktail Creek

downstream of the BMSG capture facilities. The reader is referred to relevant sections of the DEIS and the Water Resources Technical Report for details of the evaluation. (115)

Comment: Blackbird Related Issues - US Gov. is responsible party for Blackbird Mine cleanup. (115)

Response: *The United States is not considered a “responsible party” in the Blackbird Mine site cleanup efforts. To the contrary, the United States District Court for the District of Idaho found in 1994 that the United States was not liable under CERCLA as an owner, operator, or arranger with respect to the Blackbird Mine. Order Granting United States’ Motion to Dismiss and Denying the M.A. Hanna Company’s Motion for Partial Summary Judgment, State of Idaho v. The M.A. Hanna Company et al., and consolidated case, CV 83-4179(R) (December 12, 1994). The mining companies filed an appeal of that order with the Ninth Circuit Court of Appeals and the United States entered into a 1997 Settlement Agreement with the companies to avoid incurring further fees and expenses that would come from such litigation. Under the Agreement, the United States agreed to pay a small percentage of the BMSG’s costs associated with complying with the 1995 Consent Decree. That Agreement was entered into with absolutely no United States admission of liability or fault regarding the Blackbird mine site contamination. (115)*

Comment: Blackbird Related Issues - Cleanup uncertainty/ICP impact assessment unfair. (115)

Response: *The Water Resources Technical Report for the ICP (page 4-4) recognizes there is uncertainty associated with cleanup activities and states that predictions of stream concentrations would be understated if the Blackbird cleanup does not meet expectations. The comment underscores the reason enhanced monitoring of the ICP activities will be included as mitigation in the approved plan of operations. The DEIS presents an analysis of effects and doesn’t make judgments about the ICP or the ongoing BMSG cleanup. (115)*

Comment: The release of ICP Waters to the Blackbird Mine collection and treatment systems is not acceptable. (155)

Response: *The comment is correct in assuming that the estimated 5 percent or less of post-operational Ram Mine outflow potentially discharging to the BMSG Phase II capture system is based on a flow net analysis of the groundwater flow field between the Ram Mine and Bucktail Creek, and the percentage of the flow field area upgradient of the Phase II capture system. However, the DEIS analysis probably overestimates the potential for groundwater contaminants from the Ram Mine to mix with the BMSG Phase II capture system because the analysis assumes a uniform flow field exiting the mine. In reality, the majority of outflow from the Ram Mine will exit from the north half of the workings, due to the geometry of the workings and permeability of backfill material, with very little or no flow expected from the south portion of the workings which geographically overlap, and have the potential to mix with, the BMSG capture facilities. A more detailed description of outflow from the Ram and Sunshine Mines and potential for mixing with the BMSG capture facilities is included in the 2008 addendum to the Water Resources Technical Report.*

The comment further states that the assumption that groundwater flow generally follows the topographic gradient is only valid if the groundwater system behaves as an isotropic porous media aquifer. This is only partially correct. In reality, the bedrock system need only have a sufficient fracture density and interconnectivity to act as an equivalent porous media aquifer for flow to generally follow topography. As stated in responses to multiple comments (see Comment Response WTR 301-1 and WTR 310), additional safeguards have been incorporated as a result of the EIS analysis to ensure that contaminant migration through groundwater can be adequately controlled should contaminant pathways deviate significantly from those predicted by the equivalent porous

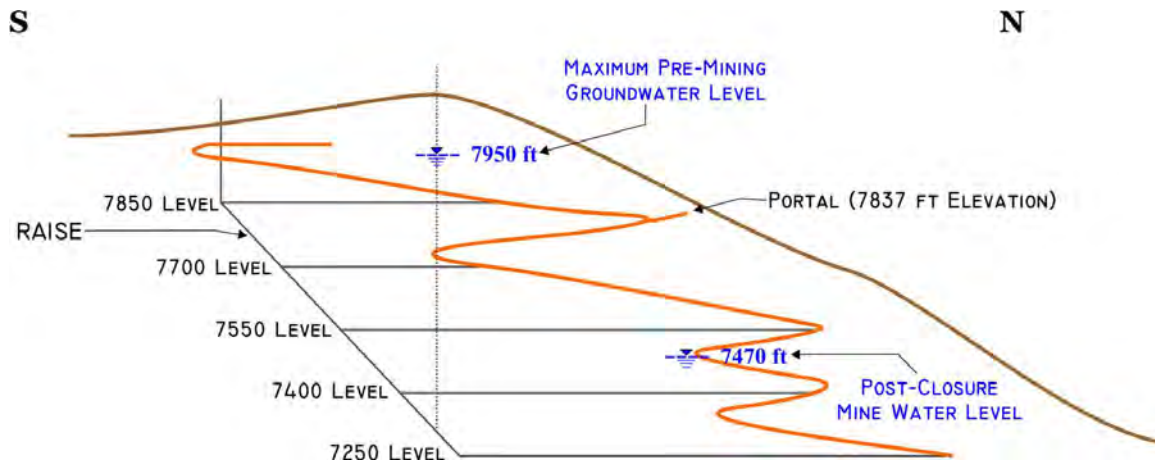
media model. These safeguards include detailed characterization of bedrock groundwater flow through mine inflow and groundwater drawdown monitoring during the mine operational period, and the multiple approaches to groundwater containment incorporated into the plan, including bedrock groundwater pumpback wells downgradient of each mine, and/or backup groundwater capture system in Lower Bucktail drainage, or maintaining the mines in a dewatered condition if necessary. Based on these monitoring requirements and contingencies, the EIS team believes that the quantity of Ram Mine-derived groundwater contaminants potentially reporting to the BMSG, if any, can be adequately quantified and controlled. (155)

Comment: The actual amount of groundwater that would be released from the Sunshine mine and the effectiveness of the proposed well capture system for ICP are not known. (155)

Response: See response to Comment WTR-301 and WTR-310. Also, note that it would be very feasible to prevent the outflow of groundwater from the Sunshine Mine after closure by keeping the mine in a partially or fully dewatered condition. Allowing the mine water level to recover to an elevation that would submerge the slash left in the mine (about 37% of the mine void), but prevent outflow through the groundwater system (by keeping the water level below the surrounding groundwater elevation), would allow the slash to rinse and the mine water quality to ultimately approach pre-ICP mine concentrations. Based on the small inflow rate predicted for the Sunshine Mine (<10 gpm), the mine water level could be controlled through pumping of the mine water to the ICP water treatment plant. Therefore, the migration of groundwater contaminants from the Sunshine Mine can be adequately controlled, if necessary. The potential need for long-term dewatering and treatment of the Sunshine Mine water after mine closure (either partial or complete dewatering), is recognized and is included as a contingency in the Alternative IV and V groundwater containment plans. Also, note that for Alternatives IV and V, the closure period copper concentrations downgradient of the Sunshine Mine are less than three times the pre-ICP mining concentrations (see Table 4-7 in DEIS). Thus, even with a 75% capture efficiency with the bedrock groundwater capture wells, the copper load reporting to Upper Bucktail drainage would be less than the current load from the Sunshine Mine area. Therefore, development of the Sunshine Mine under Alternative IV or V could actually decrease the copper load reporting to the BMSG capture system from the Sunshine Mine area (with reflooding and 75% capture) as compared to current conditions. (155)

Comment: There is no evaluation in the DEIS on the potential for groundwater to migrate into the Meadow Creek drainage. (155)

Response: The potential for southward groundwater flow from the Sunshine Mine was evaluated by the EIS team and found to not be significant. This is based on the fact that only a small portion of the upper access decline tunnel would be located south of the topographic divide, and the post-mining reflooded portion of the Sunshine workings would all be located north of the topographic divide. As shown in the figure below, the Sunshine workings are predicted to refill with groundwater to an approximate elevation of 7470 feet amsl after mine closure. Based on this prediction, all of the flooded workings would be located north of the topographic divide, thus minimizing the potential for southward migration of mine water into Meadow Creek drainage. (155)



Comment: Obstruction to BMSG, either permanent or temporary, would interfere with BMSG's ability to comply with the Consent Decree and UAO. (155)

Response: Comment noted. There are no permanent road closures planned that will preclude access to BMSG facilities. Any temporary closures due to Project related traffic would be remedied as soon as possible to prevent unscheduled interruptions to Project activities.

Access within BMSG's private property is entirely under BMSG's control. Use of access roads on public lands is managed by the Forest Service. Access to BMSG facilities will be maintained as necessary and the Forest Service will coordinate with BMSG and the EPA to ensure that adequate access exists to avoid interference with BMSG's CERCLA activities. (155)

Comment Code	Letter No.	Comment Subject
BMS-2100-2	108, 109, 112, 115, 149	Adjacent CERCLA Concerns – Consider BMSG Impacts

Comment: There is little discussion of full impacts from the nearby Blackbird Mine; details of this and other projects in the area need to be addressed. (108)

Response: The past, present and future impacts of the Blackbird mine are carefully considered in the analysis of the ICP. The baseline conditions reflect both historic impacts and recent cleanup activities. Ongoing cleanup and future impacts from the Blackbird site are considered in the DSM analysis and described in the cumulative impacts section of Chapter 4. (108)

Comment: The Tribe is particularly concerned that FCC will blame any contamination found at the site on the Blackbird Mine, and will attempt to avoid cleanup requirements on this account. (108)

Response: A key component of the selected alternative is to modify the water monitoring provisions of FCC's proposed plan of operation to enhance the ability to detect, document, and quantify effects of mining on groundwater and surface water quantity and quality. An extensive amount of baseline data has been and continues to be gathered in the project area, and monitoring would be required after commencement of mining activities that would assist the regulatory agencies in determining any actions to be required of the appropriate regulated entity(ies) to address any water quality concerns. It should also be noted that FCC would be required under an approved plan of operations to operate

pumpback wells and a water treatment system as long as needed to achieve long-term water quality goals. (108)

Comment: Throughout the length of the DEIS, there are several discussions regarding the Blackbird Mine Site, located in Lemhi County, Idaho. While it is true that the Blackbird Mine is geographically very close to the proposed ICP site and that the mine site is currently undergoing significant cleanup, what has happened at Blackbird should have no effect on whether the ICP gets permitted or not. Each mining project should be judged the merits of its own plan and should not be held accountable by mistakes that others have made. (109)

Response: The agencies have considered information from the Blackbird mine in the analysis of ICP mine geochemistry and water quality. Blackbird data have provided important insight into potential effects of the ICP. Not only have there been significant impacts to baseline conditions from Blackbird activities, but the ongoing cleanup and projected improvements in water quality have been factored in to the analysis of the ICP. The agencies are required to evaluate both baseline conditions and cumulative effects as part of the NEPA analysis. Although the decision on whether to allow the ICP to proceed is generally independent of the historic impacts of the Blackbird Mine, there is one significant area where that is not the case. Federal and State water quality regulations require that the impaired water quality in area streams resulting from historical mining be considered in determining the amount of pollutants that the ICP will be allowed to discharge. That is, the impacts of the historic activities imposes limitations on the proposed ICP operations. That being understood, the ICP has been evaluated on it's own merits and without assuming that past practices at Blackbird would necessarily be repeated by the ICP. (109)

Comment: Page 4-7, Item No. 6: Quantify “very small” in terms of range flows or chemical mass. Also, compare across alternatives and the amount of chemical mass loads that would be intercepted from BMSG sources. (112)

Response: The predicted copper concentration and chemical mass changes at Ram Spring are described in the Technical Memorandum - Water Resources Technical Report Addendum (Hydrometrics, 2008). (112)

Comment: Blackbird Related Issues - BMSG participation in JRP meetings. (115)

Response: No change has been made in the FEIS. (115)

Comment: Blackbird Related Issues - Permit condition requiring ICP/BMSG cooperative WQ monitoring. (115)

Response: Language in this section has been clarified. The Agencies, not FCC, would be responsible for coordination of monitoring through their review and approval of monitoring plans and water resource monitoring data. (115)

Comment: Blackbird Related Issues - Continued WQ impact to Big Deer Creek is caused by Blackbird Mine pollution. (115)

Response: Text in the referenced paragraph (page 4-30, 2nd paragraph, DEIS) and throughout Chapter 4 has been modified to more clearly identify the causes of existing and predicted future water quality conditions. (115)

Comment: Blackbird Related Issues - ICP/Blackbird Mine cleanup coordination. (115)

Response: The comment refers to the first paragraph of the Blackbird Mine Site Summary section in Chapter 4. The issues and areas where coordination of activities would be required to minimize impacts are described in the remaining paragraphs of the section and primarily consist of water resource monitoring and operation of Blackbird cleanup facilities (e.g. dams, groundwater pumping systems, and pipelines) in Bucktail Creek drainage that must remain operational for the cleanup to continue.

The Agencies, not FCC, would be responsible for coordination of monitoring through their review and approval of monitoring plans and water resource monitoring data. Coordination and review of ICP activities by the Agencies would be needed to ensure that ICP activities do not interfere with BMSG facilities. Language in this section has been revised for clarification. (115)

Comment: BMSG diminution of flows in Big Deer Creek drainage. (115)

Response: The section titled Surface Water (page 4-87, DEIS) clearly states that "Blackbird cleanup actions are also expected to result in long-term decreases in streamflow in Bucktail Creek and South fork of Big Deer Creek due to continued pumping and transport of groundwater and surface water...". Determining what if any water rights are required for ICP's operations is not the responsibility of nor has it been determined the EIS analysis. The ICP will have to obtain the necessary water rights to be in compliance with the Plan of Operations approved by the Forest Service. (115)

Comment: To allow the operators and successors of the old Blackbird Mine have undue influence over your agency (both the USFS and EPA) decisions would be incorrect and would not be in the best interests of the nation, Idaho or Lemhi County. Moreover, to punish Formation Capital for the mistakes made at the Blackbird Mine (by making Formation bond for that operation's water quality problems, for example) would be improper. (149)

Response: The issues that you have raised are addressed in Chapters 3 and 4 under headings referring to the Blackbird Mine Site and Financial Assurance. It is an objective of both the Forest Service and Environmental Protection Agency associated with the ICP to ensure no adverse impacts will jeopardize the ongoing CERCLA cleanup activities at the Blackbird mine site (page 4-86, DEIS). Careful coordination of ICP and the Blackbird cleanup activities will be required to ensure that no adverse impacts occur (page 4-86, DEIS). (149)

Comment Code	Letter No.	Comment Subject
BMS-2100-3	113	Adjacent CERCLA Concerns – Plan will Jeopardize BMSG Cleanup

Comment: ICP jeopardize ongoing cleanup activities at Blackbird Mine. (113)

Comment: ICP jeopardize ongoing cleanup activities at Blackbird Mine - DEIS fails to provide necessary analysis and assurances re: impacts to Blackbird Mine cleanup. (113)

Response: The ICP has been subject to careful and conservative analyses. The design, monitoring, and mitigation measures will continue to be subject to careful and conservative design, analyses, and monitoring. The Forest Service's Record of Decision provides that the ICP cannot release hazardous substances to the environment and it cannot interfere with the Blackbird Mine Superfund Site cleanup. Additionally, IDEQ has required that no net copper and cobalt loadings will be added to impaired streams. No point or non-point discharges from the mines are allowed to cause or

contribute to water quality standards violations. Because the ICP effluent discharge will meet state water quality standards at end of pipe and the State has developed a CWA 401 certification that requires no additional loads of copper and cobalt be added to the watershed, there will be no violation of the state antidegradation policy. (113 for both above)

Comment: ICP adverse impact on BMSG's Consent Decree and UAO. (113)

Response: The Forest Service's Record of Decision provides that the ICP is not authorized to release hazardous substances to the environment and it cannot interfere with the Blackbird Mine CERCLA Site cleanup. Additionally, all future plans and designs must assure that no pollutant loadings will be added to the watershed. Additionally, Section 107 of CERCLA, 42 U.S.C. §9607, provides that the owner or operator of a facility from which there is a release, or a threatened release of a hazardous substance which causes the incurrence of response costs shall be liable for all costs of removal or remedial action incurred by the United States or any other person. At this time, there is no evidence that Formation Capital's activities have resulted in releases or a potential threat of a release of hazardous substances. If the proposed mining project releases or poses a potential threat of a release of a hazardous substance into the environment requiring response action, then the owner and operator of the mine could become a potentially responsible party and subject to administrative enforcement activities or litigation by the government and/or private entities that incur response costs that should be the responsibility of the owner or operator of the ICP. (113)

Comment: ICP approval would frustrate water quality restoration objective of Consent Decree. (113)

Response: Analysis of the ICP impacts to groundwater and surface water indicate that there will be no net addition of metals to the Bucktail drainage during operations or following mine closure while water capture and treatment continue. During ICP operations they will capture and treat water that would have otherwise found its way into the BMSG collection system. Thus during operations, the ICP impact will be to reduce metals loading to Bucktail Creek and to BMSG's capture/treatment system. It is likely that once mine dewatering has ceased that a small amount of groundwater from the Sunshine mine would evade capture from the bedrock capture well system and could commingle with water that is captured by BMSG. It is also possible once Ram mine dewatering has ceased that a small amount of groundwater affected by the Ram mine would be captured by the BMSG collection pumps. During the period that the ICP bedrock capture systems operate, the metals load that could potentially reach BMSG's collection system would be lower than the existing baseline condition through the Ram and Sunshine ore zones.

During ICP mine operations (mine dewatering) the metals loads predicted to reach Bucktail Creek are lower than existing conditions. Similarly, during the period that the bedrock and or Bucktail alluvial capture systems operate, the metal load reaching Bucktail Creek would remain below the existing baseline condition. Monitoring and incremental approval of each of the critical steps that could lead to changes in groundwater conditions are intended to avoid increase in metals loads that could adversely affect BMSG's cleanup. This analysis indicates that the ICP would not have an adverse effect on BMSG's ability to meet requirements of the consent decree. (113)

Comment Code	Letter No.	Comment Subject
BMS-2100-4	112, 113, 115, 155	Adjacent CERCLA Concerns – Water Treatment

Comment: Pages 2-50 and 2-51: The listing of Other Mitigation should include an agreement between FCC and the BMSG for upgrading of the BMSG's water treatment plant and an agreement between FCC and the BMSG for long term operation, maintenance, and monitoring associated with operation of the BMSG's water treatment plan. (112)

Response: Any agreement between ICP and BMSG would be the responsibility of those parties. The FEIS indicates that any ICP activities or design changes that could effect the BMSG CERCLA remedy would have to be approved by USFS and EPA remedial project managers, this would include any agreement between the ICP and BMSG for use of the existing water treatment infrastructure as contemplated in Alternative V. (112)

Comment: Uneven ICP/BMSG playing field for water quality requirements. (113)

Response: The ICP is subject to the Clean Water Act and the Blackbird Mine Site Group is subject to a consent decree under CERCLA, CWA and State authorities and a Unilateral Administrative Order under CERCLA. The 2003 CERCLA Record of Decision for the Blackbird Mine Site and the supporting administrative record is the basis for the selected remedy, which is protective of human health and the environment. The 2003 CERCLA Record of Decision also describes the applicable or relevant and appropriate requirements for the selected remedy. ICP is not currently subject to CERCLA actions at the Blackbird site and EPA intends to ensure that the ICP, like all discharges, complies with NPDES discharge requirements. If there are releases or the potential threat of a release from the ICP mines, the owner and operator could be ordered to abate any imminent and substantial endangerment resulting from such releases or potential threats in accordance with Section 106 of CERCLA, 42 U.S.C. § 9606, and/or may be potentially liable for response costs at the Blackbird Mine Superfund Site under Section 107 of CERCLA, 42 U.S.C. § 9607.

The Plan of Operations will contain requirements including submittal of detailed plans, implementation of mitigation measures, and monitoring and reporting intended to ensure compliance with water quality regulations. The Forest Service has the authority to enforce compliance with the Plan of Operations. Additionally, the Forest Service will ensure that a bond or other financial assurance is in place that is intended to finance long-term water capture and treatment if proposed design and mitigation measures are not effective in controlling release of metals to surface and groundwater.

The Idaho DEQ has authority over groundwater quality and can enforce violations of Idaho Water Quality Law. (113)

Comment: Errors and omissions in the impact discussions - Blackbird Mine assimilative capacity vs. ICP. (115)

Comment: Blackbird Related Issues - BMSG assimilative capacity and environmental statutes. (115)

Response: The effects of the ICP on area streams and the Blackbird cleanup were identified as issues during scoping (see page 1-8 and 1-9 FEIS). The water resource evaluation makes no judgment regarding assignment of assimilative capacity, rather the effects of the ICP are evaluated relative to status of the BMSG cleanup (i.e., existing water quality conditions and water quality conditions after completion of the cleanup). In addition, the Blackbird cleanup goal for cobalt is assumed as a measure of potential toxicity in area streams as there is no numeric aquatic life criterion for cobalt. (115 for both above)

Comment: Blackbird Related Issues - ICP reduction in total copper load in Big Deer Creek prior to construction of BT-5 remedy. (115)

Response: Text has been modified to clarify Blackbird impacts and ICP effects on copper load. (115)

Comment: The BMSG has not agreed to the collection and treatment of waters released from the ICP system and the FS cannot reasonably approve an alternative that is dependent on such an agreement. (155)

Response: The ICP plan as proposed is expected to result in a decrease in metals load reaching the BMSG collection system in Bucktail Creek during all phases of operation and closure. Therefore, it is not clear that there are any adverse affects on BMSG and that there is any reason that the Forest Service cannot approve a Plan of Operations. (155)

Comment Code	Letter No.	Comment Subject
BMS-2100-5	112	Adjacent CERCLA Concerns – Sediment

Comment: Page 3-10: The discussion of the Blackbird Mine Site and Ongoing CERCLA Response sections would benefit from a clear articulation from the Record of Decision of each media found to have been presenting an ecological or human health risk. Impacts to sediment quality in surface water are not discussed nor are the sediment cleanup goals. (112)

Response: Media addressed by the CERCLA response are summarized on pages 3-8, 3-10 of the FEIS. Text has been expanded for clarification. (112)

Comment: Page 3-29: It would be useful to have the sediment contaminant levels found as part of the RI/FS referenced in this discussion and also discuss the risk-based sediment cleanup goals. (112)

Response: Sediment metal concentrations found in the RI/FS and cleanup goals are described in the Water Resources Technical Report (Tables 3-19 and 3-20), which is part of the administrative record. Additional discussion of sediment cleanup goals has been added to page 3-10 of the FEIS. (112)

Comment Code	Letter No.	Comment Subject
BMS-2100-6	112, 113, 115	Adjacent CERCLA Concerns – Inadequate Description

Comment: Page 3-79: The diversion facility to route Bucktail Creek flows around South Fork Big Deer Creek is described in the text as a diversion ditch. EPA's ROD for the Blackbird Mine site indicates that this diversion facility would incorporate a buried pipeline rather than a diversion ditch. The text should be corrected accordingly. (112)

Response: No description of the BT-5 diversion could be found on page 3-79 of the DEIS. On page 3-81 of the DEIS, (page. 3-85, FEIS), the BT-5 diversion is described as "utilizing a buried pipeline." (112)

Comment: BMSG cannot lawfully be required to clean up contamination caused by the ICP. (113)

Response: Actual mitigation designs are included in the descriptions of the alternatives in Chapter 2 of the DEIS to the extent needed to evaluate and compare the effects of alternatives. The FS would stipulate in the ROD that all mitigations would be initiated or constructed at the earliest appropriate stage of mine construction.

Text has been modified to further describe the amount of chemical mass loads from ICP that might be intercepted and treated by BMSG and the potential effects of this capture and treatment on water quality in Blackbird Creek.

While it is true that the Agencies require submittal of detailed plans as a condition of approval of the Plan of Operations, this is not an unusual situation. In many cases, such as in the case of the alkaline amendment addition, the studies required to complete the detailed Plan must be deferred because they must employ actual mining equipment to be meaningful. The Agencies believe that sufficient detail has been provided to enable conclusions to be drawn about the potential success of the mitigation measures (as indeed must be the case as the commenter has clearly formed an opinion about the potential success of mitigation). Lack of a detailed mitigation plan does not mean that a detailed plan will not be developed in the future. When such plans are developed, they will be reviewed and are subject to approval by appropriate regulatory authorities. Additionally, contingency and monitoring plans are in place to detect failure of mitigation and provide an alternative means of environmental protection. Nothing in the FEIS is intended to imply that BMSG would be required to clean up contamination contributed by the ICP.

If the proposed ICP releases or causes a potential threat of a release of a hazardous substance that requires response action or that results in the incurrence of response costs, the owner and operator of the ICP could incur liability under applicable environmental laws, including but not limited to joint and several liability under CERCLA. The Forest Service and EPA Records of Decision will provide that the ICP is not authorized to release or cause the potential threat of a release of hazardous substances to the environment. (113)

Comment: Objections: ICP access to Noranda's property and use of the power line for existing mine treatment plant and Noranda property. (113)

Response: The DEIS did not intend to imply that the ICP would use any of BMSG's power supply facilities without BMSG's consent or that modifications to the power supply system would not be required. The intent of the analysis was to identify an appropriate route for bringing power to the ICP site. It will be up to the ICP and Idaho Power to determine the line and substation requirements necessary to supply the ICP. It will also be up to BMSG to agree or deny ICP use of any of the power supply system that BMSG owns. The intent of the statement indicating a need for an agreement between ICP and BMSG was to indicate that use of these lines would be subject to BMSG's agreement.

An agreement between the ICP and the BMSG would be required to upgrade the existing private power line to accommodate the Project's power requirements. (113)

Comment: Blackbird Related Issues - Need for explanation of cleanup schedule, etc. for Blackbird Mine. (115)

Response: The Chapter 3 discussion of Blackbird Mine site activities is adequate to describe the area affected by the alternatives under consideration in the EIS. A detailed discussion of the cleanup standards for the Blackbird Mine site can be found in EPA's 2003 Record of Decision for the Blackbird Mine site. The schedule for cleanup activities can be found in the Unilateral Administrative

Order for Remedial Design and Remedial Action, effective date August 10, 2003, as amended. The cleanup schedule is subject to change as it is updated at least annually.

The United States is not considered a “responsible party” in the Blackbird Mine site cleanup efforts. To the contrary, the United States District Court for the District of Idaho found in 1994 that the United States was not liable under CERCLA as an owner, operator, or arranger with respect to the Blackbird Mine. Order Granting United States’ Motion to Dismiss and Denying the M.A. Hanna Company’s Motion for Partial Summary Judgment, State of Idaho v. The M.A. Hanna Company et al., and consolidated case, CV 83-4179(R) (December 12, 1994). The mining companies filed an appeal of that order with the Ninth Circuit Court of Appeals and the United States entered into a 1997 Settlement Agreement with the companies to avoid incurring further fees and expenses that would come from such litigation. Under the Agreement, the United States agreed to pay a small percentage of the BMSG’s costs associated with complying with the 1995 Consent Decree. That Agreement was entered into with absolutely no United States admission of liability or fault regarding the Blackbird mine site contamination. Changes were made in the FEIS as a result of the comment. (115)

Comment Code	Letter No.	Comment Subject
BMS-2100-7	93, 115	Adjacent CERCLA Concerns – Cleanup Efforts Will Not Be Impacted

Comment: If the ICP is approved, it should not compromise BMSG cleanup efforts and water quality standards should continue to improve in both Big Deer and Panther Creek watersheds. (93)

Comment: Blackbird Related Issues - Need explanation of agency goal for no WQ impact at BMSG compliance points. (115)

Response: The comment that you have provided has undergone careful review as it is an agency objective associated with the ICP to ensure no adverse impacts to the ongoing CERCLA cleanup activities at the Blackbird mine site. Careful coordination of ICP activities and the Blackbird cleanup will be required to ensure that no adverse impacts occur. The summary beginning on page 4-86 of the DEIS provides an explanation of the potential identified for the ICP to impact BMSG activities and specific monitoring and mitigation measures identified to minimize the potential for any adverse impact.

The referenced water quality goal has been established by the Forest Service and EPA and is based on the Forest Service’s interpretation of the requirements at 36 CFR 228.8(b) for protection of water quality and minimization of adverse environmental consequences. The regulation at 36 CFR 228.4(c)(3) requires the ICP plan of operations to describe the measures to be taken to meet the requirements for environmental protection found at §228.8. Explaining the water quality authorities applicable to BMSG’s activities at the Blackbird Mine site is beyond the scope of the ICP EIS. The stated goal is to ensure that the ICP is in compliance with applicable federal and State requirements and does not interfere with the Blackbird Mine CERCLA site cleanup. Accordingly, there is no shift of the Blackbird cleanup burden from BMSG to FCC. Edits were made to the Blackbird Mine Site section in Chapter 2 of the FEIS to reflect this. (93, 115)

MISCELLANEOUS

Comment Code	Letter No.	Comment Subject
MISC-2200-1	71, 113, 170	Miscellaneous – Protect Environment

Comment: I've been a stockholder for several years and I respect the quality of Formation's management. Accordingly I expect them to take the right steps to protect the environment. (71)

Response: Under regulations of the Secretary of Agriculture, Formation Capital Corporation, U.S. (FCC) must conduct mining operations in accordance with the regulations at 36 CFR 228A, and with a plan of operations that has been approved by the Forest Service. The EIS process facilitates analyses and disclosure of environmental impacts on local and regional resources in compliance with the National Environmental Policy Act. Chapter 1 explains management direction and laws and regulations that guide the Salmon-Challis National Forest analysis of FCC's Plan of Operations. (71)

Comment: Approval of the ICP without a specific, demonstrated and binding plan to avoid water quality and other environmental impacts would violate FS, EPA and IDEQ requirements and thus would be unlawful. (113)

Response: The various design components, monitoring and mitigation measures incorporated in the agency alternatives are intended to reduce environmental impacts and the risk of such impacts by the proposed mining operation. All design features, plans and mitigation measures included in whatever alternative is selected in the Record of Decision will be required to be incorporated into the ICP Plan of Operations. All of the components of the Plan of Operations are enforceable and must be implemented. The key design components included in the preferred alternative intended to protect water quality and to avoid adverse impacts to BMSG's activities are intended to provide multiple layers of protection. While both the backfill amendment and the groundwater capture and treatment systems may each alone be effective in achieving target water quality goals, the combination of systems is intended to assure that if one system does not function as predicted that there is a backup. Additionally, the application of the DSM modeling tool specifically looks at a range of effectiveness of key operating systems. (113)

Comment: Cobalt recycle alternative to mining not evaluated. (113)

Comment: Environmentally sound project, should be no impacts to fish or wildlife. (170)

Response: The EIS process facilitates analyses and disclosure of environmental impacts on local and regional resources, including both the natural and human environment. The proposed action and alternatives are reviewed using this federal structure in compliance with the National Environmental Policy Act. Forest Service decisions for acceptance of the proposed action or alternatives are in consideration of Forest Service, Council on Environmental Quality, and other relevant federal and state laws and regulations. Chapter 1 explains management direction and laws and regulations that guide the SCNF analysis of FCC's Plan of Operations. (113, 170)

Comment Code	Letter No.	Comment Subject
MISC-2200-2	2, 19, 20, 22, 28, 29, 30, 31, 32, 33, 56, 73, 77, 78, 79, 82, 83, 84, 85, 89, 94, 96, 97, 98, 99, 100, 101, 102, 109, 116, 117, 118, 119, 120, 128, 136, 138, 140, 141, 142, 143, 144, 145, 146, 148, 149, 150	Miscellaneous – Cobalt Need and Use

Comment: Cobalt strategic metal that is useful in advanced technology. Supports. (2)

Comment: Cobalt is a strategic metal, and essential to many defense applications. The need to protect and forest our own sources of such a mineral is very important for our national security. (19)

Comment: Jobs & benefits to Lemhi Co and Idaho; ICP would supply domestic cobalt, a strategic metal. (20, 22)

Comment: Support the Idaho Cobalt Project, mine will provide jobs and economic benefits to Lemhi County and the State of Idaho while supplying the United States with cobalt, a strategic metal. (28, 29, 30, 31, 32)

Comment: Cobalt used for defense applications, animal feeds, cancer treatment, batteries, fuel cell vehicles, etc. Is a strategic mineral. (33)

Comment: Cobalt is an enabling catalyst used in Batteries being developed for hybrid electric vehicles. . . . [which] hold the promise to significantly reduce our Nation's consumption of gasoline, reduce our dependence on foreign oil, and reduce greenhouse gases. (56)

Comment: Cobalt is needed for several environmentally applications (such as batteries for hybrid cars, making cleaner fuels, even for building wind turbines) the overall benefit of this project is to enhance out environment. (73)

Comment: At full production, the Idaho Cobalt Mine would supply approximately 15% of the demand within the United States, decreasing our reliance on international supply. (77)

Comment: This memo is intended to support the Formation Capital effort to develop the mine in an environmentally acceptable manner and in so doing to not only help resolve the nation's need for the critical metals that will be produced, but will in addition contribute substantially to the economy of the region. (78)

Comment: Cobalt is a vital element in our day-to-day lives, with applications ranging from industrial and health care fields, to national defense and high-tech industries. In addition, it is being used in increasing amount for environmentally friendly technologies, including batteries for hybrid vehicles, and as a catalyst for gas-to-liquid conversion. (79)

Comment: I support the project as long as all the environmental guidelines are followed. The deposit is a valuable resource that should be mined, as long as it can be done safely without polluting any of the nearby creeks or the air. (82)

Comment: It will provide a domestic source of much-needed metal to the market while leaving a very miniscule impact on our environment. (83)

Comment: There is a growing demand for cobalt as it is a very versatile metal that has many applications in our day-to-day lives. I understand there is not primary domestic source of

cobalt and the United States is almost completely dependent on external sources for its supply. (84)

Comment: The demand for cobalt is growing daily, with many various uses in the high tech industry, health care, defense, and environmental and conservation applications. Cobalt from FCC's mine would provide about 15% of the domestic demand for the metal, reducing our reliance on foreign markets. (85)

Comment: No less important, cobalt is considered a strategic commodity by the US government. Domestic production will decrease our dependence on foreign sources and provide a critical material for America's national defense. (89)

Comment: Supplying the United States with a constant supply of cobalt, a strategy metal of great and growing importance to the United States. (94)

Comment: It will provide a domestic source of much-needed metal to the market while leaving a very miniscule impact on our environment. Formation Capital's plan uses such modern, environmentally sound technology and mining methods that will allow them to extract cobalt from the ground without polluting our lands and water. (96, 97, 98, 99, 100, 101, 102)

Comment: Moreover, the United State currently has not one primary cobalt mine, yet the country imports large amounts of this strategic metal for domestic use. Domestic consumption will only increase over time, particularly because cobalt is used in many environmentally friendly applications, such as hybrid car batteries. (109)

Comment: Cobalt is a very versatile metal that has many applications in our day-to-day life. For example, cobalt is used in the production of hybrid electric and fuel cell vehicles, rechargeable batteries, solar energy panels and health care. Despite the growing demand for the metal, there is no primary domestic source of cobalt and the U.S. is almost completely dependant on external sources for its supply. (116)

Comment: Mining the metal here in Idaho would provide our nation with a domestic supply of cobalt. (117, 118, 119, 120)

Comment: In addition to the economic benefits that this mine is sure to bring, it will provide a domestic source of a much-needed metal to the market while leaving a very miniscule impact on our environment. (128)

Comment: It will provide a domestic source of a strategic metal to the United States while leaving a minimal impact on our environment. (136)

Comment: Formation Capital's plan will help supply this country with a domestic source of cobalt while at the same time protecting this area's environment. (138)

Comment: The strategic mineral that the Formation Capital cobalt project will provide is an asset that this county, the United States of America, needs to use from its own reserves. (140)

Comment: It will provide a domestic source of a much-needed metal to the market while leaving a very miniscule impact on our environment. (141, 142)

Comment: Cobalt is a very versatile metal that has many applications in our day-to-day life. For example, cobalt is used in the production of hybrid electric and fuel cell vehicles, rechargeable batteries, solar energy panels and health care. Despite the growing demand for the metal, there is no primary domestic source of cobalt and the U.S. is almost completely dependant on external sources for its supply. (143, 144)

Comment: While the United States is a major consumer of cobalt for a variety of industrial and environmental applications, there is not a single primary cobalt mine in this country. (145)

Comment: It also provides a strategic mineral for the United States that is currently either only imported or derived from secondary sources or as a by product. With the unstable nature of governments around the world it is not wise to rely on outside suppliers for a mineral that is so necessary to our daily lives. (146)

Comment: This mine will provide a domestic source of a key strategic metal to the United States while leaving very little environmental impact. (148)

Comment: All indications are that cobalt consumption is going to increase, particularly because it is being used more and more in 'green' applications, such as hybrid car batteries. Thus, cobalt must be mined somewhere. It seems the United States has an obligation to itself and the world to have a notable amount of that necessary production take place in this country, and in an environmentally sound and socio-economically responsible manner as proposed by the Idaho Cobalt Project. (149)

Comment: Cobalt is a fundamental element in our world today, with applications in industry, national defense, health care, and high-tech industries. Perhaps most interesting is cobalt's several environmentally-friendly uses, such as in batteries for hybrid vehicles, which save fuel and reduce our country's reliance on foreign oil. Other environmentally sound examples of need for cobalt include removing sulfur from oil and in the construction of solar panels. Cobalt also serves as a catalyst for gas-to-liquid conversion, which is easier to transport, creates no contaminants or particulates and burns cleaner than Liquefied Natural Gas. We already rely on cobalt daily and the demand for it will only continue to grow. (150)

Response: The DEIS recognizes the rare opportunity for development of a cobalt resource in the U.S. provided by the Idaho Cobalt Belt mineralization (page 3-2, DEIS). Additionally, the DEIS discusses the importance and versatility of Cobalt to the U.S. and Global economies under the heading Cobalt Production and Uses (page 3-5, DEIS). (2, 19, 20, 22, 28, 29, 30, 31, 32, 33, 56, 73, 77, 78, 79, 82, 83, 84, 85, 89, 94, 96, 97, 98, 99, 100, 101, 102, 109, 116, 117, 118, 119, 120, 128, 136, 138, 140, 141, 142, 143, 144, 145, 146, 148, 149, 150)

Comment Code	Letter No.	Comment Subject
MISC-2200-3	42	Miscellaneous – Lighting

Comment: The effects of the lighting of the ICP should be more fully analyzed and mitigation proposed if the lighting is visible from wilderness or private property. (42)

Response: The FS recognizes the value of minimizing the effects of day and night (sky-glow) visual quality-related impacts associated with the construction and operation of the proposed ICP project. The potential for adverse sky-glow impacts to the nearby Frank Church River of No Return Wilderness Area, and private property parcels has been evaluated and although individual wilderness users may be impacted the overall impact will be minimal and has been determined to be not significant. (42)

Comment Code	Letter No.	Comment Subject
MISC-2200-4	54	Miscellaneous – Wilderness

Comment: Suggests a recovery and restoration plan for all streams in the vicinity of the project area and supports fully preserving habitat of sensitive and T&E species. (54)

Response: Recovery and restoration of streams in the vicinity of the ICP that have been impacted by historical mining activities is occurring under CERCLA authority. This EIS (Chapter 4) and the Biological Assessment and Biological Opinion prepared for the ICP address habitat of T&E species. (54)

Comment: To fully preserve the habitats of all species, including the following: goshawk, three-toed woodpecker, bald eagle, fisher, wolverine, long-toed salamander, boreal owl, chinook salmon, spotted frog, steelhead, Canada lynx, bull trout, gray wolf, west slope cutthroat trout, Ute ladie's tresses. (54)

Response: Chapter 1 of the DEIS explains management direction and laws and regulations that guide the SCNF analysis of FCC's Plan of Operations. FCC is entitled to conduct operations that are reasonably incident to exploration and development of mineral deposits on its unpatented mining claims pursuant to the United States Mining laws. Under applicable regulations, the Forest Service must determine whether to approve the Plan of Operations submitted by FCC as it is proposed, or to require changes or additions deemed necessary to meet the requirements of the regulations for environmental protection. (page 1-3 and page 1-4, DEIS) The EIS process facilitates analyses and disclosure of environmental impacts on local and regional resources, including both the natural and human environment.

Although approval of the Plan of Operations or an alternative will aim to minimize or eliminate adverse environmental impacts from mineral development activities on National Forest System lands, some impacts will take place. Mitigation, restoration and reclamation activities are described in detail in Chapter 2 for each alternative under consideration. A primary assumption made as part of the agencies' analyses is that the majority of reclamation is anticipated to be completed within two to three years following mine closure (p. 4-2, DEIS). (54)

Comment Code	Letter No.	Comment Subject
MISC-2200-5	63, 107	Miscellaneous – Support Natural Resource Development

Comment: It is in the interest of all citizens and government agencies to support the development of domestic natural resources. (63)

Response: The Forest Service is responsible for administering National Forest lands in accordance with multiple use principles that include development of natural resources. The proposed ICP requires Federal action by the Forest Service as defined by the 1872 Mining Law, as amended, and the regulation at 36 CFR 228 Subpart A. (63)

Comment: We believe that the wise and judicious use of natural resources in Lemhi County is essential to our local economy. We firmly believe that the development of mineral and timber industry is of solid, long-term benefit to the County and its citizens. (107)

Response: The DEIS recognizes the rare opportunity for development of Cobalt in the U.S. provided by the Idaho Cobalt Belt mineralization (page 3-2). Additionally, the DEIS discusses the importance and versatility of Cobalt to the U.S. and Global economies under the heading Cobalt Production and Uses (page 3-5, DEIS).

In addition, the DEIS recognizes the benefits that the mine will offer to the local workforce in Salmon and Challis Idaho. Evaluation of the benefits have been weighed against drawbacks in Chapter 4, specifically 4-83 and 4-103. Your comments have been noted in the review process. (107)

Comment Code	Letter No.	Comment Subject
MISC-2200-6	65	Miscellaneous – Mancamp

Comment: I would suggest a man camp set up on private property in the Cobalt area for these employees [Challis], with alternating schedules 10-12 hours/shift. This will cut down on traffic problems, cut down driving fatigue, reducing accidents and lead to higher production at the mine. (65)

Response: The agencies considered a work camp to reduce traffic, but found there was no site that could meet Idaho Health Department requirements or that could provide adequate water or sewer facilities. The option of providing a work camp was dropped from consideration due to these and other regulatory issues (See page 2-72 in the DEIS). (65)

Comment Code	Letter No.	Comment Subject
MISC-2200-7	90, 103	Miscellaneous – Oppose Mine

Comment: One issue is the amount of damage to the landscape which will be done and probably has already been done for the amount of time for which the Mining Corporation permit is allowed at this time. I feel that for the 10 years that the mine would be up and running, there is too much destruction of the landscape for that very short period of time to justify this project. I fail to see that any mine in Idaho will ever return to natural habitat. Mining is . . . extraction process that forever leaves a footprint on the land. (90)

Comment: Given the utter devastation which resulted from previous mining activity in the Panther Creek drainage, I urge the Forest Service to deny this project. Panther Creek has yet to begin to recover from its toxic history and now we want to add to this? (103)

Response: The Forest Service is required to evaluate potential impacts of a project against applicable laws and regulations. The proposed reclamation plan and mitigation measures are intended to protect the environment and return the land to a similar condition to that before mining. However, as the commenters state and the EIS documents there are historic impacts from mining at the Blackbird site and there will be both long- and short-term impacts from the ICP. (90, 103)

Comment Code	Letter No.	Comment Subject
MISC-2200-8	121	Miscellaneous – Firearm Policy

Comment: Attempting to regulate firearms possession in a private vehicle on public property (roads) is beyond the purview of the NEPA process. Imposing this rule onto Formation Capital Co. as a term of employment appears to be an end-run around the laws that the USFS can impose or enforce itself. At the very least, the proposed denial of this constitutional right presents no study or evidence demonstrating any substantial benefit; only hyperbolic speculation. This proposal should be rejected outright. (121)

Response: The purpose of a Plan of Operations is to allow mining to occur and there has been no demonstration that employees require firearms on site to accomplish that goal. Concerns about additional hunting pressure from employees traveling to the mine and safety issues are not mere speculation, but are valid concerns. There is no question as to the legality of the company imposing restrictions on firearms in the workplace. Most workers will travel to the mine site in company sponsored buses or vans and all employee vehicles would park within the mine site, which is controlled by the Plan of Operations and Mine Safety and Health Administration regulations. (121)

APPENDIX E

U.S. FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Fish and Wildlife Office
1387 S Vinnell Way, Suite 368
Boise, Idaho 83709



William A. Wood, Forest Supervisor
US Department of Agriculture
Salmon-Challis National Forest
1206 South Challis
Salmon, Idaho 83467

Subject: Section 7 Consultation for Formation Capital Corporation's Proposed Idaho Cobalt Project Mine in the Panther Creek Drainage, Salmon-Cobalt Ranger District, Idaho - Biological Opinion
File #1050.1106 TAILS # F-08-0140

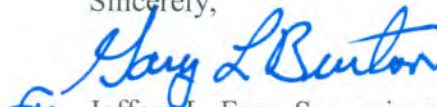
Dear Mr. Wood:

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the Salmon-Challis National Forest (Forest) Biological Assessment (Assessment) for the Idaho Cobalt Project mine proposal and associated National Pollution Discharge Elimination System (NPDES) permit (Mine Project). The Mine Project would entail developing an underground mine for cobalt, copper, and gold. The Assessment addresses potential impacts resulting from the Plan of Operations, including the need for an NPDES permit, as well as the potential for spills resulting from activities associated with the Mine Project. The Assessment/consultation is a joint effort by the Forest and Environmental Protection Agency (EPA) to address the Forest's action of permitting the Mine, and EPA's action of issuing a NPDES permit; however, the Forest has taken the lead role for consultation purposes.

The Assessment addresses the effects of the proposed Mine Project on bull trout (*Salvelinus confluentus*); the Forest has determined that the proposed project may affect, and is likely to adversely affect bull trout. The Service acknowledges the Forest's conclusion provided in the cover letter to the Assessment that consultation for Canada lynx (*Lynx canadensis*) is not necessary due to a joint determination by the Service and Forest that Canada lynx do not currently occupy lands within the administrative boundaries of the Forest.

If you have questions regarding the attached Opinion, please contact Sandi Arena at the Service's Eastern Idaho Field Office (208-237-6975 ext. 34).

Sincerely,


Jeffery L. Foss, Supervisor

Snake River Fish and Wildlife Office

BIOLOGICAL OPINION
IDAHO COBALT PROJECT MINE
SALMON-CHALLIS NATIONAL FOREST
SALMON-COBALT RANGER DISTRICT
SALMON, IDAHO

MAY 2008
FISH AND WILDLIFE SERVICE
SNAKE RIVER FISH AND WILDLIFE OFFICE
BOISE, IDAHO

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INTRODUCTION

This document is the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the Biological Assessment (Assessment) for the proposed Idaho Cobalt Project Mine and Associated National Pollution Discharge Elimination System (NPDES) Permit (Mine Project) located in the Salmon-Cobalt Ranger District of the Salmon-Challis National Forest (Forest), and its effects on bull trout (*Salvelinus confluentus*). Our opinion is provided in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended. Your December 26, 2007 request for formal consultation was received in our office on December 27, 2007. Though the Forest has taken the lead role for consultation purposes, the Assessment is a joint effort by the Forest and the Environmental Protection Agency (EPA) to analyze and address both the permitting of the mine, as well as issuance of the NPDES permit (NPDES Permit No. ID-002832-1). For clarity purposes, this joint Forest/EPA Assessment will be referred to throughout this Opinion as the Forest's Assessment, as they are the lead consulting agency.

Our Opinion is based on information provided in the December 26, 2007 Assessment, telephone conversations and email exchanges with Ray Henderson and Robert Rose of the Forest, a site visit to the Mine Project area, and meetings held with the Forest, Service, and representatives from Formation Capital Corporation. A complete administrative record of this consultation is on file at the Service's Eastern Idaho Field Office.

CONSULTATION HISTORY

March 8, 2005	The Service attended a meeting with the Forest to discuss the Mine Project and planning underway thus far, and to get a general project overview.
October 26, 2005	The Service attended a meeting with the Forest to discuss the preliminary draft Environmental Impact Statement (DEIS), alternatives developed thus far, and potential for impacts to fish and wildlife.
September 27, 2006	The Service provided comments to the Forest on their August 16, 2006 draft Assessment for impacts of the Mine Project to terrestrial species.
October 26, 2006	The Service attended a second meeting with the Forest, EPA, and Idaho Department of Environmental Quality to discuss the preliminary draft Environmental Impact Statement, alternatives developed thus far, and potential for impacts to fish and wildlife. At this meeting it was also stated that there would be a need for a NPDES permit to be issued by EPA.
April 11, 2007	The Service provided comments to the Forest on their March 2007 draft Assessment for impacts of the Mine Project to aquatic species.

December 27, 2007	The Service received the Forest's December 26, 2007 Assessment and request for consultation for the Mine Project.
January 16, 2008	The Service met the Forest, National Marine Fisheries Service, and Formation Capital Corporation to discuss the Forest's Assessment and to answer any questions the Agencies had.
January 28, 2008	The Service contacted the Forest to advise them that consultation could be initiated and that they could expect our Biological Opinion by May 9, 2008.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

A. Action Area

The proposed Mine Project is located in the Panther Creek drainage on the Salmon-Cobalt Ranger District of the Forest, in or adjacent to Sections 8, 9, 15, 16, 17, 20, 21, and 22, Township 21 North, Range 18 East. The Mine Project is approximately 45 road miles (or 22 direct miles) west from Salmon, Idaho (Figure 1).

B. Proposed Action

An overall description of the proposed action for the Mine Project is provided below in the Opinion. Specific information detailing the proposed action can be found in the Forest's Assessment (Section 2.0, Project Description). Proposed actions associated with the Mine Project (specifically transportation of chemicals, the NPDES permit, and in-stream work) that are directly related to water quality (including suspended sediments) are expanded on further in this Opinion following the general overview section.

General Overview

The proposed Mine Project would consist of an underground cobalt-copper-gold mine to extract minerals from two separate ore bodies, as well as a processing plant (mill) and associated facilities. Under their proposed plan Formation Capital Corporation (FCC) would develop, operate, and reclaim an 800-ton per day mine and mill complex. Underground mining methods would be used to extract ore from two deposits; the Ram and the Sunshine. Ore would be trucked from the mines to the mill; however, ore from the Ram mine may eventually be conveyed by an overhead tram to the mill. At the mine, the ore would be milled to extract the cobalt (mainly), as well as other constituents (i.e., copper and gold) if available, producing the bulk concentrate. Concentrate from the mill would be shipped to an off-site processing facility. The proposed Mine Project would result in surface disturbance of approximately 115 acres.

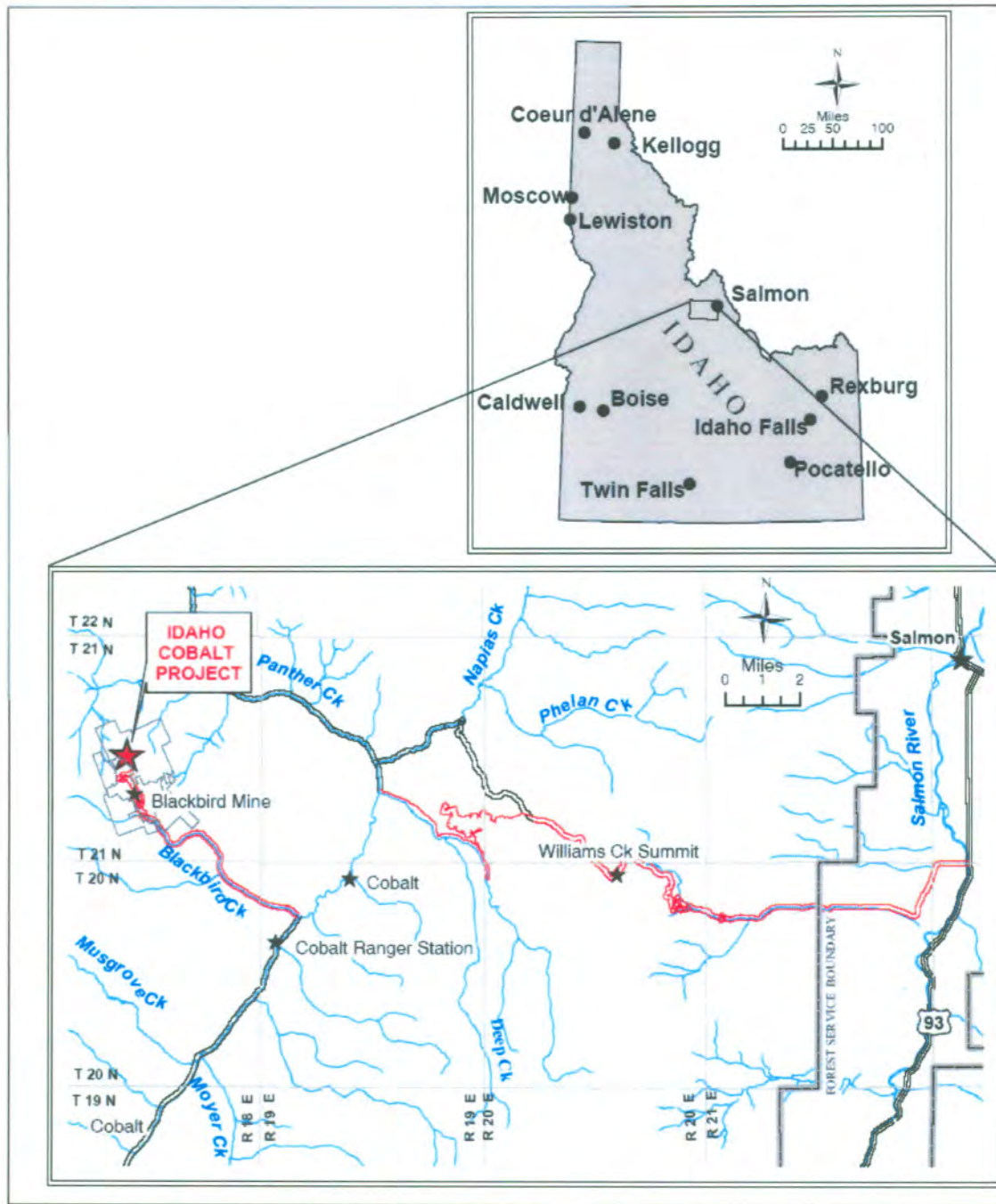


Figure 1. General Map Location, Idaho Cobalt Project.

Also included as part of the Plan of Operations for the Mine Project is an application to discharge wastewater to Big Deer Creek under the Environmental Protection Agency (EPA) NPDES permit program. The Permit would be for discharge of excess water from the Mine Project during the operational mining period for the Ram and Sunshine deposits. Additional modifications to the NPDES permit might be required following mine closure to address post-closure water discharges from the Ram and Sunshine deposits.

The ICP would consist of developing two deposits over the life of the project, the Ram (with 2,230,000 tons of ore currently known) and the Sunshine (with 340,000 tons of ore currently known). Development of each deposit would use underground mining methods. The average rate of mining production would be 800 tons per day (tpd) based on mine operation of 350-days-per-year. During start-up the rate would be approximately 400 tpd in the first year, increasing to full production in the third year of operations. It is possible, however, that mine and mill throughput could reach 1,200 tpd. Mining would begin initially on the Ram deposit, and mining of the Sunshine deposit would occur in subsequent years.

There would be three main phases in the life of the ICP: the construction phase (approximately two years), the operating phase (ten to twelve years), and the reclamation/closure phase (two years for surface reclamation and up to thirty or more years of post mine water treatment and monitoring). There would also be concurrent reclamation in the construction and operating phases as existing disturbed areas or new disturbances are reclaimed post-use.

Mine and mill facilities include the Ram and Sunshine mine portals, tram, mill/plant, tailings and wasterock storage facility (TWSF), water management pond, water treatment and discharge facilities, new and existing improved roads, borrow areas, and a soil stockpile area. Ancillary facilities would include power lines, fuel storage tanks, water ditches, and septic and drain field.

At the end of the operational mining period, cessation of mine dewatering would be contingent on monitoring results and projections indicating no unacceptable effects to water quality objectives or Blackbird cleanup goals. If monitoring indicates acceptable water quality, the mine workings would be allowed to fill with groundwater and groundwater and mine water from the mines would be released to the watershed. If needed to prevent unacceptable water quality impacts (i.e., discharge of water above Idaho water quality criteria), a bedrock groundwater capture well system would be used to capture mine water that flows out of the mine workings during the closure period. If the bedrock groundwater capture system is insufficient, an alluvial groundwater/surface water capture system in lower Bucktail Creek drainage would be used. Both the bedrock and alluvial groundwater/surface water capture systems would be installed during the construction phase. Captured water would be treated and discharged into Big Deer Creek through a NPDES permitted facility.

Transportation

The proposed year-round transportation route for employees and transportation of concentrate, equipment, reagents, and other freight from Salmon, Idaho would be via Williams Creek Road to the Williams Creek Summit, from there to the Deep Creek Road, then to the Morgan - Panther Creek Road, and Blackbird Creek Road (Figure 2).

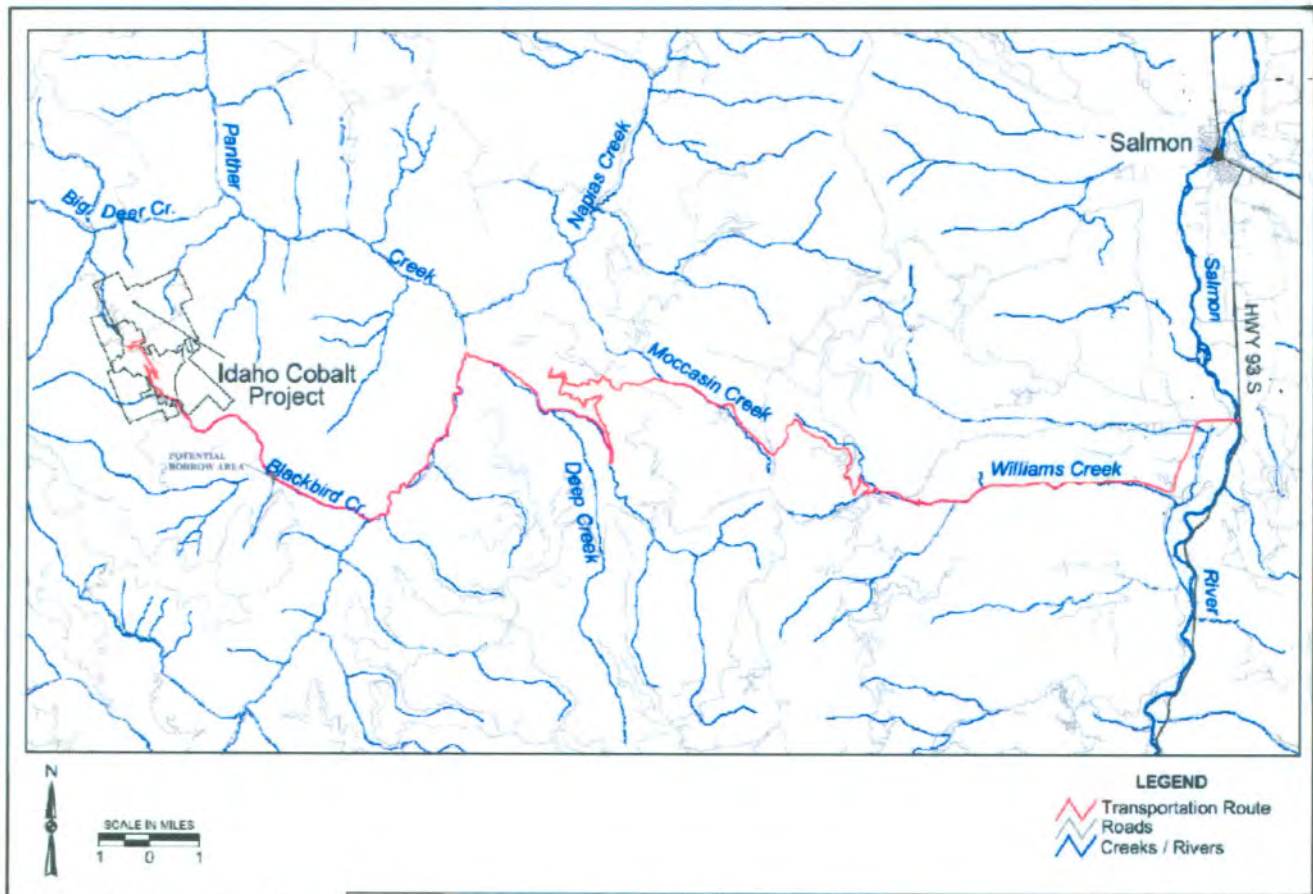


Figure 2. Proposed Transportation Route, Idaho Cobalt Project

Table 1 outlines FCC's anticipated list of chemicals, reagents, and operating supplies that would be transported to and from the mine during the operating phase.

Table 1. Chemicals, Reagents and Operating Supplies – Idaho Cobalt Project (taken from the Assessment).

Reagent / Chemical or Product	Annual Use	Container Type	Container Size	Trucks/Year (per day) ¹
AERO® 343 Xanthate	280 tons	Flo Bin	1 ton	14
AERO® 350 Xanthate	308 tons	Flo Bin	1 ton	16
AEROFROTH® 65 Frother	42 tons	Plastic Barrel	55 gallons	3
Sodium Sulfide	100 tons	Sacks	50 pounds	1 – 5
Superfloc	24 tons	Sacks	50 pounds	Ship w/frother
Lime	75 tons	Super Sack	1000 pounds	4
Diesel	750,000 gallons	Fuel Truck	4,500 gallons	150
Gasoline	5,000 gallons	Fuel Truck	4,500 gallons	Ship w/diesel
Cement	2,500 tons	Bulk	20 tons	115
Oils, Lubricants, Grease, Antifreeze	10,000 gallons	Barrel	55 gallons	Ship w/diesel
Propane	40,000 gallons	Fuel Truck	9,400 gallons	5
Anti-scalant	4,000 gallons	250 gallon tote	4,000 gallons	1
Ammonium Nitrate	450 tons	Bulk Container	10 tons	45
Bulk Concentrate	11,200 tons	Sealed Container	16 tons	700 (2)
Water Treatment Chemicals and Reagents				
Polymer Flocculant	20 gallons	Sealed Pail	5 gallons	0 ³
Hydrated Lime	20 tons	Super Sack	1,000 pounds	2
Hydrochloric Acid	400 gallons	Plastic Drum	55 gallons	2
Coagulant	250 gallons	Sealed Tote	50 gallons	0 ³
Methanol	3,000 gallons	Bulk Truck	3,000 gallons	1 ¹
Zeolites	3 tons	Super Sack	1,000 pounds	1
Employees				
		Vans		3500 (10)
		Pickups		1400 (4)

¹ Average values and actual truck count would vary.

² Does not add to truck count, as the product would be backhauled from the refinery. More fully described in FCC's Storm Water Management Plan for the Idaho Cobalt Project (Telesto, 2006).

³ Does not add to truck count, as the small quantity would be transported with other materials.

The original Plan of Operations for the Mine Project included the use of copper sulfate during the ore processing. However, in a January 28, 2008 letter, FCC modified their Plan of Operation and withdrew the use of copper sulfate as a process reagent.

Approximately 11,200 tons of concentrate is anticipated to be shipped from the Mine Project mill facility annually. Steel roll-off containers with locking lids would be used to transport the concentrate. Empty containers would be filled at the mill, sealed, and loaded on single-frame trucks for transport to Salmon, Idaho. In Salmon, concentrate containers would be transferred to tractor-trailer equipment for transportation to a processing facility.

FCC has prepared a spill control plan that addresses management of hazardous materials during shipping and storage. Their plan includes notification to the Mine Project facility prior to transport of fuels or chemicals, travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport.

NPDES Permit

Drainage is designed so that mine water, process water, and runoff from the TWSF and ore stockpile go through a treatment plant at a single point of discharge to Big Deer Creek. Water arising from ore processing, groundwater pumped from the mine, and drainage from the ore stockpile and the TWSF is stored in the water management pond. Water from the pond is recycled through the mill or is directed to the water treatment plant. The volume of mill processing water/TWSF runoff discharge treated and discharged to Big Deer Creek is limited in the NPDES permit to the net precipitation on the TWSF and water management pond. The single discharge (Outfall 001) is located in Big Deer Creek approximately 100 feet downstream (east) of water quality monitoring station WQ-24 (EPA 2007).

To estimate impacts to water resources a water and chemical mass balance for the ICP has been developed using a dynamic system model (DSM) that considers the relationships between the Project components and the surrounding water environment, and predicts the impact on them throughout the life of the mine and during the post-closure period. The DSM includes specific water balance calculations for each year of the Mine Project life. The ICP water management plan is based on operating a water treatment plant and releasing water in accordance with an NPDES permit in conjunction with temporary storage in a small water equalization pond adjacent to the water treatment plant and a larger water management pond to temporarily store process solutions. The water treatment plant would have the ability to treat up to 150 gpm of water for discharge through the NPDES outfall. Except during periods of very high inflow, the water treatment plant would treat incoming water on an as-received basis, with very little water stored in the water management pond. During periods of high inflow, water would accumulate in the water management pond for treatment during lower inflow periods.

The primary contaminants of concern (COCs) for the Mine Project are nitrate, sulfate, arsenic, copper, cobalt, nickel, and zinc. Primary COCs are constituents expected to occur at higher concentrations in the water management pond water compared to natural waters and which may also have significant environmental effects if discharged into surface water or groundwater.

The water management pond collects drainage from the TWSF and stores mining and milling process solutions if needed. The pond would be surrounded with an 8-foot high chain link fence for wildlife protection; double lined with HDPE liners, and have a leak detection and recovery system between the primary liner and secondary liner. Protection of the pond liners from potential ice damage (e.g., rub sheet of liner in pond corners) would be provided.

Water pumped from the mine workings at the Mine Project and runoff/drainage from the TWSF and ore stockpile is predicted to contain elevated concentrations of nitrate, sulfate, and metals (aluminum, cobalt, copper, iron, manganese and zinc). Therefore, a water treatment plant designed to process and discharge up to 150 gpm would be installed in the mill to treat the mine water and runoff/drainage from the TWSF and ore stockpile.

The water treatment process would utilize ion exchange as a means to remove any residual metals in excess of the NPDES effluent limits. This would eliminate the need for disposal of a stabilized waste (a potentially large waste stream), but would result in higher levels of sulfate in

the discharge water. The treatment process would include biological treatment for removal of nitrate, if needed, to meet the nitrate effluent limit. If needed to meet the ammonia effluent limit, ammonia would be removed by an ion exchange process using zeolites, a naturally occurring alumino-silicate mineral. The treatment process would result in treated water (effluent) capable of meeting effluent limits imposed by an NPDES permit for discharge to Big Deer Creek.

Treated water from the water treatment plant would be routed through a pipeline to a year-round surface discharge (Outfall 001) located on Big Deer Creek. The pipeline would be routed using existing roads where possible. Where no roads exist, the pipeline would follow an alignment that minimizes pipeline length and physical disturbance to soils, vegetation and cultural resources. The pipeline would be buried, and be made of materials suited for this application such as steel, poly-vinyl chloride (PVC), or high density polyethylene (HDPE). Where the pipeline crosses existing waterways, a culvert designed to pass the 100-year, 24-hour event would be placed in the stream channel, the pipe placed on top of the culvert, and fill placed over the pipe to prevent the water from freezing. The pipeline would affect jurisdictional wetlands at the crossings of two Bucktail Creek tributaries and at Big Deer Creek.

Rather than an open pipe discharge to Big Deer Creek, an in-stream diffuser would be used for the discharge. The diffuser would consist of a perforated pipe or pipe with engineered orifices designed to cause rapid mixing of the mine discharge with Big Deer Creek. The pipe would be placed on the surface of the streambed or would be buried within the streambed.

The expected chemical constituents and effluent limits associated with the NPDES permit will be discussed in the Effects Analysis section of the Opinion.

II. STATUS OF THE SPECIES

In this section the Service presents information about the regulatory, biological, and ecological status of the species that provides the context for examining the probable effects from the proposed or ongoing activities and formulating the Opinion.

A. Regulatory Status and Population Organization

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (Fish and Wildlife Service 1999). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon and in the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound and east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Fish and Wildlife Service 1999).

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation and alterations associated with dewatering, road construction and maintenance, mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (Fish and Wildlife Service 1999).

The bull trout was initially listed as three separate Distinct Population Segments (DPSs; Fish and Wildlife Service 1999). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (Fish and Wildlife Service 1999)

“Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.”

In its draft recovery plan for bull trout, the Service (2002) organized the rangewide distribution of the bull trout along the same lines as the DPSs in the listing document and core areas and local populations. Below is a list of important terms in the conservation strategy of the bull trout arranged in their hierarchal order.

Interim Recovery Unit - one of five population segments identified in the listing document (for example the Columbia River Interim Recovery Unit).

Core area - a division of the Interim recovery unit which is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning habitat.

Local population - a group of bull trout that spawn within a particular stream or portion of a stream system. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit.

B. Survival and Recovery Needs and Strategy

The recovery planning process for bull trout (Fish and Wildlife Service 2002) has identified the following survival and recovery needs for the bull trout: (1) maintain and restore multiple, interconnected populations in diverse habitats across the range of each interim recovery unit; (2) preserve the diversity of life-history strategies; (3) maintaining genetic and phenotypic diversity across the range of each interim recovery unit; and (4) establish a positive population trend.

More specifically, the survival and recovery needs of the bull trout are often generally expressed as the need to provide cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed

migratory pathways. All are needed to promote survival and recovery of bull trout at multiple scales ranging from the coterminus population to local populations.

Central to the survival and recovery of the bull trout at a population level is the maintenance of viable core areas described above (Fish and Wildlife Service 2002). Each of the interim recovery units listed below consists of one or more core areas. Approximately 114 core areas are recognized across the United States range of the bull trout (Fish and Wildlife Service 2002).

C. Rangewide Status and Distribution

In recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: (1) Jarbidge River; (2) Klamath River; (3) Coastal-Puget Sound; (4) St. Mary-Belly River, and (5) Columbia River. Each of these segments is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and survival and recovery needs of the bull trout within these units is provided below. A comprehensive discussion of these topics is found in the Service's draft recovery plan for the bull trout (Fish and Wildlife Service 2002).

1. Jarbidge River

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners, are estimated to occur within the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of non-native fishes.

2. Klamath River

This interim recovery unit currently contains 3 core areas and 12 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (Fish and Wildlife Service 2002). Bull trout populations in this unit face a high risk of extirpation (Fish and Wildlife Service 2002).

3. Coastal-Puget Sound

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This interim recovery unit currently contains 14 core areas and 67 local populations (Fish and Wildlife Service 2002). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With limited exceptions, bull trout continue to be

present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined especially in the southeastern part of the unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, angler harvest, and the introduction of non-native species.

4. St. Mary-Belly River

This interim recovery unit currently contains 6 core areas and 9 local populations (Fish and Wildlife Service 2002). Currently, the bull trout is widely distributed in the St. Mary River drainage and occurs in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (Fish and Wildlife Service 2002). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (Fish and Wildlife Service 2002).

5. Columbia River (includes the action area)

This interim recovery unit currently contains about 90 core areas and 500 local populations. About 62 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities: stream and river dewatering; road construction and maintenance; mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The draft bull trout recovery plan (Fish and Wildlife Service 2002) identifies the following survival and recovery needs for this unit: maintain or expand the current distribution of the bull trout within core areas; maintain stable or increasing trends in bull trout abundance; maintain/restore suitable habitat conditions for all bull trout life history stages and strategies; and conserve genetic diversity and provide opportunities for genetic exchange.

Salmon River Recovery Unit - The Salmon River Recovery Unit, one of 22 recovery units identified in the draft bull trout Recovery Plan (Fish and Wildlife Service 2002) in the Columbia River Interim Recovery Unit, encompasses the entire Salmon River basin, as area of 36,278 square kilometres. Bull trout are well distributed throughout most of the unit in 125 identified local populations located within 10 core areas. The Middle Salmon River-Panther Core Area encompasses the action area analyzed in this Opinion.

Middle Salmon River-Panther Core Area- The draft bull trout recovery plan (Fish and Wildlife Service 2002, chap 17, pg. 3) identifies the Salmon River and Panther Creek drainage (including Williams Creek) as a core area for bull trout. The Middle Salmon

River-Panther core area supports 20 existing bull trout local populations, all of which are identified as essential for bull trout recovery in the draft bull trout recovery plan (Fish and Wildlife Service 2002). A low number of bull trout exist in the Panther Creek drainage (Fish and Wildlife Service 1999).

The Blackbird Mine is continuing to release contaminants into Blackbird, Big Deer, and the South Fork of Big Deer Creeks, and Panther Creek including copper, arsenic, cobalt, and iron (Fish and Wildlife Service 2002). Water quality continues to be a problem with very low numbers of fish occupying the Mainstem Panther Creek downstream of Blackbird Creek (Fish and Wildlife Service 2002). Though contaminant releases from Blackbird Mine have improved to some degree since release of the draft bull trout recovery plan.

There are 20 local populations within the Middle Salmon River-Panther Creek core area; therefore, it is considered to be at diminished risk from stochastic events (Fish and Wildlife Service 2002). In the draft bull trout recovery plan (Fish and Wildlife Service 2002), the adult bull trout abundance in the Middle Salmon River-Panther Creek core area was estimated to be between 500 and 5,000 adult fish and, subsequently, this core area was classified as not at risk from genetic drift (Fish and Wildlife Service 2002). By population trend, the Middle Salmon River-Panther Creek core area was judged to be at an increased risk (Fish and Wildlife Service 2002). This determination, however, was driven by the lack of productivity data for the last ten years, resulting in the increased risk category. Regarding connectivity, migratory bull trout may persist in some local populations in the Middle Salmon River-Panther Creek core area; therefore, it is considered to be at an intermediate risk (Fish and Wildlife Service 2002).

D. Life History

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior. Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs. Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form), or saltwater (anadromous) to rear as subadults or to live as adults. Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more. They are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented.

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore even dams or other barriers with

fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Additional information about the bull trout's life history can be found in the final rule listing the bull trout as threatened published in the Federal Register (Fish and Wildlife Service 1999)

E. Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors. Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats, fish should not be expected to simultaneously occupy all available habitats.

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout. Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non natal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants.

Cold water temperatures play an important role in determining bull trout habitat, as these fish are primarily found in colder streams (below 59 degrees Fahrenheit), and spawning habitats are generally characterized by temperatures that drop below 48 degrees Fahrenheit in the fall. Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed. Optimum incubation temperatures for bull trout eggs range from 35 to 39 degrees Fahrenheit whereas optimum water temperatures for rearing range from about 46 to 50 degrees Fahrenheit (Buchanan and Gregory 1997). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 46 to 48 degrees Fahrenheit, within a temperature gradient of 46 to 60 degrees Fahrenheit. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 52 to 54 degrees Fahrenheit.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin. Factors that can influence bull trout ability to survive in warmer rivers include availability and proximity of cold water patches and food productivity. In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 68 degrees Fahrenheit; however, the trend in the relationship between temperature and species composition shows that bull trout made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 59 degrees Fahrenheit and

less than 10 percent of all salmonids when temperature exceeded 63 degrees Fahrenheit (Gamett 1999).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns. Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover. These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring. Increases in fine sediment can reduce egg survival and emergence.

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel. Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater. Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows.

Migratory forms of the bull trout appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993). Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss. In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993).

Additional information about the bull trout's habitat requirements can be found in the final rule listing the bull trout as threatened published in the Federal Register (Fish and Wildlife Service 1999)

F. Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish. Adult migratory bull trout feed on various fish species. In coastal areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasii*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (WDFW et al. 1997).

Fish growth depends on the quantity and quality of food that is eaten and as fish grow their foraging strategy changes in quantity, size, or other characteristics. Resident and juvenile

migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, mysids and small fish. Bull trout that are 4.3 inches long or longer commonly have fish in their diet (Shepard et al. 1984), and bull trout of all sizes have been found to eat fish half their length (Beauchamp and Van Tassell 2001).

Migration allows bull trout to move to or with a food source, access optimal foraging areas and exploit a wider variety of prey resources. Migratory bull trout begin growing rapidly once they move to waters with abundant forage that includes fish (Shepard et al. 1984). As these fish mature they become larger bodied predators and are able to travel greater distances in search of prey species of larger size and in greater abundance. In Lake Billy Chinook as bull trout became increasingly piscivorous with increasing size, the prey species changed from mainly smaller bull trout and rainbow trout for bull trout less than 17.7 inches in length to mainly kokanee for bull trout greater in size (Beauchamp and Van Tassell 2001).

Additional information about the bull trout's diet can be found in the final rule listing the bull trout as threatened published in the Federal Register (Fish and Wildlife Service 1999)

III. ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultation, as well as the impacts of state and private actions which are contemporaneous with the consultations in progress.

A. Status of the Species in the Action Area

The Action Area for the Mine Project encompasses Bucktail Creek, Big Deer Creek, and Panther Creek, associated with the NPDES permit, as well as Williams, Moccasin, Deep, Panther, and Blackbird Creeks as related to the transportation of chemicals/reagents to and from the Mine Project (including road reconstruction work). The Mine Project is drained by Bucktail, Little Deer, and Big Flat Creeks. Bucktail Creek flows into South Fork Big Deer Creek, to Big Deer Creek, and on to Panther Creek. Big Flat and Little Deer creeks flow directly into Panther Creek. Figure 2 shows the locations of the above creeks in relation to the Mine Project.

Numbers of bull trout in the Panther Creek drainage are low and connectivity and interactions between resident populations in Napias and upper Deep creeks have been reduced or eliminated by migration barriers (Fish and Wildlife Service 1999). Connectivity among resident populations is unobstructed in other portions of the Panther Creek drainage (Fish and Wildlife Service 1999).

Big Deer Creek contains an impassable cascade/falls approximately 0.7 miles upstream from the confluence with Panther Creek that precludes fish migration. Fish population sampling in Big Deer Creek in 2001 (Kuzis 2004), 2003 (Stantec 2004), and 2005 (Ecometrix 2006,) and 2005 (Forest Service 2006) found only redband/ rainbow trout or cutthroat trout; no bull trout were

found. Additionally, researchers from Idaho State University conducted sampling in the Panther Creek watershed in 2004 and 2005; no bull trout were found in Big Deer Creek (E. Keeley, pers. comm. 2008). In general, there were very few fish downstream of the South Fork of Big Deer Creek. The lack of fish below the South Fork reflects the ongoing impacts of chemically contaminated water. The 2005 Forest Service survey crew sampled above and below the Big Deer cascade and found west slope cutthroat trout, above the falls, and rainbow trout in a presence /absence below the falls (Forest Service 2006). Big Deer Creek has the potential to be impacted by Mine Project operations.

The Big Deer Creek sub-watershed contains the South Fork Big Deer Creek and Bucktail Creek, both of which are located near the Mine Project site. This subwatershed has been impacted by historic mining activities. Waste Rock and tailings from the Blackbird mine site drain into Bucktail Creek which discharges chemically polluted water into the South Fork of Big Deer Creek; the copper and iron concentrations in Big Deer Creek below the South Fork have exceeded the lethal limits for most forms of aquatic life (Forest Service 1993). However, ongoing clean-up efforts and remediation activities including collection and storage of contaminated water from Bucktail Creek for treatment at the Blackbird Creek drainage collection pond have significantly improved water quality conditions. The IDEQ 303(d) list identifies Big Deer Creek from the confluence of South Fork Big Deer Creek to Panther Creek as water quality limited for sediment, pH, and metals. Bucktail Creek is on the 303(d) list from its source to its confluence with South Fork Big Deer Creek for metals contamination (IDEQ 2003). Bull trout have not been identified in S. Fork Big Deer Creek or Bucktail Creek.

Little Deer Creek is a second order stream draining the Mine Project which flows to the northeast into Panther Creek. There are no 303(d) water quality limited stream segments listed for Little Deer Creek (IDEQ 2003). However, the entire upper portion of the Little Deer drainage was severely burned in the Clear Creek fire. As a result during a storm event in October 2000 the Little Deer Creek channel destabilized and unraveled. Though potential bull trout habitat is present, no bull trout have been found during survey efforts.

Big Flat Creek is a 3 mile long second order tributary to Panther Creek which is the primary drainage from the Mine Project site. There are no stream segments for Big Flat Creek listed on the IDEQ 303(d) list. Big Flat Creek is a steep first order drainage with only occasional surface flows. Much of the creek below the Mine Project flows under rocks or flows subsurface with no surface connection to Panther Creek. Thus the creek contains no fish habitat, and thus, no bull trout.

Blackbird Creek is a second order tributary to Panther Creek flowing southeast for about nine miles. Blackbird Creek is on the Idaho DEQ 303(d) list from Blackbird Reservoir to its confluence with Panther Creek for sediment, pH and, metals contamination (IDEQ 2001). The area is undergoing a remediation cleanup with the EPA as the lead agency that includes removal of mill facilities, expansion of a water treatment facility, capping of waste rock, and removal of tailings from along streambanks and impoundments have been undertaken in recent years. Cleanup activities are still occurring and agreements between the agencies and companies are ongoing to meet cleanup goals. The habitat conditions in Blackbird Creek have historically been poor, due to chemical pollution, stream bank degradation, low pools and woody debris, and high

temperatures (Forest Service 1993). However, surveys completed in 2003 found juvenile Chinook salmon and bull trout in the lower 100 yards of Blackbird Creek indicating that conditions have improved significantly (Stantec 2004). Blackbird Creek has the potential to be impacted by Mine Project operation, as well as the transportation route for the Mine Project.

Williams Creek is tributary to the Salmon River near Salmon, Idaho. During the irrigation season the lower reaches of the creek may be dewatered although in some years there may be sufficient flow for fish passage (IDEQ 2001). Bull trout have been surveyed/identified in Williams Creek. Williams Creek has the potential to be impacted by the transportation route of the Mine Project.

Moccasin Creek is a first order tributary to Napias Creek. Bull trout were the only fish species sampled in Moccasin Creek during 2001 electrofishing surveys (Kuzis 2004). Moccasin Creek is part of the Napias watershed (HUC 1706020313) that has been designated in whole or part as a priority watershed in PACFISH/INFISH for bull trout fisheries recovery during section 7 consultation for amending the Salmon and Challis Forest Plan. A falls in Napias Creek, located about 0.5 miles from the mouth, may limit stream connectivity between bull trout population in the Panther Creek drainage. Moccasin Creek has the potential to be impacted by the transportation route of the Mine Project.

Deep Creek is a major tributary stream of the Panther Creek drainage. Deep Creek is part of the Deep-Moyer watershed (HUC 1706020314) that has been designated in whole or part as a priority watershed in PACFISH/INFISH for bull trout fisheries recovery during section 7 consultation for amending the Salmon and Challis Forest Plan. Bull trout have been surveyed/identified in Deep Creek. The transportation route for the Mine Project parallels the lowest 4.2 miles of Deep Creek.

B. Factors Affecting Species in the Action Area

The Panther Creek watershed is being impacted by several factors including non-compliance with grazing standards to alterations of stream channels by agricultural practices, water withdrawals, and diking (Fish and Wildlife Service 2002). Roads are also encroaching on the floodplains of several creeks within the watershed, as well as Panther Creek itself. This causes increased peak flows, reduced off-channel habitat, and elevated sediment loads; resulting in degraded bull trout habitat (Fish and Wildlife Service 2002).

The Blackbird Mine continues to release contaminants into Blackbird, Big Deer, the South Fork of Big Deer Creek, and Panther Creek; chemicals include copper, arsenic, cobalt, and iron. Downstream of the Blackbird Mine discharge in Blackbird Creek there is an absence of aquatic life, including bull trout. The Blackbird Mine Site Group is currently working on remediation activities at the site in response to a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) action at the site. Clean-up goals are being met in some areas, and are working towards attainment in others. Fish, including bull trout, are beginning to reoccupy portions of the Blackbird Mine impact area where they once avoided (Fish and Wildlife Service 2002).

Migration barriers also impact bull trout within the Panther Creek watershed, as does seasonal dewatering. Williams Creek (along the transportation route for the Mine Project) is separated from the mainstem Salmon River by season dewatering (Curet, *in litt.* 2001).

IV. EFFECTS OF THE PROPOSED ACTION

Effects of the action are defined as “the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the actions, that will be added to the environmental baseline” (50 CFR §402.02).

A. Direct and Indirect Effects

1. Direct Effects

Direct effects are defined as the direct or immediate effects of the action on the species or its habitat. Direct effects result from the agency action, including the effects of interrelated and interdependent actions.

Direct effects to bull trout from the Mine Project would occur from water quantity changes in Bucktail Creek from mine dewatering; hazardous material spills from transportation of chemicals to/from the Mine Project; water quality impacts from the NPDES outfall on Big Deer Creek; riparian disturbance for discharge pipeline construction and cable car crossing construction; and, changes in sedimentation to streams from ground disturbance, road construction and increased traffic, including decreased long term sediment delivered to streams due to road improvements.

Water Quantity

The mine dewatering process would alter groundwater flow and is expected to reduce the groundwater inputs into Big Flat and Bucktail Creeks causing reduction of flow into the South Fork of Big Deer and Big Deer Creeks. Data indicates that bull trout are not present in Big Flat, Bucktail, or S. Fork Big Deer creeks (see Status of the Species section of the Opinion for more details); therefore, reductions in baseflows to those creeks would not impact bull trout. Predicted changes in baseflow of Big Deer Creek and Panther Creek due to the Mine Project are a 1% flow reduction during operation and 0% flow reduction post closure for Big Deer Creek, and 0% flow reduction both during operation and post-closure for Panther Creek. Based on the multiple surveys conducted for bull trout in Big Deer Creek, as outlined in the Status of the Species section of this Opinion, and that no bull trout have been found, and the fact that there is an impassable cascade near the mouth of Big Deer Creek, the Service considers Big Deer Creek to be unoccupied by bull trout. Therefore, it is the Service’s position that impacts due to water quantity are not likely to adversely affect bull trout. Likewise, as there are no predicted changes in baseflow expected for Panther Creek, there would be no impacts to bull trout from water quantity in Panther Creek.

Chemical Transportation

The direct and indirect effects of a hazardous materials spill on bull trout are determined by characteristics of the material, life stage of bull trout, time of year, and the environment. Material characteristics which influence the effects of a spill include the toxicity of the substance that could be spilled, the chemical form (i.e., gas, solid, liquid), the environmental fate if spilled (e.g., persistence, bioaccumulation, etc.), the quantity of the material spilled, and the physical and chemical properties of the material such as solubility and volatility. Some of the environmental characteristics that influence the effects of a spill include stream temperature, pH, stream velocity, volume, gradient, and the proximity of the spill to surface water. The soil absorption and neutralization rates at the spill site also influence the effects of a hazardous materials spill. The effects of a spill can be reduced if the response time to the spill site is rapid, the response team is well trained, and effective mitigation measures are used to contain and treat the spill.

When looking at effects to bull trout from a spill, the Service is assuming a worst-case scenario based on the highest probability for a spill to occur (based on frequency and quantity of shipments) and the toxicity of chemicals being transported. If a spill occurred, it could impact bull trout directly through lethal or sub-lethal effects, or indirectly by reducing prey base and/or degrading habitat. All of the streams located along the transportation route for the Mine Project are occupied by bull trout (Williams, Moccasin, Deep, Panther, and the lower portion of Blackbird Creek); additionally, they all contain suitable habitat for bull trout spawning and/or rearing.

A hazardous material spill that reaches toxic levels in Williams Creek (tributary to the Salmon River) may or may not reach the Salmon River. Whether or not the Salmon River is affected would be influenced by the time of year of the spill, the amount of spilled material, and the amount of surface water in the lower portion of the stream. On low water years, lower Williams Creek may be completely de-watered for irrigation during the growing season. If a spill were to occur during this time, the toxic materials are unlikely to be transported to the Salmon River. The Salmon River is occupied by bull trout.

Accident probabilities were calculated based on Forest data of accidents per vehicle mile (Forest Service 1997) and is described fully in Section 7.2.3.2.1 and Table 7-2 of the Assessment. Basically, calculations indicate that four of the 19 chemicals to be transported to/from the Mine Project have an accident probability of once in less than 200 years (with the greatest probability being once every 9 years). All others have an accident probability of once every 300 years or greater (all the way up to once every 6,220 years). The materials with the highest accident probability are bulk concentrate (once every 9 years), diesel/gasoline/oils/lubricants (typically shipped on the same truck; 41 years), cement (54 years), and ammonium nitrate (156 years). That being said, there is a lower probability than those provided above of an accident *that involves a spill* into an occupied bull trout stream (based on the shipping container, form of the material, etc), and that is discussed more fully in the following paragraphs.

Based on several factors (amount of material transported, form of material, and durability of the shipping container) the Assessment indicated diesel, gasoline, and antiscalant fell into the category of high risk of release during a spill event.

Toxicity hazard ratings provided in the Assessment were derived using information from the literature (EPA Ecotox database, MSDS sheets, and independent refereed literature), and using the 96-hour LC₅₀ (lethal concentration where by 50% of the test subjects died following a 96-hour exposure) for salmonids and/or freshwater aquatic species. Results of the calculations indicate sodium sulfide and Super FLOCtm are highly toxic (copper sulfate also fell into the highly toxic category, although a modification to the Mine Project Plan of Operations removed copper sulfate from the ore processing step and therefore will not be used).

Based upon the volume of materials and frequency of transportation to the Mine Project, as provided in the Assessment, the materials with the probability of an accident near a stream of less than once in 100 years are bulk concentrate and cement. Based upon the spill analysis, the materials with the highest probability of a release in the event of an accident are diesel and gasoline, and antiscalant. Additionally, the most toxic materials identified that would be transported are sodium sulfide and Super FLOCtm. Generally the spill analysis indicated that the materials with the highest probability of accidents are generally less toxic, and the more toxic materials have much lower accident probabilities (Table 2).

Table 2: Materials selected for toxic effect analysis (taken from the Assessment).

	Years between Accidents near Streams	Spill Risk	Toxicity
Gasoline	40	High	moderately toxic
Diesel	40	High	slightly toxic
Anitscalant	1244	High	not acutely toxic
Bulk Concentrate	9	Low	insoluable – not toxic
Cement	54	Low	slightly toxic (pH)
Sodium Sulfide	1244	Low	highly or moderately toxic depending on source
Super Floc	2073	Low	highly toxic

As specified in the Assessment, the potential effects of a spill were evaluated based on the toxic thresholds for each material and the streamflows in the adjacent and downstream receiving waters, to determine the quantity of material necessary to reach the predicted toxic concentration in a one minute spill. Streamflows used in the calculation were based on average minimum low flows in order to take the most conservative approach. Table 3 describes toxicity thresholds for those materials with a high spill risk and/or are of high toxicity.

Quantities of gasoline displayed in Table 3 that would be required to reach toxic concentrations range from less than 1/100th of a gallon in Williams, Moccasin, Blackbird and Deep Creeks to two gallons in the Salmon River, depending on the chemistry of the gasoline and which reach of the river is impacted.

Table 3 shows that a spill of less than 20 gallons of diesel would likely cause toxicity to aquatic organisms in Williams, Moccasin, Blackbird, Deep, and Panther Creeks. In the Salmon River

below Panther Creek the Assessment estimates as little as 75 gallons would be toxic. Effects from petroleum spills on fish include disruption of oxygen uptake at the gill interface (suffocation), physical coating, and ingestion of product. In addition, if the chemical is absorbed into the sediments, there is also potential for continued release to the water column and subsequent impacts to aquatic organisms over time.

As with all chemicals to be transported to the Mine Project, the Assessment projects that toxic concentrations would be reached with the smallest volume of spilled materials in Moccasin Creek, due to the low baseflows in this stream. For the antiscalant, this would amount to a volume of only 1 gallon released into Moccasin Creek. In contrast, a release of 726 to 1349 gallons would be required to yield toxic concentrations of antiscalant in the Salmon River below the confluence of Williams and Panther creeks, respectively. Table 2 outlines the quantity of material spilled into or transported to a stream that would reach the toxic threshold.

Table 3. Toxic thresholds for key materials at risk of release in the event of a one minute spill (taken from the Assessment).

			Moccasin Creek	Blackbird Creek	Williams Creek	Deep Creek	Panther Creek below Blackbird Creek	Salmon River below Williams Creek	Salmon River Below Panther Creek
Low Flow cfs			1	2.5	3	4.1	20	700	1300
Material	Toxicity (mg/l)								
LIQUIDS									
Gasoline	2.7	gallons	0.002	0.004	0.005	0.006	0.031	1.102	2.046
Diesel	18		0.01	0.02	0.03	0.04	0.20	6.98	12.97
Diesel	25		0.01	0.03	0.04	0.06	0.28	9.70	18.01
Antiscalant	2660		1.04	2.60	3.11	4.26	20.76	726.76	1349.70
SOLIDS									
Cement	92	lbs	0.34	0.86	1.03	1.41	6.89	241.22	447.98
Ammonium Nitrate	8.01		0.03	0.08	0.09	0.12	0.60	21.00	39.00
Sodium Sulfide, Hydrated	0.55		0.000005	0.0052	0.0062	0.0084	0.041	1.44	2.68
Superfloc	0.22		0.0008	0.0021	0.0025	0.0034	0.0165	0.58	1.07

The bulk concentrate will be the most transported material from the Mine Project; however, steel roll off containers with locking lids will be used to ship the concentrate. This material has a low spill risk because it is a solid and with the low solubility is unlikely to be toxic unless left exposed to air for an extended time period.

According to the analysis provided in the Assessment, aquatic spill hazards of cement would be more likely associated with effects on physical habitat if not quickly removed, rather than acute toxicity, as the acute toxicity hazard rating is 'slightly toxic'. Spills of cement could increase the

pH significantly, which could result in high levels of mortality to aquatic organisms and physical habitat alteration from hardening of the activated cement in the streambed.

Ammonium nitrate (ANFO) would be mixed on site at the mine with diesel fuel to produce a commercial grade explosive used for blasting rock in the mine pits. It would be hauled to the mine approximately four times per month as a dry bulk product. Given this low frequency of transport and the fact that it will be shipped as a dry bulk product, there is less probability an accident would occur, as well as a low risk of a spill based on the transport method (container type). The toxicity level for ANFO was derived from studies conducted with rainbow trout and solutions of ammonium and nitrite, the intermediate product of ammonia oxidation. As stated in the Assessment, the quantities of ANFO that could cause toxic concentrations are in the range of 0.1 pounds in Moccasin Creek, and in the range of 1 to 39 pounds for the Salmon River, depending on the duration of the release and which reach of the river is impacted.

Sodium sulfide has a low accident probability near streams (2,073) and will be shipped dry in 50 lb sacks giving it a low spill risk if there is an accident near a stream. The toxicity ranged from highly to moderately toxic depending on which toxicity source is used. The manufacturer's MSDS data sheet listed a toxicity of 0.55mg/l for *Brachydanio rerio*. (zebra fish). At this level it would require less than one pound of material to create toxic conditions in the small creeks and 1 to 2 ½ pounds to create toxic conditions in the Salmon River.

The flocculent that is used at mill in the processing would be a dry cationic polyamide, hauled as a dry bulk product in 50 pound sacks and therefore would have a low risk of release into streams in the event of an accident. Because of its infrequent delivery it has a very low accident probability of once every 2,073 years for locations along the haul route that could result in a spill reaching a stream. According to the material safety data sheet provided by the supplier (CYTEC) the 96 hour static acute LC₅₀ for rainbow trout is 0.22 mg/l. Quantities of flocculent that could cause toxicity are low; less than 1/1000th of a pound in the small creeks to about 1 pound for the Salmon River below Panther Creek, depending on the duration of the spill and which reach of the river is impacted.

As part of the Plan of Operations, FCC has developed and will implement a Spill Prevention and Response Plan. The Plan outlines transportation requirements that must be adhered to while transporting all fuel, reagents, and concentrates and should include, but are not limited to:

- All shipments of fuel, reagents, and concentrates shall be accompanied by a pilot vehicle that will be in radio communication with the truck and the mine site at all times.
- All transport vehicles transporting fuel, reagents, and concentrates shall carry a copy of the Spill Prevention and Response Plan in the vehicle, as well as the necessary equipment for 'first response' actions to control a spill.
- Transportation of fuels and reagents is allowed only during daylight hours.
- Maximum speed on Forest roads is 30 miles per hour, unless otherwise posted, and would be adhered to.

Full details on the transportation of fuels and chemicals and on-site handling and storage of fuels and chemicals can be found in FCC's Spill Prevention and Response Plan (FCC 2002).

Affects of Chemical Transportation

Based on accident probability data collected for the Forest, the chance of an accident with a spill into a stream occupied by bull trout is expected to occur once within 40 years (based on the most likely scenario of a spill), all the way out to once within 2073 years (based on the least likely scenario). The life of the Mine Project is expected to be 16 years (including construction, operation, and reclamation). As such, an accident with a spill into an occupied bull trout stream is not expected within the life of the Mine Project. Thus adverse affects to bull trout are not anticipated based on the implementation of the Mine Project as outlined in the Assessment.

NPDES Permit

The draft NPDES permit contains discharge limitations for 16 potential pollutants: eight metallic elements, arsenic (a metalloid), ammonia, sulfate, sulfide, total suspended solids (TSS), pH, dissolved oxygen, and temperature (Table 4). The discharge point (Outfall 001) is proposed for Big Deer creek, approximately 1,500 feet downstream from Southfork Big Deer Creek. Panther Creek lies approximately 3.0 miles downstream from the outfall, with an impassable cascade located in Big Deer Creek approximately 0.7 miles from the confluence of Big Deer and Panther Creeks (i.e., 2.3 miles downstream from the outfall). A mixing zone is not being requested as part of this permit, with the exception of sulfate. For all other constituents, water quality criteria will need to be met at the discharge point (i.e., end of pipe).

Arsenic

Arsenic occurs naturally in the environment. It is bioaccumulated by organisms but is not biomagnified through the food chain (Eisler 1988). Toxic effects of arsenic to aquatic life are significantly modified by numerous biological and abiotic factors such as water temperature and hardness, pH, organic content, phosphate concentration, suspended solids, etc. (Eisler 1988). This is particularly important in the Panther Creek watershed if land management activities (e.g. grazing) decrease riparian shading of streams resulting in increasing water temperatures. Sublethal effects including anemia, gallbladder inflammation, and liver degeneration were observed in salmonids at dietary concentrations of 43.1 - 60 µg/g (Eisler 1988). These changes may in turn result in altered feeding behavior, reduced body weight and reproductive success, and survival. Additionally, concentrations of 40 - 42 µg/l were associated with onset of mortality of rainbow trout embryos after 30 days post-hatching exposure (Birge *et al.* 1979, 1981).

Table 4. Outfall 001 Effluent Limits and Monitoring Requirements (taken from the Assessment)

Parameter	Units	Effluent Limits and Monitoring Requirements ¹			
		Maximum Daily Limit ³	Average Monthly Limit	Monitoring Frequency	Sample Type
Arsenic ²	µg/l	100	50	Weekly	Grab
Cadmium ²	µg/l	0.52	0.26	Weekly	Grab
Cobalt ²	µg/l	141	70.4	Weekly	Grab
Copper ²	µg/l	4.80	2.40	Weekly	Grab
Lead ²	µg/l	0.90	0.45	Weekly	Grab
Mercury ²	µg/l	0.02	0.01	Weekly	Grab
Nickel	µg/l	26.52	13.22	Weekly	Grab
Thallium	µg/l	0.95	0.47	Weekly	Grab
Zinc	µg/l	37.02	18.45	Weekly	Grab
Ammonia (total as N)	mg/l	4.1	1.6	2/Month	Grab
Nitrate + Nitrite	mg/l	10 ⁴	--	2/Month	Grab
Sulfate	mg/l	250	--	2/Month	Grab
Sulfide	µg/l	2	--	2/Month	Grab
TSS	mg/l	30	20	Weekly	Grab
pH	s.u.	Between 6.5 and 9.0 at all times		Weekly	Grab
Dissolved Oxygen	mg/l	Must exceed 6.0 at all times		2/Month	Grab
Temperature	C°	19	--	2/Month	Grab
Iron	µg/l	--	--	Monthly	Grab
Aluminum	µg/l	--	--	Monthly	Grab
Hardness	mg/l	--	--	Monthly	Grab
Chloride	mg/l	--	--	Monthly	Grab
Conductivity	mS/m	--	--	Monthly	Grab
TDS	mg/l	--	--	Monthly	Grab
Whole Effluent Toxicity (WET)	TUC	--	--	1x/6 months	Grab
Expanded Effluent Testing	--	--	--	3x/5 years	Grab

Notes to Table:

1. Metals limits expressed as total recoverable except for mercury which is expressed as total.

2. Expanded effluent testing includes the 126 chemicals listed in 40 CFR § 131.36. This testing shall occur in years 2, 3 and 4 of the permit cycle, and should occur coincident with the September WET testing and other routine monitoring (see Part I.C.1).

3. Reporting is required within 24 hours of a maximum daily limit violation.

4. The maximum daily limit for nitrate was reduced from 100 mg/l to 10 mg/l since the Assessment was released to the Service (Lisa Olsen, EPA, Pers. Comm. May 8, 2008).

Cadmium

Cadmium occurs naturally in the environment. It is bioaccumulated by organisms but is not biomagnified through the food chain (Eisler 1985). Toxicity of cadmium to aquatic organisms varies with water hardness, alkalinity, the type and life stage of organisms, presence of organic matter, presence of other toxicants, and the duration of exposure (EPA 1999). Cadmium is considered one of the most toxic of metals to fish (Sorensen 1991).

EPA (1996) reported mean acute toxicity values of sensitive life stages for rainbow and brown trout at 3.6 and 1.6 µg/l, respectively and chronic values for brown and brook trout at 7.4 and 2.2 µg/l, respectively. Concentrations above the daily and monthly effluent limits proposed in the NPDES permit. However, chromium and zinc are reported to alter toxicity of cadmium when in

a mixture, resulting in enhanced uptake of cadmium. Studies with bull trout in water column mixture toxicity tests with Cadmium and zinc indicate that bull trout are sensitive to cadmium at concentrations near the effluent limits. The 120-hour LC₅₀ for Cadmium in a mixture was 0.51 µg/l (hardness=30 mg/l), just below the daily effluent limit (0.52 µg/l) but above the monthly limit (0.26 µg/l; Hansen *et al.* 2002).

Cobalt

EPA has not adopted aquatic life criteria for cobalt due to a lack of sufficient toxicology data. However, as part of the CERCLA action at the Blackbird Mine, a site-specific criterion was developed based on site-specific toxicity testing. Summary results indicate the LC₅₀ to rainbow trout (using Panther Creek water) ranged from 800 to 860 µg/l for acute exposure, while a chronic exposure of 242 µg/l resulted in a 5% reduction in growth, and no reduction in growth at 101 µg/l (Mebane 2007). Daily and monthly effluent limits are well below concentrations expected to result in adverse effects.

Copper

Copper occurs naturally in the environment and is an essential trace element for most organisms. The toxicity of copper to aquatic organisms is dependent on the speciation of the chemical, water hardness, and type and life stage of the exposed organisms. Studies have reported rainbow trout growth was significantly reduced and whole body copper concentrations elevated in fry after 20 days of exposure to copper levels of 4.6 µg/l (hardness=0.027 µg/L; Marr *et al.* 1996), concentrations below the maximum daily limit proposed for the NPDES permit. Additionally, studies by Hansen *et al.* (1999) reported avoidance behavior in rainbow trout exposed to concentrations of 1.6 µg/l copper.

Lead

Lead occurs naturally in the environment and has been reported to bioconcentrate; it can be found in rocks, soils, water, plants, animals, and air. It is soluble in water and its bioavailability increases in environments with low pH, low organic content, and low metal salt content (Eisler 1988). Lead is most often precipitated to sediments in aqueous environments. Adsorption of lead by aquatic animals is affected by the age, gender, and diet of the organism, as well as the particle size, chemical species and presence of other compounds in the water (Eisler 1988). Species that are sensitive to lead are affected more strongly by dissolved rather than total lead. Likewise, the toxicity of lead is increased when it forms organolead compounds and when environmental conditions consist of high temperature and low pH. Much of the available data demonstrates adverse effects to salmonids at concentrations above the proposed NPDES effluent limits.

Mercury

Mercury occurs naturally in the environment and accumulates and biomagnifies through the food chain (Eisler 1987). Among metals tested, mercury was the most toxic to aquatic organisms, and organomercury compounds showed the greatest biocidal potential (Eisler 1981). Both organic

and inorganic mercury bioaccumulate, but organic mercury (methylmercury) accumulates at greater rates (EPA 1997). In general, toxicity was higher at elevated temperatures and in the presence of other metals such as lead and zinc (Eisler 1987). The Service (2000) previously developed an adverse effect concentration for total mercury in water for larger, piscivorous fish or tertiary consumers (as bull trout are) of 0.005 µg/l using the EPA (1997) default Bioaccumulation Factor and a LOAEL of 2.7 µg/g whole body concentration in brook trout determined by McKim et al. (1976). This concentration is likely to be associated with reproductive impairment.

Nickel

Nickel occurs naturally in the environment and is an essential trace element for many organisms. It is bioaccumulated and bioconcentrated by aquatic organisms (Eisler 1998). Toxicity of nickel to aquatic organisms is dependent on water hardness, pH, ionic composition, chemical form, type and concentration of ligands, presence of mixtures, and availability of solid surfaces for adsorption (Eisler 1998). Nickel interacts with many compounds to produce altered patterns of accumulation, metabolism, and toxicity (Eisler 1998). Birge and Black (1980) reported an LC₁₀ for rainbow trout embryos of 11 µg/L while avoidance was observed in adults at water concentrations of 23.9 µg/L (Nebeker et al. 1985), both concentrations fall below the monthly and daily effluent limits, respectively.

Thallium

Thallium is a nonvolatile heavy metal that exists in water primarily as a monovalent ion. Aquatic life criteria have not been developed for thallium due to the lack of toxicity data, therefore the draft NPDES permit incorporated the human health criterion for toxic substances, which is based on human consumption of fish (maximum of 0.47 µg/l). The literature reports for thallium toxicity to aquatic species indicate concentrations at which adverse effects are expected to be well above the daily and monthly effluent limits.

Zinc

Zinc occurs naturally in the environment and is an essential trace element for most organisms. It bioaccumulates but does not biomagnify (EPA 1999). Cadmium, copper, iron, and molybdenum can interact antagonistically with Zn (Hammond and Beliles 1980), whereas calcium and magnesium can reduce toxicity (EPA 1999). However, aqueous solutions of cadmium and zinc have also been additive in toxicity to freshwater fish (Skidmore 1964). Mixtures of Zn and Cu are generally acknowledged to have greater than additive toxicity to a wide variety of aquatic organisms including freshwater fish (Eisler 1993). This becomes particularly important when effluent limits for other constituents (e.g., copper) are at or above concentrations reported to cause adverse effects.

Mixtures

Fish and other aquatic organisms will be exposed to the whole effluent with unknown combined effects of the metals. Antagonistic metal reactions, which reduce the toxicity of metals primarily

through precipitation, result in solutions that are less toxic than simple metal solutions. For example, calcium markedly counteracts the toxic effects of copper, lead, potassium, sodium and zinc (Dourdoroff and Katz 1995: in Nelson et al. 1991). Conversely, combinations of metals can be synergistic; their joint effect being greater than the sum of the separate effects. Copper, cobalt, zinc and cadmium, which occur in the effluent, are known to act synergistically. Of the metals in the effluent, the metals of primary concern with potential synergistic effects are cobalt and copper, since copper loading is an issue in the watershed from past mining activities. Additionally, avoidance responses have been demonstrated to occur at very low concentrations both in the laboratory and in field studies (Sprague 1985) and the avoidance response varies depending on the mixture of metals encountered, the species of salmonid studied, and water chemistry conditions.

Ammonia

Discharge of ammonia may impact receiving waters in three ways: 1) by causing acute or chronic toxicity, 2) by causing DO depression due to nitrogenous biological oxygen demand (BOD), and 3) by adding nitrogen, which may act as a nutrient, to the receiving water. Studies have reported acute toxicity of un-ionized ammonia to freshwater organisms in a wide range of concentrations. Acute effects include loss of equilibrium, hyperexcitability, increased breathing, cardiac output, and oxygen uptake, convulsions, coma, and death. Chronic effects of ammonia on freshwater organisms include reduced hatching success, growth rate, and morphological development, and pathological changes in tissues of gills, livers, and kidneys (EPA 1999).

Nitrates

Nitrate is a pollutant present in mine drainage water at the ICP as a residual from explosives used in underground blasting operations. EPA applies the permit limit to the combined form of nitrogen as "nitrate plus nitrite" because nitrite nitrogen is relatively unstable and is easily oxidized to the nitrate form. As discussed in the NPDES permit fact sheet materials, nitrite is not expected to be present in the Mine Project wastewaters. Elevated nitrate concentrations are a concern from both the standpoint of toxicity, which may occur at very high concentrations, and from the standpoint of eutrophication (stimulating excessive algal growth) and resulting in negative effects on dissolved oxygen and pH regimes. Based on concentrations reported in the literature that cause adverse effects, and the concentrations predicted to be discharged from the Mine Project, it is not likely concentrations of nitrates will rise to toxic levels (McGurk et al. 2006). Additionally, based on discussion between National Marine Fisheries Service and EPA, and the concern for adverse affects to salmonids, it was determined that the NPDES effluent limit would be lowered from 100 mg/l nitrate (which is the effluent limit set in the draft NPDES permit) to 10 mg/l nitrate (Lisa Olsen, EPA, Pers. Comm. May 8, 2008).

Total Suspended Solids

Total suspended solids (TSS) measures both settleable and suspended sediment and organic matter in a discharge. Although concentration and duration of exposure are the primary drivers of TSS effects on fish, other factors influence the degree of effects. Using available past study results, Newcombe and Jenson (1996) developed matrices of TSS dose and response. For

juvenile and adult salmonids, their results suggest behavioral effects are likely at 20 mg/l TSS over short durations (< 144 hours). Over longer durations, the severity of ill effects increases, but does not exceed a sublethal level of effects at this exposure concentration. For larval salmonids, effects of 20 mg/l are sublethal when maintained for 1 to 144 hours. Sublethal effects include: reduction in feeding rate and success and physiological stress. For the egg stage, effects of 20 mg/l are sublethal (physiological stress) when maintained for 1 to 144 hours. The lethal effects occur at longer durations of exposure. A secondary effect of TSS is degradation or loss of habitat due to fine sediment deposition at areas with diminished flow. Also, populations of macroinvertebrates, a primary food source for salmonids, can be reduced due to habitat reduction from fine sediment deposition. Based on typical flows in Big Deer Creek, dilution of the effluent water should minimize any potential adverse effects from TSS.

pH

The pH of natural waters is a measure of the acid-base equilibrium achieved by the various dissolved compounds, salts, and gases in the water and is an important factor in the chemical and biological systems of natural waters. The IDEQ and EPA freshwater criteria indicate that water quality standards for pH lie between values of 6.5 and 9.0. The primary concern with changes in pH is the interaction and effect of pH on toxicity of metals. pH activity has a significant impact on the availability and toxicity of metals. Metal-hydroxide complexes tend to precipitate (i.e., reduced ability to remain suspended) and are quite insoluble under natural water pH conditions, thus, the metal is not able to exert a toxic effect. However, the solubility of these complexes increases sharply as pH decreases. The pH activity also affects the sensitivity of organisms to a given amount of metal.

Dissolved Oxygen

The dissolved oxygen concentration limit in the draft NPDES permit is set at the State water quality criteria minimum of 6 mg/L for cold water aquatic life. Dissolved oxygen concentrations can be expected to remain at or near saturation with air in high gradient mountain streams unless they are impacted by organic sources of pollution. As with other constituents, the early life stages of fish (egg, embryo, alevin) are the most sensitive life stage to alterations of dissolved oxygen. The general recommendation is that dissolved oxygen should be at or near saturation for successful incubation of salmonid fish. Juvenile salmonids may be able to survive when dissolved oxygen concentrations are relatively low (< 5 mg/L), but growth, food conversion efficiency, and swimming performance will be adversely affected. High water temperature, which reduces oxygen solubility, can compound the stress on fish caused by marginal dissolved oxygen (Bjornn and Reiser 1991). Mining and milling operations are expected to have little effect on dissolved oxygen concentration as predicted by the low biological and chemical oxygen demand concentrations as outlined in EPA's fact sheet for the NPDES permit.

Temperature

Studies on the growth and survival of bull trout indicate that as temperature increases, growth and survival of bull trout decreases (Selong et al. 2001). At temperatures above 22°C, survival of larval bull trout was 0 %. At temperatures greater than 16°C, food consumption declined

significantly, and completely ceased when temperatures reached 22°C. Saffel and Scarnecchia (1995) also found that stream reaches with the highest densities of bull trout had maximum summer temperatures ranging from 7.8 - 13.9°C, whereas most reaches with low densities had higher maximum summer temperatures (18.3 - 23.3°C). Additionally, temperature change may increase, decrease, or cause no change in toxicity depending on many factors including the toxicant or species (Sprague 1985). As outlined in Appendix C of the Assessment, the effluent discharge from the Mine Project is expected to be in the range of 11°C in the winter and 14°C in the summer.

Sulfate

Sulfur is one of the critical elements in living matter, as it participates in several structural, metabolic and catalytic activities; it is a critical component of photosynthesis. Sulfur compounds are naturally occurring within the ore body at the Mine Project in the form of metallic sulfide minerals. In contact with aerated water the sulfides are oxidized to sulfate ions. Once liberated, both sulfates and sulfides would be present in wastewater from the mill and in the discharge at Outfall 001.

EPA has not established toxics criteria for sulfates or sulfides in 40 CFR § 131.36, and Idaho has not adopted any numeric criteria for these pollutants to protect aquatic life or human health in their Water Quality Standards and therefore effects to aquatic biota are based on the best available science. EPA set the sulfate maximum daily limit in the draft NPDES permit at 250 mg/l based on the secondary drinking water standard (EPA 2004), and not on toxicity to aquatic life. The maximum daily limit for sulfide was set at 2 µg/l, based on the chronic criteria for protection of freshwater aquatic life (EPA 1986).

A review of the literature indicated that the potential toxicity of sulfates to salmonid species and invertebrates is 2 to 3 times higher (BC Research 1998, Davies and Hall 2007, Soucek 2004, Soucek 2007) than the draft permit effluent limit of 250 mg/l. For impact evaluation purposes, the No Observed Effect Concentration for an early life stage of a salmonid species of 1060 mg/l is considered protective of listed species (BC Research 1998) and will be used to evaluate the potential effluent toxicity to fish that may occur in Big Deer Creek.

Treated water that is discharged to Big Deer Creek is predicted to have sulfate concentrations ranging from approximately 400 to 840 mg/l, depending on flow. As part of the Plan of Operations for the Mine Project, a mixing zone for sulfate has been requested. Within the mixing zone, the Mine Project discharge would be diluted to meet the water quality standard of 250 mg/l established in the draft NPDES permit.

At the point of discharge, sulfate concentrations immediately adjacent to the diffuser ports would be similar to the discharge, 400 to 840 mg/l. At the edge of the assumed regulatory mixing zone (25% mixing; the mixing zone should be limited to 25% of the width and volume of the stream to allow a zone of passage for aquatic life), sulfate concentrations would range from approximately 34 to 166 mg/l during average conditions and low flow (7Q10) conditions, respectively. Outside of the regulatory mixing zone after mixing with the entire volume of Big Deer Creek is achieved, sulfate concentrations in Big Deer Creek are predicted to increase from

approximately 7 mg/l to 54 mg/l, depending on flow in Big Deer Creek. The worst case scenario of low stream flow and 25% mixing area results in a predicted maximum sulfate concentration of 166.1 mg/l, much lower than the estimated protective value of 1,060 mg/l.

Affects of NPDES Permit

No bull trout have been surveyed in Big Deer Creek (Kuzis 2004, Stantec 2004, Ecometrix 2006, Forest Service 2006, Keeley, pers. comm. 2008). Based on the multiple sample attempts, the Service does not consider Big Deer Creek to be occupied by bull trout, and they are blocked from access to Big Deer Creek at the cascades/falls located 2.3 miles below the outfall location.

Stream flow characteristics of Big Deer and Panther Creek were derived using US Geological Survey StreamStats and Q-80 flow duration statistics (Q-80 is the 80% exceedence flow, an estimate of the natural flow stream flows for an average year that characterizes dry year flows). Low flow stream characteristics are estimated at 6.9 cfs (at the lowest flow in the summer) for Big Deer Creek (at the proposed outfall) and 51.1 for Panther Creek and the confluence of Big Deer Creek. The estimated mean and maximum volume for the discharge is 112 gpm (0.25 cfs) and 150 gpm (0.33 cfs), respectively. When discharged into Big Deer Creek and Panther Creek the dilution of the effluent ranges from a factor of 21 – 28 in Big Deer Creek to 155 – 204 in Panther Creek, based on flows. As such, at Outfall 001, contaminants are mixed by a dilution factor of 21-28 at expected low flows (based on September Q-80 estimates); further dilution occurs after mixing with Panther Creek increasing the dilution factor to a range of 155 – 204.

As such, while concentrations of constituents discharged through Outfall 001 may be elevated enough to cause acute and chronic effects at the discharge point (as straight effluent prior to any dilution, which would occur immediately), and/or mixtures of metals may act synergistically with each other, increasing toxicity, the dilution factors (the lowest being a dilution of 21 times once the discharge water mixes with Big Deer Creek) results in concentrations of constituents that would be insignificant to any bull trout exposed to it in Big Deer Creek below the impassable cascade (2.3 miles downstream from the outfall) and below concentrations at which adverse effects have been reported. Concentrations of constituents discharged from Outfall 001 would be well below Idaho water quality criteria by the time they reach the impassable cascade at the bottom of Big Deer Creek (where they may come in contact with bull trout). As such, adverse affects to bull trout are not anticipated and would not be measurable as a result of the NPDES permit.

Riparian Disturbance and Sedimentation

Disturbance to riparian vegetation would include short-term impacts during installation of a cable car across Panther Creek near Big Flat Creek and construction of the NPDES outfall on Big Deer Creek. The cable car would result in localized vegetation removal and streambank disturbance on each bank, and localized, transient disturbance of the streambed from crossing of a backhoe or excavator (a total of two trips – to one side of the Creek and back) to access the far-bank deadman site. However, per discussions with Bob Rose, Forest Fisheries Biologist (Pers. comm., April 2008), the instream work windows as recommended in the June 2004 Upper Salmon River Recommended Instream Work Windows and Fish Periodicity report would be

adhered to, along with the associated Best Management Practices (BMPs). This includes a work window of the 3rd week of July to the 2nd week of August for Panther Creek, as well as appropriate BMPs including, but not limited to, use of silt fences, straw bales, coir logs, timing of disturbance, or other methods to minimize negative effects of the project. This also assumes that the entire channel will not be completely obstructed during construction (i.e., there would still be fish passage). The portion of Panther Creek where the stream crossing will occur is not suitable spawning habitat, and given the time of year when the activity would occur, due to higher stream temperatures, it's likely the bull trout would have moved out of Panther Creek to higher elevation (cooler) tributary streams (B. Rose, Pers. Comm., April 2008). While there may be minor sedimentation into Panther Creek from the stream crossing, the adherence to the work windows and implementation of the BMPs are expected to minimize sedimentation to the point it is insignificant and would not rise to the level of 'take'.

Construction and placement of the in-stream diffuser for the NPDES outfall is not expected to impact bull trout, as bull trout do not occur in Big Deer Creek (above the impassable cascade) and disturbance (sedimentation) associated with the diffuser are not expected to impact bull trout below the cascade (more than 2 miles downstream). Sediment would be diluted by the time it reached the cascade to the point it would be negligible.

Sediment input into streams occupied by bull trout may occur as a result of road improvement projects as part of the Mine Project. Disturbance to 40 miles of road is anticipated as a result of the Mine Project, including from activities such as regarding, total reconstruction of new road segments, regravelling portions of the haul route, and construction of new turnouts. Short term impacts due to construction activities will result in increased sediment deposition into streams where the road construction activities are adjacent. Long term benefits will include decreased sedimentation (due to improved road surfaces), along with increased safety and decreased risk of spills (resulting in reduced risk for chemicals getting into the streams).

Sediment delivery to streams along the haul route and within the Mine Project area is expected to decrease overall based on modeling completed for the Assessment. However, during actual construction activities, sediment delivery to Big Flat and Bucktail Creek is expected to increase by 1% and 31%, respectively. Neither stream is occupied by bull trout. A 1% increase in sediment to Big Flat Creek, tributary to Panther Creek (approximately three miles downstream and occupied by bull trout), is expected to be diluted by the time it reaches Panther Creek and as such would be insignificant and discountable, and not rise to the level of harm/harassment. A 31% increase in sediment to Bucktail Creek which flows approximately 1 mile to Southfork Big Deer Creek, then another $\frac{3}{4}$ mile to Big Deer Creek, and eventually another $3\frac{3}{4}$ miles to Panther Creek (which is the only occupied bull trout stream in that section), is not likely to adversely affect bull trout in Panther Creek. A 31% increase in sediment is significant for Bucktail Creek; however, the closest occupied stream reach from where the sediment input occurs is over five miles away and as such, sediment is expected to settle back into the system prior to reaching Panther Creek. Therefore, sediment delivery to Bucktail Creek is insignificant and discountable to bull trout present in Panther Creek, and is not expected to rise to the level of harm/harassment.

Activities associated with the Williams Creek road reconstruction does have the potential to impact listed fish both from sediment and salvage activities. Currently Williams Creek road runs

immediately alongside Williams Creek in some locations, with several tight switch-back turns. As part of the road reconstruction, Williams Creek road would be reconstructed away from the Creek (by a couple hundred yards), and the old road would be obliterated (using heavy equipment) and returned to natural conditions (recontouring and re-establishment of riparian vegetation). Additionally, as part of the obliteration of the old road, two, approximately 50 foot long culverts on the North Fork of Williams Creek, would be completely removed and the associated channel rehabilitated. Specific details on the road reconstruction and associated culvert removal are not available, as the Forest has requested an engineering design from FCC for those activities. The Service intends to review those plans and provide comment in order to minimize the potential for adverse affects.

The culvert removal associated with this Mine Project can not be covered under the Programmatic Biological Opinion for Stream Crossing Structure Replacement and Removal Program (Programmatic; Service 2006), as any culvert project that is part of a larger project and has other components with potential adverse effects on listed fish are exempted from the Programmatic and require separate consultation that considers project impacts from all action components. Though not covered under the Programmatic, it is assumed the Forest would adhere to the guidelines/ recommendations outlined in the Programmatic for the Mine Project culvert removal. Similarly, the effects of the action (the culvert removal on North Fork Williams Creek) would have similar affects to bull trout as those analyzed in the Programmatic. The effects of the action related to the Williams Creek road reconstruction will be analyzed in this Opinion; however, detailed information on culvert removal and affects of such actions can be found in the Programmatic as well, which is incorporated by reference (Service 2006).

As stated previously, though this activity is not covered under the Programmatic, the Service assumes the Forest will be following the guidelines/recommendations in the Programmatic. That being said, the Service assumes that FCC's engineering plan for the road construction work will involve damming North Fork Williams Creek and diverting the water around the project area. As the project area dewateres (due to the upstream dam/diversion) any bull trout present will need to be removed from the project area. Williams Creek is a relatively small stream (mean annual flow of 10 cfs with a range of mean monthly flows of 40 cfs to 3 cfs); and the project would be implemented in the late summer and early fall when the stream flow is at its lowest (approximately 3 cfs). As such, the Service anticipates electroshocking will not be necessary to salvage fish and remove them from the project area, but that any bull trout present can be 'encouraged' to leave the area by physically walking in the stream and 'hazing' them downstream. Upon project completion, the upstream dam/diversion would be removed and water would be slowly turned back into the Creek. It is anticipated that no more than approximately 100 meters of North Fork Williams Creek, including the existing culvert reach, will be dewatered for project operations.

The road reconstruction/culvert project has the potential to impact bull trout in two ways: 1) sediment/turbidity and 2) physical barriers. Potential adverse affects associated with those impacts may include: 1) sediment-related affects from increased turbidity/sediment movement during reintroduction of streamflow back into the stream; and 2) harassment-related affects associated with installing the diversion and 'hazing' the fish out of the project area. Adverse affects of the above described impacts will likely include disruption of normal behavioral

patterns (feeding/sheltering), the severity of which will depend on the North Fork Williams Creek channel, and the low flow anticipated during the work window (1st quarter of July to the 2nd quarter of August), the Service does not expect copious sediment inputs into the system. Since suspended sediment input into the system is not expected to be high, and because electroshocking will not be necessary, the Service anticipates effects to bull trout during the period between maximum observed turbidity and the return to pre-project levels will be behavioral, including avoidance and potential effects to feeding rates; no lethal take is expected. As analyzed in the culvert Programmatic (Service 2006), the Service believes that all impacts associated with increased turbidity and suspended sediment will be short-term in nature, with the majority of all effects occurring in a one to two hour period. Also, as analyzed in the Programmatic (Service 2006), we anticipate suspended sediment levels will return to pre-project levels within 600 feet of the culvert project area.

Regarding bull trout habitat, we anticipate that project actions may increase substrate embeddedness, which may result in displacement (Service 2006). This is expected to cause a short-term disruption in normal behavior of bull trout in the area. However, these increased levels of substrate embeddedness are expected to be temporary in nature, as natural flows will mobilize any sediment deposited during project activities. Following project activities, in the long-term, substrate embeddedness and sediment in general are expected to decrease as the placement of Williams Creek road away from the stream is expected to remove chronic sources of sediment.

Sediment deposition into the stream during revegetation/recontouring work associated with movement of the road away from the Creek also may input sediment into Williams Creek; however, similar to the cable car installation in Panther Creek, all work associated with the Williams Creek road reconstruction will adhere to the Upper Salmon River Recommended Instream Work Windows and Fish Periodicity report, including associated BMPs. Adherence to the work windows and installation of BMPs (i.e., silt fences, straw bales, etc.) are expected to minimize sedimentation to the point it is insignificant and would not rise to the level of 'take'.

2. Indirect Effects

Indirect effects are caused by or result from the agency action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the immediate footprint of the Project area, but would occur within the action area. The Service has not identified any indirect effects on bull trout that would result from actions related to the proposed Mine Project.

B. Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The Service has not identified any effects on bull trout that would result from actions interrelated to or interdependent on the proposed Mine Project.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Previous mining activities at Blackbird Mine have resulted in significant impacts to the fisheries and aquatic life in the Blackbird Creek drainage, and to a lesser extent, Big Deer Creek and Panther Creek. As such, remedial activities associated with an ongoing CERCLA action were initiated in the mid 1990s. Clean-up goals are currently being met in some areas, and are working towards attainment in others. Fish, including bull trout, are beginning to reoccupy portions of the Blackbird Mine impact area where they once avoided (Fish and Wildlife Service 2002); however, full clean-up is still several years away, and there are still areas where impacts from Blackbird Mine are evident and where impacts to aquatic life are occurring.

Fires, such as the Clear Creek Fire in 2000 that burned approximately 170,000 acres in the Panther Creek watershed, also have the potential to occur in the Action Area. Post-fire effects on water quality and aquatic habitat could be significant depending on where the fire occurs. In addition to increased sediment, water yield also may affect aquatic habitat.

VI. CONCLUSION

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Opinion that the Mine Project, as proposed, is not likely to jeopardize the continued existence of the bull trout.

The Service reached this conclusion for the following reasons:

- Under the present environmental baseline conditions, bull trout populations remain reduced from historic levels; however, bull trout are widely distributed across the Salmon River Recovery Unit.
- Based on accident probability, an accident resulting in a spill to an occupied bull trout stream is not likely to occur within the life of the Mine Project. FCC has incorporated a Spill Prevention and Response Plan as part of the Plan of Operations in order to minimize chances for a spill and to allow for immediate response in the unlikely event a spill does occur.
- Based on surveys, bull trout are not present in Big Deer Creek (location of NPDES permit outfall), and there is an impassable falls 2.3 miles downstream from the Outfall location.
- All in-stream work windows and associated BMPs would be adhered to for any in-stream work as outlined in the 2004 Upper Salmon River Recommended Instream Work Windows and Fish Periodicity report. As such, sedimentation into bull trout occupied streams would be minimized to the point it is insignificant and not expected to rise to the level of take.

- Adverse effects experienced by bull trout from suspended sediments are likely to be localized to Williams Creek and occur at the individual, not the population level; we do not anticipate alterations in distribution or abundance of bull trout within the Panther Creek watershed, as a whole.

While some individuals may be harassed as a result of activities associated with the culvert removal, any impacts will be limited in time and space and will not amount to an appreciable change in the status, distribution, or long-term persistence of the species. The adverse effects are not expected to appreciably reduce the likelihood of survival and recovery of bull trout range-wide in terms of numbers, distribution, or reproduction of the species. No critical habitat has been designated for this species in the Action Area; therefore, none will be affected.

VII. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest so that they become binding conditions of any grant or permit issued to FCC, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by the Incidental Take Statement. If the Forest (1) fails to assume and implement the terms and conditions or (2) fails to require FCC to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement. [50 CFR §402.14(i)(3)]

A. Amount or Extent of Take Anticipated

The Service anticipates take in the form of harassment of individual fish is reasonably certain to occur as a result of the Williams Creek culvert removal portion of the Mine Project.

Fish density information for the mainstem of Williams Creek is not available, as recent surveys have not identified any bull trout in that stretch. However, bull trout were identified in the South

Fork of Williams creek (which flows into the mainstem just below the Williams Creek road reconstruction), and the Forest biologist's opinion is that he expects bull trout to occur in the Mainstem of Williams Creek and that fish densities in the S. Fork and the mainstem would be comparable (B. Rose, pers. comm. 2008). In the S. Fork of Williams Creek, bull trout were found at a density of 6 bull trout per 100 meters.

The extent of take anticipated for the road reconstruction project would include the 100 meter diversion/work area, as well as the 600 foot (183 meter) extent beyond the project area where suspended sediment is expected to be elevated. Thus the total extent of take is estimated at 283 meters, corresponding to 17 bull trout. Of those 17 bull trout, no more than 6 are expected to be taken by activities associated with hazing the fish out of the project area during dewatering of the project area; take in the form of harassment is likely, resulting in disruption of normal feeding and sheltering behaviors, and no lethal take is anticipated. Eleven bull trout are anticipated to be taken related to elevated suspended sediments resulting from rewatering the channel following culvert removal. Take in the form of disruption of normal feeding and sheltering behavior is anticipated, as is avoidance of the area; no lethal take is expected.

The temporal extent of anticipated take is as follows (and is further analyzed in the Culvert Programmatic (Service 2006):

- Direct injury from sediment will be restricted to the 90 minute period during and immediately following the re-watering of flow through the new crossing structure or back to the existing channel. This is the period when turbidity levels are expected to be the highest and may result in minor to moderate physiological responses such as changes in blood chemistry, coughing, and other respiratory issues and gill trauma.
- Elevated sediment levels will occur as a result of the culvert removal aspect of the Mine Project with levels that result in behavioral effects restricted to the 24 hour period following channel rewatering. During this period we anticipate behavioral and avoidance responses that may cause increased energy expenditures, decreased feeding rates, and/or abandonment of cover. Behavioral effects and injury may occur simultaneously during the initial large sediment pulse immediately following channel rewatering.

To summarize elements considered in this Incidental Take Statement, sublethal take of no more than 17 bull trout is exempted for a 90 minute period during and immediately following flow reintroduction when suspended sediment levels are likely their highest. However, sublethal take is not exempted if suspended sediment levels reach or exceed 22,026 mg/l or remain at 3,000 mg/l for 3 hours or more, which Newcomb and Jensen (1996) anticipates as levels that may be lethal for fish. Take of bull trout resulting from sediment levels beyond those conditions described above are not exempted by this Incidental Take Statement. Elevated suspended sediment levels will return to background levels within a 24 hour period and within 600 feet downstream of the culvert project area.

B. Effect of the Take

In the preceding Opinion, the Service has determined that the level of take anticipated as a result of the proposed action is not likely to jeopardize the Columbia River DPS of bull trout. The proposed culvert work is not expected to reduce the reproduction, status, and distribution of bull trout in the action area, and will not appreciably reduce the likelihood of survival and recovery of the Columbia River DPS.

We do not anticipate appreciable changes in the numbers, distribution, or reproduction of bull trout in any of the core areas or local populations that occur in the action area. Over the long term, the culvert portion of the Mine Project is expected to contribute to the conservation and recovery of bull trout throughout the action area, and the Columbia River DPS.

C. Reasonable and Prudent Measures

The Service believes that the following Reasonable and Prudent Measures are necessary and appropriate to further minimize take from the Mine Project in the Panther Creek Watershed.

1. Minimize disturbance to aquatic habitats and potential take to bull trout from the Williams Creek culvert removal portion of the Mine Project.

D. Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Forest must ensure compliance with the following Terms and Conditions that implement the Reasonable and Prudent Measures described above. These Terms and Conditions are non-discretionary.

- 1a. The Forest shall adhere to the Upper Salmon River Recommended Instream Work Windows and Fish Periodicity report for timing of in-stream work and implementation of associated BMPs.
- 1b. The Forest shall adhere to all project design criteria and BMPs provided in the Programmatic Biological Opinion for Stream Crossing Structure Replacement and Removal (Service 2006) when implementing the Williams Creek road culvert removal.
- 1c. Blocknets will be deployed at the upstream end of the site to prevent additional fish from entering the work area during dewatering and construction activities.
- 1d. Water flows/levels in the Williams Creek culvert project area shall be ramped down slowly as the stream reach is dewatered to encourage voluntary movement of bull trout to escape downstream easily.

- 1e. Following installation of the upper block net, fish should be 'hazed' out of the dewatered section by walking seines downstream from the upstream block net location to the end of the work site in an attempt to 'herd' fish out of the worksite. A downstream block net would then be installed and efforts to capture remaining fish with dip-nets would follow. Due to the small size of the stream and minimal flows, electroshocking is not authorized.
- 1f. Following culvert removal, the work site will be pre-washed prior to diversion dam removal and reintroduction of flow in order to minimize suspended sediments being flushed downstream.
- 1g. Reintroduction of water through the Williams Creek stream channel shall occur in a slow, gradual manner in order to minimize suspended sediments being flushed downstream.
- 1h. The Forest shall ensure the Service has the opportunity to review and approve the engineering/project design for the Williams Creek culvert removal to ensure all appropriate conservation measures are in place to minimize impacts to bull trout.

Reporting and Monitoring Requirements

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following Reporting and Monitoring Requirements. The Reporting and Monitoring Requirements are non-discretionary and must be undertaken by the Forest, or be made a binding condition of any permit issued to the applicant, as appropriate.

- 1. In order to confirm the assumption that dilution in Big Deer Creek will reduce concentrations of the constituents discharged in the effluent to concentrations below which adverse affects are expected, sampling of Big Deer Creek surface water shall be conducted. In order to document the concentrations of constituents in the effluent just below the impassable cascade, the Forest will ensure one sampling event for all constituents discharged per the NPDES permit, at a point immediately below the impassable cascade in Big Deer Creek. This sampling event shall occur once full mining (not pre-mining) activities have been underway for 1 year, and sampling shall occur during high (spring) flows. A report (and associated data) from this sampling shall be provided to the Service within 4 months of the sampling event. Should sampling indicate concentrations of constituents in the effluent are occurring below the cascade at levels above those reported to cause adverse affects, the Forest and Service will meet to discuss the possible need for reinitiation.
- 2. Should it be necessary to implement additional treatments (biological and ion exchange using zeolites) in order to meet effluent limits for nitrate and ammonia, respectively, the Service requests notification. This notification should include documentation on the exceedances, timing of implementation of treatments, and confirmation of compliance once additional treatment is implemented.

3. Screening shall be conducted for any new reagent/formulation not considered in the Assessment. Should screening reveal the new reagent/formulation contain higher toxicity levels than those outlined in the Assessment, the Forest must submit a brief report to the Service discussing what, if any, impacts might occur and the possible need for reinitiation.
4. Reports generated from testing required as part of the NPDES permit (i.e., WET testing, toxicity tests, etc.) shall be submitted to the Service for our review as they become available. Additionally, any notifications of violations of compliance with the NPDES permit shall be submitted to the Service as they occur.
5. The Forest shall monitor turbidity at the Williams Creek culvert project to assure that the incidental take exempted in this Opinion and associated with suspended sediment (intensity, duration) has not been exceeded. The Forest shall ensure that turbidity monitoring results are provided to the Fish and Wildlife Service's Eastern Idaho Field Office in Chubbuck, Idaho.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act, directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop information. The Service has not identified any Conservation Recommendations applicable to the Mine Project.

IX. REINITIATION--CLOSING STATEMENT

This concludes formal consultation for the potential effects of the Mine Project on bull trout. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Activities that would trigger reinitiation would include, but not be limited to, an accident involving a spill, or in-stream work that does not adhere to the recommended instream work windows and associated BMPs. Should a spill occur, the Forest shall ensure the Service is notified immediately. Information provided should include, but not be limited to: location and time of spill, material spilled, immediate impacts to bull trout and bull trout habitat observed,

clean-up actions taken at that time and what actions are expected to continue, and what plans are in place for sampling to monitor extent of spill.

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APPENDIX F

**NATIONAL MARINE FISHERIES SERVICE
BIOLOGICAL OPINION**



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE

Northwest Region

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Seattle, WA 98115

Refer to NMFS No: 2007/08256

May 20, 2008

William A. Wood, Forest Supervisor
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Elin Miller, Regional Administrator
U.S. Environmental Protection Agency
Region 10 Pacific Northwest
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Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Idaho Cobalt Project. Big Flat Creek, Bucktail Creek, Little Deer Creek, South Fork Big Deer Creek, Big Deer Creek, Blackbird Creek, Panther Creek, Deep Creek, Moccasin Creek, Williams Creek, Perreau Creek, and Salmon River. 6th Field HUCs: 170602030902; 170602031001; 170602031104; 170602031703; 170602031805; 170602032004; 170602032006; 170602032107; and, 170602032201. Lemhi County, Idaho (Two Projects).

Dear Mr. Wood and Ms. Miller:

The enclosed document contains a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of constructing, operating, reclaiming, and closing the proposed Idaho Cobalt Project by Formation Capital Corporation in accordance with a Plan Of Operation (POO) approved by the Salmon-Challis National Forest (SCNF) under the General Mining Law of 1872, the Federal Land Policy and Management Act of 1976, and the Surfaces Resources Act of 1955. The SCNF is the lead Federal agency for this consultation, which also includes the issuance of a National Pollution Discharge Elimination System (NPDES) permit by the U.S. Environmental Protection Agency for the discharge of treated mine wastewater into Big Deer Creek under the Clean Water Act. In this Opinion, NMFS concludes that the actions, as proposed, are not likely to jeopardize the continued existence of Snake River spring/summer Chinook salmon or Snake River Basin steelhead, or result in the destruction or adverse modification of designated critical habitats for Snake River spring/summer Chinook salmon or Snake River Basin steelhead. In this Opinion, NMFS also concludes that the actions, as proposed, are not likely to adversely affect Snake River sockeye salmon.



As required by section 7 of the ESA, NMFS provided an incidental take statement with the Opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize incidental take associated with these actions. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal agencies and any person who implements the actions must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

This document also includes the results of our analysis of the actions likely effects on Essential Fish Habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These Conservation Recommendations are a non-identical set of the ESA Terms and Conditions. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the SCNF and EPA must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

If you have questions regarding this consultation, please contact Mr. Bill Lind at (208) 378-5697.

Sincerely,


for D. Robert Lohn
Regional Administrator

Enclosure

cc:	W. Scales – FCC	J. Kraayenbrink - BLM
	D. Miller – FWS	R. Brochu – COE
	C. Mebane – USGS	T. Curet – IDFG
	T. Bassista – IDWR	T. Herron – IDEQ
	B. Edmo - Shoshone-Bannock Tribes	R. Miles - Nez Perce Tribe

Endangered Species Act – Section 7 Consultation Biological Opinion

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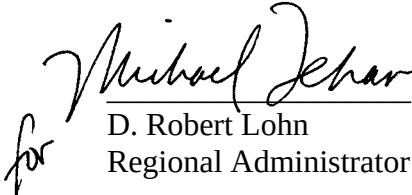
Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Idaho Cobalt Project - Big Flat Creek, Bucktail Creek, Little Deer Creek, South Fork Big Deer Creek, Big Deer Creek, Blackbird Creek, Panther Creek, Deep Creek, Moccasin Creek, Williams Creek, Perreau Creek, Salmon River. 6th Field HUCs: 170602030902; 170602031001; 170602031104; 170602031703; 170602031805; 170602032004; 170602032006; 170602032107; and, 170602032201. Lemhi County, Idaho.

Lead Action Agency: USDA Forest Service, Salmon-Challis National Forest

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region

Date Issued: May 20, 2008

Issued by: 
for D. Robert Lohn
Regional Administrator

NMFS No.: 2007/08256

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ACRONYMS

4H:1V	4 horizontal to 1 vertical
ATSDR	Agency for Toxic Substances and Disease Registry
BMPs	Best Management Practices
BMSG	Blackbird Mine Site Group
BOD	Biological Oxygen Demand
CaCO ₃	Calcium Carbonate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHART	Critical Habitat Analytical Review Team
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
DEIS	Draft EIS
DO	Dissolved Oxygen
DPS	Distinct Population Segment
DQA	Data Quality Act
DSM	Dynamic System Model
EFH	Essential Fish Habitat
Eh	redox potential
EIS	Environmental Impact Statement
EOG	Electro-Olfactogram
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FAV	Final Acute Value
FCC	Formation Capital Corporation
FCRPS	Federal Columbia River Power Systems
FEIS	Final EIS
FR	Forest Road
FWS	U.S. Fish and Wildlife Service
GMAV	Genus Mean Acute Values
GPD	Gallons per Day
GPM	Gallons per Minute
H ₂ S	Hydrogen Sulfide
HDPE	High-Density Polyethylene
HUC	Hydrologic Unit Codes
ICBTRT	Interior Columbia Basin Technical Recovery Team
ICP or Project	Idaho Cobalt Project
IDEQ	Idaho Department of Environmental Quality

IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
ILL	Incipient Lethal Level
ILT	Incipient Lethal Temperature
ISHO	Idaho State Habitat Office
LOECs	Lowest-Observed-adverse Effect Concentrations
LWD	Large Woody Debris
MP	Milepost
MPGs	Major Population Groups
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSDS	Material Safety Data Sheet
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOEC	No Observed Effect Concentrations
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
Opinion	Biological Opinion
PCEs	Primary Constituent Elements
PFMC	Pacific Fishery Management Council
POO	Plan Of Operation
PVC	Poly-Vinyl Chloride
QA/QC	Quality Assurance/Quality Control
RHCA	Riparian Habitat Conservation Areas
RPMs	Reasonable and Prudent Measures
RUP	Road Use Permit
SCNF	Salmon-Challis National Forest
SMAV	Species Mean Acute Values
SPCC	Spill Control and Countermeasures
SWMP	Stormwater Management Plan
TDS	Total Dissolved Solids
tpd	Tons per Day
TPY	Tons per Year
TSS	Total Suspended Solids
TU _C	Toxicity Units
TWSF	Tailings and Waste rock Storage Facility
UILT	Upper Incipient Lethal Temperature
USFS	U. S. Forest Service
UUILT	Ultimate Upper Incipient Lethal Temperature

VSP	Viable Salmonid Population
WEPP	Water Erosion Prediction Project
WET	Whole Effluent Toxicity

1. INTRODUCTION

The biological opinion (Opinion) and incidental take statement portions of this consultation were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531, *et seq.*), and implementing regulations at 50 CFR 402. With respect to designated critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of “destruction or adverse modification” at 50 CFR 402.02.

The Essential Fish Habitat (EFH) consultation was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801, *et seq.*) and implementing regulations at 50 CFR 600. The administrative record for this consultation is on file at the Idaho State Habitat Office (ISHO) in Boise, Idaho.

1.1. Background and Consultation History

Formation Capital Corporation (FCC) has developed a Plan of Operations (POO) outlining a mineral development project located in the Panther Creek drainage of the Salmon-Cobalt Ranger District, Salmon-Challis National Forest (SCNF). The project is located in T21N, R18E, sections 8, 9, 15, 16, 17, 20, 21, and 22. The FCC property is composed of several mineral deposits acquired by locating and filing mining claims within the Salmon-Cobalt Ranger District of the SCNF. The property consists of unpatented mining claims on National Forest System Lands. The SCNF is the lead Federal action agency for the Idaho Cobalt Project (ICP or Project) and is responsible for the ESA/MSA consultation under a joint Biological Assessment (BA) drafted with the U.S. Environmental Protection Agency (EPA). EPA will be issuing a National Pollutant Discharge Elimination System (NPDES) permit for the ICP and is also an action agency for the purposes of this consultation. The FCC has been granted formal applicant status by the SCNF and the EPA.

The SCNF held an initial public meeting to provide information on the ICP on July 20, 2001, at the City Center in Salmon, Idaho. The SCNF issued a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the proposed mining project in the Federal Register on September 10, 2001, and held public scoping meetings on October 10, 2001, in Challis, Idaho, and October 11, 2001, in Salmon, Idaho.

In spring of 2001 the SCNF and FCC developed Plans of Study and began baseline data collection. FCC continued data collection for some disciplines such as water quality through 2006. In 2002, FCC notified the SCNF that the project planning was being placed in an interim status to review issues, collect supplemental environmental baseline information, prepare a modified POO, and obtain adequate funding to carry the Project forward.

In 2004, FCC reinitiated active work on the Project including additional environmental data collection and analysis. The FCC’s technical consultants prepared final Technical Reports and evaluations in support of a Modified Plan of Operations. A Modified Plan of Operations was submitted in February 2005; further modifications were submitted in April and June 2006.

In May 2006, FCC submitted an application to EPA for a NPDES permit to discharge treated water to Big Deer Creek and submitted additional revisions to their POO. With the submittal of the NPDES application, the EPA decided to enter the National Environmental Policy Act (NEPA) process as an official cooperating agency. Idaho Department of Environmental Quality (IDEQ) is also a cooperating agency. A revised NOI was published in the Federal Register on November 1, 2006, indicating EPA's involvement as a cooperating agency and the projected Draft EIS (DEIS) distribution in 1st Quarter 2007.

The SCNF, the EIS contractor, and participating agencies have been involved with review of the FCC POO and supporting documents, analysis of effects, development of alternatives, and preparation of the DEIS. In February 2007, a DEIS was completed and distributed to the public for review and comment.

NMFS routinely participated in weekly conference calls on the ICP with the SCNF, EPA, IDEQ, and the U.S. Fish and Wildlife Service (FWS) since 2004. NMFS has reviewed the DEIS, the draft NPDES permit (NPDES Permit Number ID-002832-1), and the final biological assessment (BA) received December 28, 2007. NMFS staff also attended a workshop held on October 25, 2007, in Boise, Idaho, and participated in a field tour of the mining site and surrounding watersheds. Information was also provided to the Salmon-Challis Level I Team in 2007 but no action was requested. NMFS provided the SCNF, EPA, and FCC with draft terms and conditions on April 10, 2008.

The ICP would likely affect tribal trust resources. Because the action is likely to affect tribal trust resources, NMFS contacted the Shoshone-Bannock and Nez Perce Tribes pursuant to the Secretarial Order (June 5, 1997). NMFS provided draft terms and conditions to the Nez Perce and Shoshone-Bannock Tribes on May 01, 2008. No comments have been received from the Nez Perce Tribe. The Shoshone-Bannock Tribe has requested a meeting with NMFS to discuss the Project, but is aware that this Opinion may be finalized before the meeting can be conducted.

1.2. Proposed Action

The activities that are the subject matter of this consultation are FCC's construction, operation, closure, and reclamation of the ICP. This Opinion evaluates two Federal actions associated with these activities, the SCNF's approval of FCC's POO, and the EPA's issuance of the NPDES permit.

The ICP would consist of developing two deposits over the life of the Project, the Ram (with 2.23 million tons of known ore) and the Sunshine (2.57 million tons known ore). Development of each deposit would use underground mining methods. The average rate of mining production would be 280,000 tons per year (tpy), or 800 tons per day (tpd), based on mine operation of 350 days per year. During start-up, the rate would be approximately 400 tpd in the first year, increasing to full production by year three. However, it's possible that production could reach as much as 1,200 tpd. Mining would begin initially on the Ram deposit, with mining of the Sunshine deposit occurring in subsequent years.

Exploration for additional ore reserves is anticipated to continue through the life of the ICP operations. If additional ore tonnage is identified and defined, the production life of the ICP may be extended beyond the currently proposed mine and mill life schedule. Any such extension is beyond the scope of this consultation and would require further ESA review.

1.2.1. Action Overview

There would be three main phases in the life of the ICP: the construction phase (approximately 2 years), the operating phase (10 to 12 years), and the reclamation/closure phase (2 years for surface reclamation, and up to 30 or more years of post mine water treatment and monitoring). There would also be concurrent reclamation in the construction and operating phases as existing disturbed areas or new disturbances are reclaimed post-use.

The construction phase would include improving existing roads, and construction of new roads and facilities. Mine and mill facilities to be constructed would include the Ram mine portal, the tram, the mill/plant, the first phase of the tailings and waste rock storage facility (TWSF), water management pond, water treatment and discharge facilities, new and existing improved roads, borrow areas, and a soil stockpile area. Ancillary facilities would include power lines, fuel storage tanks, water ditches, and the septic and drain field.

The Ram and Sunshine mine portals would be located on the slopes above Bucktail Creek. Declines would be developed from portals located above the groundwater level and would be designed to ensure that water does not drain from the portals. The ore processing mill (flotation) and ancillary facilities would be located on the Big Flat, a relatively flat area located between the drainages of Big Deer Creek and Little Deer Creek. Ancillary facilities would include water treatment, offices, warehouse, change rooms, shipping and receiving docks, emergency sleep quarters, and other structures.

Power for the Project would be obtained from an existing power line that delivers power to the adjacent Blackbird Mine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Emergency power would be supplied with diesel generating equipment.

The operating phase would include mining, ore processing, and disposal of waste products including tailings, waste rock, water treatment waste, and excess water. Following development of the Ram mine, the Sunshine Mine would subsequently be developed to supplement production from the Ram mine. The mill would initially process approximately 400 tpd; increasing to 800 tpd as the underground Ram mine expands. The TWSF would be expanded to final capacity.

At full production, the mill would produce approximately 32 dry tons of concentrate and 768 dry tons of tailings per day. The proposed action provides for disposal of waste rock and tailings in a 36 acre lined TWSF. The underliner would consist of an impermeable soil (or engineered clay)

layer and a synthetic liner. A drainage collection system would be constructed over the liner to collect water that infiltrates the tailings and waste rock. This water would be conveyed to the nearby water management pond.

Tailings would be dewatered prior to placing them in the TWSF. Water treatment waste would be placed in the TWSF and any post closure waste would be hauled offsite. Approximately half of the tailings produced at the mill would be turned into paste tailings and utilized in backfilling the Ram underground workings. Excess treated water would be discharged via a pipeline to an instream diffuser at Big Deer Creek in accordance with a NPDES discharge permit. A comprehensive operational surface water and groundwater quality monitoring and reporting program would be implemented.

The reclamation and closure phase would focus on reclaiming lands disturbed by FCC's mining activities and providing for long-term management of the reclaimed facilities and mine water following cessation of mining and dewatering. There would be limited concurrent reclamation during the operations phase, primarily on completed portions of the TWSF. The reclamation phase would include final shaping, covering, and vegetation of the TWSF, sealing mine portals and demolishing the mill and tram system. Ultimately as they are no longer needed the water treatment system, power line, substation, and roads would be reclaimed.

At the end of the operational mining period, cessation of mine dewatering would be contingent upon monitoring results and projections indicating no unacceptable effects to water quality objectives or Blackbird cleanup goals. If appropriate, the mine workings would be allowed to fill with groundwater, and water from the mines would be released to the watershed. If needed to prevent unacceptable water quality impacts, a bedrock groundwater capture well system would be used to capture mine water that flows out of the mine workings during the closure period. If the bedrock groundwater capture system is insufficient, an alluvial groundwater/surface water capture system in lower Bucktail Creek drainage would be used. Captured water would be treated and discharged into Big Deer Creek through a NPDES permitted facility.

A comprehensive post-operational (closure) surface water and groundwater quality monitoring and reporting program would be implemented. Bonds or other financial security sufficient to allow the U.S. Forest Service (USFS) to reclaim the project would be posted. Agreements with Noranda to utilize existing roads and power lines on private property would be obtained. A more detailed description of each component/phase of the proposed action is included below.

1.2.2. Transportation

The FCC's proposed transportation route for employees and supplies would be via Williams Creek Road (Forest Road [FR] 201) to the Williams Creek Summit, to the Deep Creek Road (FR 101), then to the Morgan - Panther Creek Road (FR 055), to Blackbird Creek Road (FR 115). The FCC estimates that 10 vans and four pickup trucks would be required daily to transport employees to and from the site. The FCC's proposed employee transportation route is also proposed for the transportation of concentrate, equipment, reagents, and other freight.

Table 1 outlines FCC's anticipated list of chemicals, reagents, and operating supplies that would be transported to and from the mine during the operating phase. During the closure and reclamation phase, the majority of the chemicals/reagents (e.g., blasting compounds, ore processing reagents, ore concentrate) with the exception of fuel, lubricants, and possibly water treatment chemicals would no longer be used or transported. If post-closure water treatment is needed, water treatment waste consisting of lime sludge (20 tons) and zeolites (3 tons) would be transported off-site to an approved repository.

All ICP personnel would carpool to the site in FCC vans or pickups. All ICP personnel and contractors would be instructed regarding the ICP Transportation Procedures and Plans and the requirements of the USFS Road Use Permit (RUP) to enhance the safety of access to the site and to reduce the impacts of travel to the site.

Table 1. Chemicals, Reagents, and Operating Supplies – Idaho Cobalt Project

Reagent / Chemical or Product	Annual Use	Container Type	Container Size	Trucks/Year (per day) ¹
AERO [®] 343 Xanthate	280 tons	Flo Bin	1 ton	14
AERO [®] 350 Xanthate	308 tons	Flo Bin	1 ton	16
AEROFROTH [®] 65 Frother	42 tons	Plastic Barrel	55 gallons	3
Sodium Sulfide	100 tons	Sacks	50 pounds	1 – 5
Superfloc	24 tons	Sacks	50 pounds	Ship w/frother
Lime	75 tons	Super Sack	1000 pounds	4
Diesel	750,000 gallons	Fuel Truck	4,500 gallons	150
Gasoline	5,000 gallons	Fuel Truck	4,500 gallons	Ship w/diesel
Cement	2,500 tons	Bulk	20 tons	115
Oils, Lubricants, Grease, Antifreeze	10,000 gallons	Barrel	55 gallons	Ship w/diesel
Propane	40,000 gallons	Fuel Truck	9,400 gallons	5
Anti-scalant	4,000 gallons	250 gallon tote	4,000 gallons	1
Ammonium Nitrate	450 tons	Bulk Container	10 tons	45
Bulk Concentrate	11,200 tons	Sealed Container	16 tons	700 (2)
Water Treatment Chemicals and Reagents				
Polymer Flocculant	20 gallons	Sealed Pail	5 gallons	0 ³
Hydrated Lime	20 tons	Super Sack	1,000 pounds	2
Hydrochloric Acid	400 gallons	Plastic Drum	55 gallons	2
Coagulant	250 gallons	Sealed Tote	50 gallons	0 ³
Methanol	3,000 gallons	Bulk Truck	3,000 gallons	1 ¹
Zeolites	3 tons	Super Sack	1,000 pounds	1
Employees				
		Vans		3,500 (10)
		Pickups		1,400 (4)

¹ Average values and actual truck count would vary.

² Does not add to truck count, as the product would be backhauled from the refinery. More fully described in FCC's Storm Water Management Plan for the Idaho Cobalt Project (Telesto, 2006a).

³ Does not add to truck count, as the small quantity would be transported with other materials.

During construction, large mobile equipment, large loads of construction materials, and large equipment being installed at the ICP facility sites would be transported to the site by tractor-trailer. Supplies would be transported by single-frame trucks whenever feasible. Pilot cars would lead tractor-trailer loads and fuel trucks to the site to reduce accident risk. The operators of tractor-trailer loads and fuel trucks would also be instructed regarding the requirements of the Transportation Procedures and Plans.

The type and quantity of supplies to be used by the ICP during operation are listed in Table 1. Single-frame trucks would be used to transport operating supplies. For materials transported via tractor-trailer, whenever possible, the tractor-trailer would be off-loaded in Salmon, Idaho, and supplies reloaded onto a single-frame truck for transport to the ICP.

Approximately 11,200 tons of concentrate are anticipated to be shipped from the ICP mill facility annually. Steel roll-off containers with locking lids would be used to transport the concentrate. Empty containers would be filled at the mill, sealed, and loaded on single-frame trucks for transport to Salmon, Idaho. In Salmon, concentrate containers would be transferred to tractor-trailer equipment for transportation to a processing facility.

The FCC has prepared a spill control and countermeasures (SPCC) plan that addresses management of hazardous materials during shipping and storage. Their plan includes notification of the ICP facility prior to transport of fuels or chemicals, travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport.

1.2.2.1. Road Upgrades

Proposed road improvements are required to improve public safety and reduce potential sediment yield to streams. Proposed mitigation would improve safety, reduce sediment delivery to streams, and reduce spill risks associated with transporting hazardous materials. Appendix A, Figure 1 and Table 1 show the locations and describe the types of road upgrades proposed. Mitigation measures proposed would occur in a phased approach, which would result in resurfacing the entire project access route. The phased work would include:

Phase I – Repair or replace areas with safety and environmental concerns.

1. Reconstruct sections of Morgan Creek – Panther Creek Road (No. 60055), to raise the road grade through the sections lying within the floodplain, shape and drain the subgrade, and place 6 inches of gravel between Deep Creek Road and Blackbird Creek Road.
2. Construct a new section of Williams Creek Road (No. 60021) between milepost (MP) 7.1 and 8.1 to bypass the switchbacks and create a steady grade climbing to the upper bench. Two culverts will be removed from the switchbacks where the existing road crosses North Fork Williams Creek. The stream will be restored to a natural condition

following culvert removal. Recontour and reclaim the replaced section of road between MP 7.1 and 8.1. Shape the subgrade and place 6 inches of gravel from the end of the pavement at MP 4.0 to the end of the new construction at MP 8.1.

3. Construct five turnouts on Blackbird Creek Road (No. 60115) between MP 36.6 and 38.7 to allow safe passing of vehicles.
4. Reconstruct segments between MP 35.7 and 37.4 to raise the grade above the floodplain and improve channel width. Shape the subgrade and place 6 inches of gravel from the Blackbird gate to the mine site.

Phase II – Replace gravel in worn areas.

1. Shape and drain the subgrade of Blackbird Creek Road and place 6 inches of gravel from Morgan Creek – Panther Creek Road to the Blackbird gate.
2. Shape and drain the subgrade of Deep Creek Road, (No. 60101), from the junction with Williams Creek Road to MP 20.85. Place 6 inches of gravel on this road segment.
3. Shape and drain Williams Creek Road from Williams Creek Summit to MP 8.1, with the exception of the segment between MP 12.45 to 12.85. Reinforce the subgrade between MP 11.65 and 12.45, and place 6 inches of gravel.

Phase III – Place surface rock on worn areas not surfaced under Phase I and Phase II.

1. Place 4 inches of gravel on Williams Creek Road between MP 12.45 and 12.85, and from Williams Creek Summit to the Deep Creek Road junction.
2. Place 4 inches of gravel on Deep Creek Road from MP 20.85 to the Morgan Creek to Panther Creek junction.
3. Place 4 inches of gravel on any sections of Phase I and Phase II that show excessive wear. Additionally, the Project Access Route would be treated with dust abatement for safety and to protect the investment in the gravel by keeping the fines in the gravel structure.

An easement through Homestead Entry Survey 71 (Cobalt Townsite) will need to be finalized.

1.2.2.2. On-Site Transportation

A combination of newly constructed roads and existing improved roads are proposed to provide access to the ICP site. All roads would be constructed and improved in accordance with USFS guidelines for road construction. The specifications for road design are provided in the ICP Conceptual Road Design (TTE, 2006).

The proposed facility layout and site roads are shown in Appendix A, Figure 2. The proposed project would require construction of 4.1 miles of new road. Approximately 11.3 miles of existing roads would be improved as necessary to handle ore haulage, larger trucks and increased traffic. Stormwater ditches and sediment control measures on all roads would be constructed in accordance with Best Management Practices (BMPs) for Mining in Idaho guidelines (Idaho Department of Lands [IDL] 1992) to control stormwater runoff.

Primary Roads - All main access roads and roads over which ore or waste rock would be hauled are considered primary roads. Turnouts would be constructed in appropriate locations along the primary roads to allow safe passage of vehicles. Existing and proposed primary roads include:

- A road from the Big Flat to the Ram portal. This road requires improvements, as well as construction of approximately 0.5 miles of new road in two segments. Road distance from the Ram portal to the mill site is approximately 2.8 miles.
- An existing road is proposed for access to the Sunshine portal. The haul distance from the Sunshine portal to the mill site is approximately 1.0 mile.
- About 0.7 mile of new road is proposed for access from the mill site to the TWSF.

Secondary Roads - Roads proposed for daily, year-round use in the operations but are not ore haul routes or main access routes are considered secondary roads. Approximately 1.5 miles of new secondary road construction is proposed for access to the TWSF, soil stockpile, water management ponds, and rerouted access to the upper Bucktail drainage.

Tertiary Roads - Site roads proposed for seasonal use or intermittent use such as roads required to access surface water and groundwater monitoring locations are considered tertiary roads. Tertiary roads are proposed to provide access to the tram tower corridor, the soil stockpile, and surface water and groundwater monitoring locations. This class of roads, as proposed, includes use of about 8.2 miles of existing roads and the construction of approximately 1.4 miles of new roads.

The FCC proposes to negotiate an access agreement with the Blackbird Mine to use the existing mine road on private land (Noranda) through the Blackbird Mine CERCLA site to the Meadow Creek/Bucktail Creek divide. The FCC, for the duration of use, would maintain BMPs, channels, culverts, and other sediment/stormwater control facilities that exist on sections of Noranda property that would be used by FCC. The FCC would upgrade the road from the Noranda water treatment plant gate to the top of the ridge (6.0 miles), including vertical realignment of a 0.3 mile section known as Buddy's Grade.

The primary and secondary roads on the Project site would be maintained year-round, including snow removal during the winter months. Snow removal would generally be accomplished on these roads with the use of a rotary snow blower/plow. The snow would be thrown above or below the road corridor into areas where snowmelt would not create sedimentation or where the snowmelt would be addressed by BMPs. If snow removal by rotary snow blower/plow were not possible, a grader or loader and truck team would remove the snow.

1.2.3. Workforce

The anticipated personnel requirements for the mine, mine maintenance, engineering and geology, and surface facilities support departments during the first year of production would be 69 persons, increasing to 109 persons at full production. The anticipated personnel requirements for the milling operation would be approximately 31 persons. Total Project employment would be approximately 157. The work force numbers may be temporarily higher during construction and start up. During closure and reclamation, the work force would be reduced significantly.

The FCC plans to operate the mine 24 hours per day, five days per week, for approximately 250 days per year. Mill production would operate 24 hours per day, seven days per week, for approximately 350 days per year.

1.2.4. Mine Mill and Facilities

The mill would be located at the Big Flat, an area of relatively flat topography east of the Ram deposit. The mill would include crushing and grinding equipment, flotation cells, concentrate thickeners, tailings thickeners, concentrate filters, tailings filters, and ancillary equipment. Additional facilities located at or near the mill site would include the mine office, change house, maintenance shop, emergency sleeping quarters, and warehouse. Facilities would result in a total surface disturbance area of 10.9 acres. Additionally, there would be a portable explosives magazine located in a suitable site with good access, but removed a safe distance from the mine buildings. There would also be a startup/backup generator.

1.2.4.1. Mill Processing

Trucks or a tramcar would transport ore from the Ram to the mill where it would be dumped into a hopper. Ore from the Sunshine would be hauled by off-highway trucks and dumped into a hopper. A conveyor would lift the ore from the hopper onto the coarse ore stockpile. The stockpile area would have a maximum capacity of approximately 22,000 tons. The ore stockpile area would be a concrete pad designed to collect all surface water runoff, decant, and pipe the water to the process pond.

A flotation mill would be used to process ore from the mine. The milling process would reduce the run-of-mine ore to minus 0.5-inch size in the primary and secondary crushing area. This material would then be reduced to minus 200-mesh size, in a liquid pulp, in the ball mills. The pulp from the ball mills would be conditioned and processed in the flotation circuits, where the ore minerals would be floated away from the waste (gangue). The concentrated ore minerals would be dewatered in a thickener and a drum filter prior to shipment. The waste material, or tailings, would also be dewatered prior to disposal at the TWSF or as backfill in the mine.

At a production rate of 800 tons of ore per day, the mill would produce approximately 32 to 40 dry tons of concentrate per day and approximately 768 dry tons of tailings per day. The concentrate would be shipped to an offsite processing facility. Mill production may vary from 800 to 1,200 tpd, and the operating schedule may vary from 250 to 350 days per year.

The concentrate would be dried to approximately 10% moisture content using a conventional thickener followed by a vacuum filter. The concentrate would be temporarily stored, prior to shipping to the offsite processing facility, in a shed adjoining the mill building. Concentrate would be shipped in modified roll-off containers. Each container would hold approximately 16- to 20-tons of concentrate. The containers would be of steel construction with steel locking lids. Concentrate would be loaded into the containers, and the lids would be closed and locked. Excess concentrate would be removed from the exterior of the containers and the containers would be hoisted onto a truck and clamped into position prior to beginning the journey to the off-site processing facility.

1.2.4.2. Materials and Supplies

Mill reagents used to recover the minerals include sodium xanthate, potassium xanthate, SUPERFLOC™, and lime. An estimate of the annual quantity of the mill materials and supplies is shown in Table 1. The xanthates, frother, and superfloc are biodegradable polymers. The reagent lime would largely be sorbed by the sulfides.

1.2.4.3. Borrow Areas

During construction and reclamation there would be a need for road surfacing materials, drain rock, and riprap. Three borrow areas, including one on the Williams Creek road near the Williams Creek summit (Leesburg East), one along Blackbird Creek, and another in the Bucktail Creek drainage have been identified (Appendix A, Figure 2). All of these borrow areas are on USFS land and have been previously used as borrow sources.

The materials in the borrow area in the Bucktail drainage would be used for surfacing materials for the underground mine roads and other construction and reclamation activities. Approximately 40,000 cubic yards of these materials would be required, and this amount is available at this borrow area. The materials in the Blackbird Creek borrow area have been tested and found to be appropriate for use as road surfacing materials. It is estimated that an additional 20,000 cubic yards of materials would be required for site roads, and is also available at this borrow area. Road improvement work on the Williams Creek Road would utilize borrow from the existing Leesburg East pit located on Forest land in T21N, R20E, section 27. Use of the Leesburg East Pit would require an estimated three acres additional disturbance at this site, which would be reclaimed following its use. All three borrow areas are located outside of riparian habitat conservation areas (RHCAs).

1.2.5. Mine Workings

The mining methods for the Ram and Sunshine deposits would use cut and fill mining. The mining sequence would include drilling between 30 to 40 holes in the ore face, loading these holes with explosive, blasting, scaling loose rock from the back (ceiling) and ribs (walls), mucking the broken ore with a scoop tram, loading a haul truck with the scoop tram, and installing rock bolts for rib and back support. The openings (stopes) created from ore excavation would then be filled with paste tailings and waste rock while the access tunnels would be left open.

The FCC estimates that the mines at full development would produce an average of approximately 51 gallons per minute (gpm) of water. Mine water flows would be collected in sumps in the mine to allow suspended solids to settle. Water storage tanks would be located at the portals for storage of water pumped from the mines. The water would then be pumped to the mill for treatment and reuse, and then to the water management ponds for storage and handling. Water would also be used in the underground mine for dust suppression. Excess water would be treated and discharged to Big Deer Creek.

Ram Portal - The Ram portal is located in an area of steep slopes. A retaining wall for the portal platform would be constructed using an engineered soil reinforcing technique. The platform would contain an office, tool/maintenance shed, surge water tank/pump station, and hoppers for loading ore and waste rock onto trucks or into the tramcar. Other equipment located on the platform would include a transformer, emergency generator, and diesel storage tank.

Mine access to the Ram would be via road from the Big Flat to a portal at 7,060 feet in elevation (Appendix A, Figure 2), and then via an underground decline driven at approximately 12% to the ore zones. The decline would be used to transport people and materials in and out of the mine and as a haul route for the waste rock and ore to the portal, as well as for a portion of the tailings to be brought back into the mine. Two ventilation raises, or airshafts, approximately 8 feet in diameter, would provide ventilation and emergency escape ways. Additional drifts and crosscuts would be developed to provide access to the ore blocks. The total length of mine workings for the Ram deposit is estimated to be about 38,000 feet. There would be approximately 9,800 feet of open stope at any given time. The Ram underground workings would also include a chamber to accommodate tailings dewatering equipment.

An overhead tram would potentially be constructed from the Ram portal to the mill located on the Big Flat. The tram would be built if and when economic conditions justify its construction. The conceptual design for the tram includes an approximate 100 cubic-foot tramcar traveling on track cables and moved by a haul rope. Three or more towers, approximately 45 feet high, would support the track cables. The tramcar would be loaded with either waste rock or ore from a hopper at the Ram portal. Ore would be discharged onto an ore stockpile at the mill crusher. Waste rock would be discharged at the mill and trucked to the TWSF for final disposal.

Sunshine Portal - At the Sunshine, an existing portal would be upgraded to access the internal decline. The existing portal platform would be reshaped and backsloped to control runoff. An office, tool/maintenance shed, diesel storage tank, and water tank would be located on the

platform. The decline would be used to transport people and materials in and out of the mine and as a haulage route for ore, waste rock, and tailings. One airshaft, approximately 8 feet in diameter, would provide ventilation and an emergency escape way. Sunshine ore would be hauled directly to the mill in 20-ton trucks and placed in the ore stockpile. Waste rock slash that remains in the mine would be amended with alkaline materials (e.g., limestone, cement) to reduce the potential for leaching of metals after closure.

1.2.6. Mine Dewatering

Mine dewatering would be accomplished by a series of skid-mounted, self-contained pump units. Discharge from the mine dewatering system would be delivered to a holding tank on the portal pad. This tank would be sized to contain the entire backflow from draining the pipeline from the mill on the Big Flat. The tank would be housed in the heated portal pump station to prevent icing in the winter.

The pump station would also house pumps for lifting water to the mill from dewatering the mine and tailings. Pumping from the Ram portal to the mill would be accomplished via a steel pipe with secondary containment. To reach the 8,050 elevation high point at the mill site, this pipeline would be approximately 2,300 feet long. An air intake with a check valve at the high point would allow the line to be self-draining in the event of a pump shutdown. The pipeline would follow the tram right-of-way (Appendix A, Figure 2) and would be winterized to prevent freezing. During an emergency shutdown or production curtailment, the mine pumps would continue to operate.

Secondary containment would include pipe-in-pipe for all areas where the piping is not within the mine or other secondary containment such as the mill building. The system would include leak detection at all low points and at pipe-to-pipe connections. The pumps would have the capacity to handle short periods of high-yield mine inflows caused by structure dewatering. However, it is possible a flow event could occur that exceeds the capacity of the mine pumps. Should that occur, water would build up in the mine sumps until the inflow once again falls below the pumping capacity at which time water levels would begin to return to their long-term operating level.

The Sunshine Mine is not expected to produce enough water for dust suppression or drilling; makeup water would be supplied from the mill circuit. If excess water were produced, it would be pumped back to the mill.

1.2.7. Tailings and Waste Rock Management

The mining operation would produce waste rock and tailings that would have to be contained. This would be accomplished through three mechanisms: (1) A TWSF would be developed to store excess waste rock and tailings; (2) tailings would be converted into a paste and used for

backfill in the Ram Mine as mining progresses; and (3) waste rock slash remaining in the mine for use in ramp construction would be amended with alkaline materials to reduce the risk of acid generation and leaching of metals.

1.2.7.1. Waste Rock Production and Characterization

Waste rock would be delivered to the TWSF by truck or tram from the Ram and by truck from the Sunshine. Waste rock was characterized in the baseline geochemical testing program by the analysis of 239 waste rock samples. The majority of the waste rock (approximately 80%) is not expected to present an acid-generation problem as the quartzite has a low pyritic sulfide content. However, approximately 20% of the waste rock is predicted to generate slightly acidic solutions containing variable concentrations of soluble arsenic, cobalt, copper, and zinc. Waste rock would be placed in a separate area of the TWSF and would be layered with tailings in the waste rock area. Commingling of tailings and waste rock as they are placed in the TWSF would result in the hydrologic and geochemical characteristics of the TWSF behaving as though it consisted almost entirely of tailings and reduce risk of metals leaching from waste rock. Segregation of waste rock into a separate area would allow drainage from the waste rock to be handled and monitored separately from tailings should the need arise.

1.2.7.2. Tailings Production and Characterization

The mill would produce between 768 and 1,152 dry tons of tailings per day at full production. Tailings would be dewatered in the mill through a thickener and vacuum filter. The dewatered tailings would either be trucked to the TWSF or delivered to the paste plant, also located at the mill, where they would be mixed with water and cement and pumped into the Ram mine for use as paste backfill.

Samples of the tailings solids and the solution stripped from the tailings, after being passed through a filter press, were collected as part of the metallurgical testing activities. The tailings generated by metallurgical testing were then characterized in the baseline geochemical program by a variety of static and kinetic tests to determine the potential for tailings to generate acidic and metal-bearing solutions. During milling, sulfide minerals are removed from the ore. As a result, tailings are relatively low in sulfide minerals (including pyrite) and are considered not to be potentially acid-generating. Results of static acid generation testing (acid-base-analysis or ABA) indicate that the tailings materials are neutral in pH and retain a relatively low level of sulfide-sulfur (approximately 0.05%). However, kinetic tests have indicated there is a potential for long-term release of low levels of metals from the tailings.

Tailings Management - Tailings slurry would be delivered to a dewatering station in the mill, where a thickener and vacuum filter would separate the solids from the liquids. Details on the filter cake are provided in the Conceptual Design of the Tailing/Waste Rock Facility and Water Management Ponds (Telesto, 2006). The final filter cake would be approximately 80% solids after moisture conditioning. If not used as backfill, the filter cake would be trucked from the

dewatering facility to the TWSF and end dumped. The tailings would then be leveled and shaped in 2-foot maximum lifts by a small tracked dozer. Compaction of the tailings to 90% standard Proctor density would be achieved by the truck and dozer traffic on the pile.

During winter operations, the working areas would be kept small. Snow would be removed from the working area and placed in the snow removal area. Operational procedures would specify requirements to prevent incorporating snow and frozen tailings into the pile prior to compaction.

1.2.7.3. Tailings Backfill

Tailings would be placed in the TWSF or the Ram mine as backfill. It is estimated that the amount of backfill material required for the mine would consume approximately 40% to 45% of the tailings stream. As the mining method is dependent on backfill as a working platform and for ground support, maintenance of the backfill schedule would be critical to mine production. Backfilling serves the purpose of providing structural support in the mine while reducing the area required for surface tailings storage. Backfill is considered a construction material that is used to create a floor to mine on top of, a rib to mine next to, or a back to mine under. It provides important support to the surrounding rock mass, reducing the ground support requirements in active mining areas. Backfill reduces dilution of the ore by non-economic wall rock.

Tailings, for use as backfill, would have cement added to increase backfill strength and be delivered to the Ram dewatering facility as a paste. Cement would also add alkalinity that would reduce metals mobility in the backfill. The paste functions primarily as a void filler, and its strength need only be sufficient to support mine vehicles working in the stope. It would be a highly viscous mixture of mill tailings, water and cement. Nominal design parameters show a paste consisting of 65% to 70% solids and 30% to 35% water. Solids would include between 96% to 98% tailings and from 2% to 4% Portland cement.

The backfill schedule indicates that backfill would be required within the first six months of mining of the Ram deposit. By the end of the first year of mining, approximately 400 tons of backfill would be required each day. After each cut in a stope is made (approximately 15 feet on the first cut and 10 feet thereafter) and the ore has been removed, backfill material would be placed into the void. Backfill would only be used in ore zones and would not be used in access ramps. By the end of mining the ore zone stopes would be approximately 90% filled with backfill. Approximately 30% of the mine consisting of ramps, access decline and ventilation raises would be left open.

A portion of the backfill would be waste rock (slash) from ramp construction. Some of the slash would be potentially acid generating. Slash left underground will be amended with alkaline material (i.e., limestone, lime, cement) to reduce the leaching of metals from the slash. Slash would be trucked from the ramp being slashed to the mined out area being backfilled, placed on top of previously placed tailings backfill, and subsequently covered by additional tailings backfill. This backfilling sequence would provide a suitable working platform as well as partially isolate the slash. The FCC would submit a plan for USFS approval that provides details on the methods to be used to incorporate the amendment into the slash.

1.2.7.4. Tailings and Waste Rock Storage Facility

The FCC would develop a surface TWSF to store and contain tailings and waste rock material not otherwise disposed of underground, as well as, residuals, or waste products from the water treatment plant. The TWSF would be constructed east of and downslope from the mill on the Big Flat. This location was chosen because of its relatively flat topography, soil characteristics, and distance from active drainages and streams. Specific design elements of the TWSF include:

- Phased design and construction a 36 acre, 1.7 million cubic yard (MCY) initial facility, expanding to 55 acres and 2.5 MCY of tailings and waste rock upon identification of additional ore reserves of similar geochemical characteristics to the materials evaluated in the Final EIS (FEIS);
- Placing tailings and waste rock to allow separate drainage collection systems;
- Layering waste rock and tailings (commingling) in the waste rock area to reduce metals leaching from waste rock;
- Placing a composite under liner system with drainage collection;
- Staged construction and reclamation;
- Collection of runoff from waste rock and tailings with conveyance to the process pond;
- Inclusion of water treatment wastes in covered trenches within the TWSF;
- Should historically contaminated soils be encountered while facilities or road upgrades are being constructed, these soils may be disposed within the TWSF;
- Snow removal storage area with conveyance to the storage pond;
- Diversion of runoff around operating areas of the facility; and
- Use of a soil cap 4 feet thick with 2 feet of clean tailings underneath.

The TWSF would have 4 horizontal to 1 vertical (4H:1V) side slopes, constructed in three 50-foot raises with two 100-foot wide benches. A toe berm would be constructed at the base of the tailings facility to provide containment for seepage and runoff water from the tailings stack and to enhance geotechnical stability. The facility would occupy an area of about 36 acres. The TWSF would be constructed in the following sequence:

- The area would be cleared and grubbed to ensure the surface is free of vegetation, large rocks or boulders, and other debris;
- The topsoil and subsoil would be removed and hauled to the stockpile area;

- A drainage system would be constructed within the subgrade to intercept and remove groundwater from the TWSF foundation soils. The system would consist of a series of French drains constructed upstream and within the footprint of the TWSF and would discharge to engineered wetlands located east of the TWSF;
- The foundation area subgrade would be graded and compacted in-place to create a suitable foundation for the liner;
- The toe berm would be constructed using materials excavated from the water management ponds and other borrow materials as necessary;
- The clay member of the composite liner would be placed. Final design would determine whether a 1-foot clay liner or a geosynthetic clay liner would be used;
- A synthetic liner (such as 60-mil poly-vinyl chloride [PVC]) would be placed over the subgrade in a scheduled construction sequence. Subsequent liner expansions would be installed as needed;
- A drainage collection system would be constructed over the synthetic liner to collect water infiltrating through the tailings and waste rock and to convey flow to the process pond. This system would be constructed within a protective sand layer, which would also act to protect the liner from damage during tailings and waste rock placement;
- Drainage channels would be constructed along the outside slopes of the TWSF, along the toe berm, and on the intermediate benches of the TWSF (as construction progresses) to collect surface drainage from the facility and convey it to the process pond. All drainage channels would be designed to handle runoff from a 25-year, 24-hour storm event. Perimeter drainage channels would be constructed to intercept storm water run-on to the TWSF, direct water around the TWSF, and convey water back to natural flow paths via BMPs and sheet flow;
- Snow would be removed from the active disposal areas prior to placing waste rock or tailings in the TWSF. The snow would be stockpiled in a designated area within the facility;
- Reclamation of the TWSF would occur incrementally after each phase of tailings and waste rock placement is completed. The facility would be regraded to a continuous slope of 4H:1V or less to reduce potential for erosion;
- A cover system consisting of a 60-mil high-density polyethylene (HDPE) geomembrane, a geonet drainage layer over the HDPE, and a 4-foot thick surface soil layer would be constructed over the TWSF to limit infiltration into the tailings and waste rock;
- The cover soil would be revegetated to help reduce infiltration and erosion; and,

- After reclamation, tailings drainage would continue to be conveyed to the process pond as long as closure water treatment is needed. After cessation of water treatment, tailings drainage would be conveyed to an infiltration field located east of the pond.

Waste rock would be delivered to the TWSF by truck or tram from the Ram and by truck from the Sunshine. Waste rock would be placed in approximate 5-foot lifts on the prepared surface by end dumping from mine trucks and would be spread and leveled with a dozer.

1.2.7.5. Tailings Disposal Quality Assurance/Quality Control

To meet material placement specifications for the TWSF, a quality assurance/quality control (QA/QC) plan would be utilized to determine steps for tailings and waste rock placement. Tailings material received from the plant/mill facility would be dewatered to +2% of the optimum moisture content prior to being placed in the TWSF. Once the tailings material has been dewatered to +2% of the optimum moisture content, the material would be end dumped and compacted in two-foot lifts to 90% of the standard Proctor maximum density. During cold weather, dried tailings would be spread and compacted before they freeze. Any non-compacted material that does freeze would be stockpiled. Dried tailings material that cannot be placed because of snowfall events would also be stockpiled. The tailings stockpile would be located on the lined portion of the TWSF. Material that has been stockpiled through the winter that does not meet the stacking requirement of +2% of optimum moisture content would be mixed with newly processed material to ensure that the mixed material meets the stacking requirement. Field verification of the moisture content and density would be conducted once per week and documented.

1.2.8. Water Utilization and Treatment

The ICP's primary demand for water is ore processing. The milling process requires approximately 960 gallons of water per ton of ore processed, which equates to about 768,000 gallons per day (gpd) for the nominal ore production of 800 tpd. Except for water lost to the concentrate and the tailings, the effluent from the milling operation would report to the process pond. This water would mix with mine water and other waters reporting to the process pond and be recycled back to the mill.

The primary source of water for the operation would come from the developed Ram deposit. Mine flow would be a function of the length and depth of mine workings, and flow would increase with the development of the mine. At full development, the POO estimates the Ram would produce approximately 43 gpm and the Sunshine would produce an average of 8 gpm. Additional water for the operation would come from the collection of runoff from the TWSF and stormwater from the ore stockpile area. During startup, process water would be provided by pumping groundwater from water supply wells as needed.

The water supply for the mill is expected to vary throughout the life of the mining operation. Although sufficient water for processing is predicted to be available from the Ram workings and

precipitation on the TWSF and ore stockpile, there is the possibility that additional water would be required to support operations. Two water supply wells would be constructed in the Big Flat area to meet additional demand.

Water for human consumption would be supplied as bottled water or from on-site wells. Human consumption water would be less than 100 gpd. Water for showers, toilets, and other human uses would either come from on-site wells or would be site water that has been processed through an on-site treatment plant to produce water of adequate quality for this use. A septic tank and drain field would be permitted and installed north of the mill site.

1.2.8.1. Water Management

Drainage is designed so that mine water, process water, and runoff from the TWSF and ore stockpile go through the treatment plant at a single point of discharge to Big Deer Creek. Water arising from ore processing, groundwater pumped from the mine and drainage from the ore stockpile and the TWSF is stored in the water management pond. Water from the pond is recycled through the mill or is directed to the water treatment plant. The volume of mill processing water/TWSF runoff discharge treated and discharged to Big Deer Creek is limited in the NPDES permit to the net precipitation on the TWSF and water management pond. The single discharge (Outfall 001) is located in Big Deer Creek approximately 100 feet downstream of water quality monitoring station WQ-24.

To estimate impacts to water resources a water and chemical mass balance for the ICP has been developed using a dynamic system model (DSM). The DSM considers the relationships between the Project components and the surrounding water environment, and predicts the impact on water resources throughout the life of the mine and during the post-closure period. The DSM includes specific water balance calculations for each year of the Project life. The ICP water management plan is based on operating a water treatment plant and releasing water in accordance with an NPDES permit in conjunction with temporary storage in a small water equalization pond adjacent to the water treatment plant and a larger water management pond to temporarily store process solutions. The water treatment plant would have the ability to treat up to 150 gpm of water for discharge through the NPDES outfall. Except during periods of very high inflow, the water treatment plant would treat incoming water on an as-received basis, with very little water stored in the water management pond. During periods of high inflow, water would accumulate in the water management pond for treatment during lower inflow periods.

Process Water Characteristics - The primary contaminants of concern (COCs) for the ICP are nitrate, sulfate, arsenic, copper, cobalt, nickel, and zinc. Primary COCs are constituents expected to occur at higher concentrations in the water management pond water compared to natural waters. They may also have significant environmental effects if discharged into surface water or groundwater.

Water Management Pond - The water management pond collects drainage from the TWSF and stores mining and milling process solutions if needed. The pond would be surrounded with an

8-foot high chain link fence for wildlife protection, double lined with HDPE liners, and have a leak detection and recovery system between the primary liner and secondary liner. Protection of the pond liners from potential ice damage (e.g., rub sheet of liner in pond corners) would be provided.

The pond would be sized to contain process waters and would also have the capacity to contain the runoff from a 500-year return period event plus 2 feet of freeboard. The design capacity for the pond is 10 million gallons. After adding the freeboard, the ultimate pond capacity is 12 million gallons. The 10 million gallon active capacity is evenly divided between two cells within the pond. The pond includes a spillway designed to pass a 100-year event to minimize the risk of failure in the event of overtopping.

Prior to commencing construction of the water management pond, FCC would provide a final engineering design to the USFS. The final design would include stability analysis based on actual material and site parameters. It would also include specifications for materials, construction, and QA/QC. The QA/QC plan would specify that construction monitoring would proceed under the supervision of a qualified professional engineer.

In the event projections show that there would be insufficient water for winter operations, adequate water would be retained in the pond to prevent a water shortage. A minimum amount of water would be kept in the pond at all times to hold the liner in place. Water from the mine and effluent from the milling process would flow by gravity to the pond as needed during periods of mill shutdown, or other operational reasons when storage is required. The pipeline from the pond to the mill would be double contained and complete with leak detection at all low points and at pipe-to-pipe connections.

Equalization Pond - The equalization pond would receive water and solids from mine and mill process streams for temporary storage prior to treatment. This pond would serve to equalize inflows from the source waters to provide a more consistent flow quantity to the water treatment equipment. This pond is sized at 90,000 gallons (8 hours storage at 150 gpm plus 25% contingency).

1.2.8.2. Water Treatment

Water pumped from the mine workings at the ICP and runoff/drainage from the TWSF and ore stockpile is predicted to contain elevated concentrations of nitrate, sulfate, and metals (aluminum, cobalt, copper, iron, manganese, and zinc). A water treatment plant designed to process and discharge up to 150 gpm would be installed in the mill to treat excess mine water and runoff/drainage from the TWSF and ore stockpile.

Water Treatment System Design - The water treatment process for the proposed action would utilize ion exchange as a means to remove any residual metals in excess of the NPDES effluent limits. This would eliminate the need for disposal of a stabilized reverse osmosis waste (a potentially large waste stream), but would result in higher levels of sulfate in the discharge

water. The treatment process would include biological treatment for removal of nitrate, if needed to meet the nitrate effluent limit. If needed to meet the ammonia effluent limit, ammonia would be removed by an ion exchange process using zeolites, a naturally occurring alumino-silicate mineral. The treatment process would result in treated water (effluent) capable of meeting effluent limits imposed by an NPDES permit for discharge to Big Deer Creek.

A Draft NPDES permit has been issued and is considered as part of this document. Treated water from the water treatment plant would be routed through a pipeline to a surface discharge located on Big Deer Creek below monitoring site WQ-24 (Appendix A, Figure 2). The pipeline would be routed using existing roads where possible. Where no roads exist, the pipeline would follow an alignment that minimizes pipeline length and physical disturbance to soils, vegetation and cultural resources. The pipeline would be buried, and be made of materials suited for this application such as steel, PVC, or HDPE. Where the pipeline crosses existing waterways, a culvert designed to pass the 100-year, 24-hour event would be placed in the stream channel, the pipe placed on top of the culvert, and fill placed over the pipe to prevent the water from freezing. The pipeline would affect jurisdictional wetlands at the crossings of two Bucktail Creek tributaries and at Big Deer Creek.

Rather than an open pipe discharge to Big Deer Creek, an instream diffuser would be used for the discharge. During the initial mine construction phase, the FCC would be required to conduct a field investigation and engineering evaluation to determine the final design of the diffuser. The diffuser would consist of a perforated pipe or pipe with engineered orifices designed to cause rapid mixing of the mine discharge with Big Deer Creek. The pipe would be placed on the surface of the streambed or would be buried within the streambed.

1.2.8.3. Stormwater Management Plan

The FCC has proposed a Stormwater Management Plan (SWMP) with the goals of: (1) Preventing stormwater run-on to proposed facilities; (2) minimizing erosion; and (3) reducing sediment transport to downstream receiving waters. The FCC would be required to obtain a Stormwater Permit or Permits from EPA prior to beginning construction. The FCC intends to apply for coverage under the Construction General Discharge Permit and Multi-Sector General Discharge Permit. EPA will make decisions on stormwater permits after FCC submits NOIs for these permits. Facilities to be covered under the Permit for the proposed project are as follows: (1) Topsoil and borrow material stockpiles; (2) haul and access roads; (3) parking lots; (4) office buildings; and, (5) ancillary disturbance areas not associated with milling process.

A construction stormwater permit would be required to address construction activities proposed for the site. Snow removal and storage is another component of the SWMP and includes a plan for snow removal for each major facility.

Design Criteria – Separation of clean stormwater runoff would be accomplished through the use of diversion channels to prevent upgradient water from coming into contact with proposed facilities or mined material stockpiles. The diversion channels would be V-shaped channels with

1 foot of freeboard and 1:1 side slopes. These upgradient diversion channels would route clean runoff around proposed facilities and disturbed areas and would distribute flows back to the watershed via sheet flow.

The FCC has proposed that the design storm for the proposed clean water channels, which would exist beyond the life-of-mine, would be either the 25-year, 24-hour storm or the 100-year, 24-hour storm depending on the association of channels with mine roads, process facilities or process materials. The BMP facilities designed to cover mine roads and operations are proposed to handle the 2-year, 24-hour storm.

The sections of road adjacent to the TWSF would be outsloped to minimize concentration of flows. The stormwater runoff generated from these sections of road would be dispersed by the use of slash (stacked timbers and brush). The remainder of roads would be insloped and runoff would report to stormwater diversion channels. Channels would have erosion protection in the form of check dams and riprap at outfalls. Outfalls would be protected with brush barriers, biofiltration swales, or rock structures, to dissipate runoff energy and prevent headcutting.

Stormwater channels installed around proposed facilities would intercept runoff before it interacts with a facility. The intercepted runoff would report to BMP structures, which would also be used to entrap sediment carried by flow in the channels. Design elements of typical BMPs are included in Appendix D to the *Storm Water Management Plan for the Idaho Cobalt Project* (Telesto, 2006).

Specific design elements of the SWMP are:

- Diversion of upslope clean runoff around the proposed TWSF, process ponds, and proposed borrow area;
- Maintenance of existing sheet and overland flow characteristics over undisturbed areas;
- Conveyance of collected runoff to frequently spaced, erosion-protected outfalls;
- Use of available forest slash (partially burned timber and brush), rock sediment basins, silt fencing, and biofiltration swales in BMPs; and,
- Revegetation of mining-disturbed areas, concurrently with operations as practical, to increase erosion protection and reduce sediment loading.

1.2.8.4. Spill Control

The FCC's spill control plan to address management of hazardous materials during shipping and storage would be revised to address any changes in the POO, and would be reviewed and approved by the agencies prior to initiation of construction activities. The plan would include notification of the ICP facilities prior to transport of fuels or chemicals, use of closed trucks,

travel only during daylight hours, use of pilot vehicles, and continuous radio contact with pilot vehicle and facility during transport. An approved SPCC plan would be required within 6 months of starting operations.

1.2.8.5. Water Rights

The FCC has applied for water rights on the groundwater from the mines and groundwater from two wells, for mining and milling purposes. Water from the wells would be used initially for drilling and other start-up water needs until the mine pumping and precipitation capture from the TWSF is adequate to supply operating water needs. The wells would also supply water for human use.

1.2.9. Water Resource Monitoring

The SCNF and the ICP would review the POO including the Reclamation Plan and monitoring plans on an annual basis. Water monitoring and stormwater monitoring following all surface disturbing activities, as well as spring runoff, large storm events, and the fall reclamation effort would occur in accordance with approved plans. The results of this monitoring would be documented by FCC and submitted to the USFS. The FCC has prepared a water monitoring plan for the project, the *Operational Water Monitoring Plan for the Idaho Cobalt Project* (Telesto 2007).

The proposed water monitoring plan was prepared to address operational and closure assessment of water resources. The monitoring plan includes a performance-based approach to compliance assessment. For example, groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance. If performance criteria exceed pre-established targets (e.g., if the calculated groundwater load were to result in exceedance of a surface water compliance target), a response action would be required by the mine to reduce the groundwater load to acceptable levels.

Components of the water monitoring plan support source identification and/or source allocation to differentiate effects of ICP from those of Blackbird Mine Site Group (BMSG), the monitoring plan includes:

- Groundwater monitoring wells located to the north of the Ram underground workings to monitor for possible groundwater flow along a fault that is present in the area;
- Groundwater monitoring wells located to the south of the Ram underground workings to monitor for possible connections to Blackbird workings;
- Groundwater monitoring wells in lower Bucktail Creek alluvium to evaluate potential effectiveness of capture system;

- Groundwater monitoring wells and piezometers in the area of the Ram bedrock groundwater capture system to determine potential capture effectiveness and monitor dewatering effects;
- Additional groundwater monitoring wells west of Ram Mine to provide information on Ram mine chemical mass loads;
- Groundwater monitoring wells located to the east of the Sunshine underground workings to monitor conditions between Sunshine and Blackbird workings;
- Groundwater monitoring wells located to the west/northwest of the Sunshine underground workings to monitor conditions between Sunshine and West Fork Bucktail Creek;
- Groundwater monitoring wells located in the area of Sunshine groundwater capture system to evaluate potential effectiveness of capture system;
- Monitoring of stormwater outfalls to determine effects of stormwater on streams and to judge effectiveness and adequacy of stormwater controls;
- Installation, testing and monitoring of monitoring wells/recovery wells down gradient of the Ram workings in the first years of mining to determine the effectiveness of FCC's proposed recovery system and to monitor groundwater release from the mine;
- Monitoring of mine water quality (drainage from tailings backfill, groundwater inflows, mine water sumps); and,
- Coordination of ICP and BMSG monitoring activities to ensure consistency and comparability of data.

To collect information needed for final design of the reclamation and closure plan, the modified monitoring plan would also include:

- Monitoring of mine inflow quantity and quality. This information would be used in assessing mine recharge rates after shutdown and in design and operation of the post-closure mine dewatering system; and
- Operational monitoring of mine water quality (drainage from tailings backfill and mine water sumps).

These data would be used in assessing and predicting the effectiveness of tailings and slash waste rock amendment in reducing the leaching of metals to groundwater and would characterize underground mine water sources. The monitoring plan also includes:

- Coordination of ICP and BMSG monitoring activities in the timing, frequency, sampling methods, analytical methods, and QA/QC requirements of monitoring to ensure consistency and comparability of data;
- Consistency with agency guidance and BMSG cleanup requirements in the evaluation of monitoring data to determine compliance with surface water and groundwater water quality standards, performance standards and limits. For surface water, this would include compliance testing compatible with the Blackbird Unilateral Order on Consent statement of work requirements for Big Deer Creek/Panther Creek watershed (compliance based on 96-hour testing). For groundwater, this would include compliance testing based on IDEQ guidance (e.g. test for difference in mean concentrations with standards/limits);
- Consistency with IDEQ requirements on development of a statistically significant baseline data set for groundwater;
- Adaptive management to enhance monitoring as needed to support compliance monitoring;
- Reporting of all monitoring data to the USFS, IDEQ and EPA; and,
- Additional detail regarding the justification for and requirements of a revised water monitoring plan can be found in the Water Resources Technical Report (Hydrometrics, 2006) and Chapter 4 of the EIS.

In order to complete the proposed monitoring, FCC would also install a cable car crossing of Panther Creek to facilitate baseline and operational monitoring of lower Big Flat Creek. The cable crossing would be installed south of the confluence of Big Flat Creek and Panther Creek and would be accessible from FR 055. However, the exact location of this structure would be determined with on-site USFS review. Design and construction of the cable car crossing would be similar to that of the BMSG crossing located upstream on Panther Creek and would consist of two, thirteen-foot high “A” frames anchored with concrete deadmen (2 to 3 yards of concrete), with a 90- to 120-foot cable span (Appendix A, Figure 3). The foot of each A-frame would be bolted into a pre-formed Ecology block embedded into the ground. The support structures would be installed at approximately the same elevation above Panther Creek as the existing road and well above the channel profile. A platform would be built on each “A” frame to allow passenger access. Equipment (e.g., backhoe or excavator) would be required to cross the Creek in order to install the two or three yards of concrete for the deadman. The crossing would be installed in early spring prior to high flow.

1.2.10. Water Management at Closure

At the completion of mining, the decision to cease pumping from the mine would be made based on results of water quality monitoring and predictions of impacts to groundwater and surface water. Post closure groundwater capture wells would be installed and tested during the initial construction phase to confirm that the system would capture a sufficient amount of groundwater to protect downstream water quality. If testing indicated that bedrock wells could not capture enough of the groundwater metals load, an additional groundwater/surface water capture system consisting of an interception trench or series of wells across Bucktail Creek alluvium would be installed downgradient of the Ram mine. The Bucktail capture system would collect alluvial groundwater, and surface water if necessary. The Bucktail capture system would allow collection of additional groundwater and COCs from the Ram and Sunshine mines, and would allow capture and treatment of additional metal load to ensure that the ICP does not contribute to a net increase in metal loading to the South Fork Big Deer, Big Deer, and Panther Creeks. Additional permitting related to disturbance in the streambed (404 and stream alteration permits) would likely be required if the backup lower Bucktail system were required. Additionally, because there would be a larger area of groundwater affected by mine contaminants (between the source and the capture system) the State of Idaho, who regulates groundwater quality, would have to sanction this capture system concept.

The Bucktail capture system would be located in lower Bucktail drainage between monitoring sites WQ-19 and WQ-21, upstream of the unnamed tributary where WQ-11 is located, and upstream of the proposed BT-5 pipeline system (see description of BT-5 diversion under Remedial Actions in Chapter 3, page 3-81 DEIS). The backup capture system would consist of a series of pumpback wells and/or capture trenches within the Bucktail Creek alluvium and provisions for surface water capture at the same location. The surface water diversion structure would use the lower sediment dam with some modifications to the existing outlet structure or a new outlet structure. If the lower sediment dam is removed, an alternative diversion structure along lower Bucktail Creek would be required. The FCC would be required to provide a final design of the groundwater/surface water capture system prior to mining.

The captured water from the bedrock or lower Bucktail capture systems would be pumped to the water treatment plant. The treated water would be piped back to the discharge location in Big Deer Creek near monitoring station WQ-24.

1.2.10.1. Water Management Pond

Prior to reclamation of the water management pond, any remaining water would be treated and discharged. Any sediment or residual material in the pond would be analyzed for pH and metals. If the testing shows leachable metals exceeding the regulatory limits, the sludge would be either stabilized in place and retested, or removed from the site and disposed of in a permitted disposal facility consistent with Federal and state regulations. Following testing, the liner would be folded into the pond, dikes would be pushed into the pond, and the area would be regraded to approximate the pre-construction topography. Following the regrading operation, the area would

be covered with growth medium and revegetated. Seedbed preparation and seed application would be performed in one operation with a tractor pulling a chisel tooth harrow and seed drill. The water management pond would be reclaimed after pumping in the Ram and Sunshine Mine pumpback well fields ceases.

1.2.11. Wetland Construction

Jurisdictional wetlands would be impacted by the cable crossing over Panther Creek and the water treatment discharge pipeline which crosses over unnamed drainages along the road to the NPDES discharge location in Big Deer Creek. The discharge pipeline would also affect wetlands near the discharge point in Big Deer Creek.

Cable Crossing of Panther Creek - Construction of footings for the cable crossing would occur at approximately the same elevation above Panther Creek as the existing road and well above the channel profile. Thus the wetland impacts would consist of the construction access and the footings of the cable towers.

Treated Water Discharge Pipeline - The discharge pipeline would follow the access road from the mine area to near the confluence of Little Deer and Big Deer Creeks; along this route the road crosses two drainages that have jurisdictional wetlands. The lower drainage to be crossed is incised about 4- to 6-feet deep and contains a flowing stream (Appendix A, Figure 2). A culvert crossing would be installed for the incised gully.

The pipeline would be constructed across the surface of the newly constructed road bed and would be constructed to prevent freezing. If there is sufficient soil thickness over the culvert pipe, the pipeline would be excavated into the road bed similar to the construction along the bulk of the pipeline route. In the event there is not sufficient soil thickness above the culvert to bury the pipe, the pipe would be brought out of the ground and would lie on the roadway for a short distance. The pipe would once again be buried when it is past the culvert. Wetland topsoil would be salvaged prior to culvert installation and would be in the wetlands mitigation project. Construction stormwater BMP controls such as silt fences, sediment traps, and any other appropriate measures would be used as needed during road construction.

The upper crossing on Ram Gulch is a flat wetlands area and the pipeline would be buried or otherwise constructed to prevent freezing in this area. Methods to eliminate trenching in the wetland could be employed but would require protection from freezing. The discharge pipeline would also cross wetlands for some distance before reaching the terminus point in Big Deer Creek. The discharge would be via an instream diffuser. During the initial mine construction phase, the FCC would be required to conduct a field investigation and engineering evaluation to determine the final design of the diffuser.

In Big Deer Creek, a trench will be excavated to a depth of 1- to 4-feet, extending across no more than 50% of the channel width (personal communication, Ray Henderson, SCNF, April 8, 2008). A backhoe/excavator will be used to conduct the trenching. A 4- to 6-inch pipe will be laid in the trench bottom. Effluent diffuser orifices consisting of smaller diameter pipe

will extend from the pipeline to the streambed surface and will be located at regular intervals along the diffuser pipeline. A small volume of streambank (<1 cubic yard) below the ordinary high water mark will need to be excavated to place the pipe. The trench will be backfilled with native material excavated from the site and revegetated. No material will be stored below the ordinary high water mark.

1.2.12. NPDES Draft Effluent Limits

On May 25, 2006, the FCC submitted an application to EPA Region 10 to discharge wastewater to Big Deer Creek under the NPDES permit program. EPA reviewed the application and after several supplementary submittals deemed the application complete on July 14, 2006. The draft NPDES permit contains discharge limitations for 16 potential pollutants, including eight metallic elements, arsenic (a metalloid), ammonia, sulfate, sulfide, total suspended solids (TSS), pH, dissolved oxygen (DO), and temperature (Table 2). The rationale for calculating the effluent limits are identified in the Draft NPDES permit. Outfall monitoring is also specified for iron, aluminum, hardness, chloride, conductivity, total dissolved solids (TDS), Whole Effluent Toxicity (WET), and Expanded Effluent Testing. The list of parameters for ambient stream monitoring is the same with the exception of the addition of silver as a monitoring parameter.

The outfall is proposed to discharge to Big Deer Creek approximately 1,500 feet below the confluence with South Fork Big Deer Creek by way of a diffuser. The outfall is located approximately 3 miles upstream from the confluence with Panther Creek. Access for anadromous species in Big Deer Creek is blocked by a series of impassable falls and cascades approximately 0.7 stream miles upstream from Panther Creek.

Table 2. Outfall Effluent Limits and Monitoring Requirements (draft permit, EPA 2007).¹

Parameter	Units	Effluent Limits and Monitoring Requirements			
		Maximum Daily Limit	Average Monthly Limit	Monitoring Frequency	Sample Type
Arsenic ¹	µg/L	100	50	Weekly	Grab
Cadmium ¹	µg/L	0.52	0.26	Weekly	Grab
Cobalt ¹	µg/L	141	70.4	Weekly	Grab
Copper ¹	µg/L	4.80	2.40	Weekly	Grab
Lead ¹	µg/L	0.90	0.45	Weekly	Grab
Mercury ¹	µg/L	0.02	0.01	Weekly	Grab
Nickel	µg/L	26.52	13.22	Weekly	Grab
Thallium	µg/L	0.95	0.47	Weekly	Grab
Zinc	µg/L	37.02	18.45	Weekly	Grab
Ammonia (total as N) (Superceded)	mg/L	5.62	2.80	2/Month	Grab
Ammonia (total as N) (REVISED 10/1/07)	mg/L	4.1	1.6	2/Month	Grab
Nitrate + Nitrite	mg/L	100	--	2/Month	Grab
Sulfate	mg/L	1,000	--	2/Month	Grab
Sulfide	µg/L	2	--	2/Month	Grab
TSS	mg/L	30	20	Weekly	Grab
pH	s.u.	Between 6.5 and 9.0 at all times		Weekly	Grab
Dissolved Oxygen	mg/L	Must exceed 6.0 at all times		2/Month	Grab
Temperature	C°	19	--	2/Month	Grab
Iron	µg/L	--	--	Monthly	Grab
Aluminum	µg/L	--	--	Monthly	Grab
Hardness	mg/L	--	--	Monthly	Grab
Chloride	mg/L	--	--	Monthly	Grab
Conductivity	mS/m	--	--	Monthly	Grab
TDS	mg/L	--	--	Monthly	Grab
Whole Effluent Toxicity (WET)	TUC	--	--	1x/6 months	Grab
Expanded Effluent Testing ²	--	--	--	3x/5 years	Grab

Notes to Table:

1. Expanded effluent testing includes the 126 chemicals listed in 40 CFR § 131.36. This testing shall occur in years 2, 3 and 4 of the permit cycle, and should occur coincident with the September WET testing and other routine monitoring.
2. Metals limits expressed as total recoverable except for mercury which is expressed as total.

1.2.13. Reclamation

The proposed reclamation plan involves approximately 115 acres of surface disturbance. This includes existing roads that would not be reclaimed and would become a part of the post-mining road system in the area. Additionally, some newly constructed Project roads would be incorporated into the post-mining road system. During construction, ICP proposes to reclaim

¹ Effluent limits for Ammonia were lowered by EPA (Personal Communication, Lisa Olson, EPA Permit Writer, Seattle Washington, October 2007) in comparison to the limits in the draft permit (dated approximately February 2007).

about 4.54 miles of substandard and non-essential existing roads in the vicinity of the ICP. The Agencies propose reclaiming an additional 2.95 miles of non-essential existing roads during construction. Once mining has ceased or when no longer required for post-closure water management or other closure activities, all above ground facilities would be demolished, removed from the site, and their former location reclaimed.

The proposed reclamation plan is designed to meet the following goals:

- Conduct reclamation and revegetation concurrently with the mining program, as much as possible. Concurrent reclamation would be performed on areas no longer required for the mining operation;
- Keep all clearing and disturbance to the minimum consistent with Project needs;
- Place waste rock, tailings, roads, structures, diversions, and water management ponds so that they minimize subsequent shaping and recontouring and do not pose a hazard to human health and the environment;
- Reestablish stable and diverse surface topography and hydraulic features that are compatible with the surrounding landscape;
- Establish soil conditions that promote regeneration of stable, diverse, and self-sustaining native plant communities through removal, storage, and redistribution of suitable soil materials;
- Revegetation of all areas disturbed by the operation to stable and diverse native vegetation communities that provide wildlife habitat and minimize erosion;
- Work with the USFS to identify opportunities to improve the post-mining land use of the site through reclamation of existing, unnecessary roads;
- Provide methods, procedures, and practices for seasonal activities, temporary shutdowns, and final reclamation;
- Maintain water quality such that water quality standards are met at the BMSG compliance points in Big Deer Creek (WQ-24), Panther Creek, (WQ-25) and South Fork Big Deer Creek (WQ-22); and,
- Meet NPDES permit stipulations regarding no net increase in copper load in Big Deer Creek.

1.2.13.1. Facility Reclamation

Once the ore reserve is exhausted and mining ceases, surface and underground facilities not needed for reclamation or closure activities would be removed.

Mines - Reclamation of the flat areas adjacent to the Ram and Sunshine portals would include removal of buildings, cables, piping, and concrete pads, regrading, ripping to alleviate compaction, applying available growth medium (and amendments if determined necessary), and revegetating. Adit portals would be sealed to prevent human or animal access. This would include backfilling the entries of adits with clean waste rock and grading the area to fill the portal depression. Grading would include bringing as much of the portal bench fill as possible onto the cut area and reestablishing a continuous hillside slope, to the extent practicable. Abrupt surface features would be smoothed to create uniform grades and to produce a near naturally appearing surface.

Mill - The combined mill, administration building, warehouse, shop, and ancillary facilities (such as piping and tanks) would be demolished and disposed of. Buildings and equipment would be dismantled and removed from the property. Equipment and facilities with salvage value would be sold. All remaining scrap and demolition debris would be disposed of off-site at an approved landfill. Foundations and walls would be demolished to 1 foot below grade and covered with fill to eliminate any safety hazards for wildlife or humans. Sumps or other voids would be backfilled with sufficient soil so that depressions would not occur after settling. Slab foundations would be broken up for adequate drainage, placed in the deeper portions of the regraded fill, and buried under no less than 2 feet of cover.

Regrading of this area would include moving much of the fill into the original cut area to establish a natural looking topography. The edges of the area would be shaped to blend with the surrounding contours. The area would be ripped to relieve compaction prior to topsoil placement. Topsoil would be placed over the area to a minimum depth of 12 inches.

The water treatment plant would be attached to the mill building such that the mill building and equipment can be dismantled and removed without disturbing the treatment operation. Water treatment operations would continue as long as pump-back groundwater wells are operated. At the cessation of pump-back well operation, the water treatment plant would be decommissioned by dismantling and removing all equipment, building, and support structures. Decommissioning and reclamation activities described for the mill process area would be applied to the water treatment plant and surrounding area, including foundation demolition, backfilling, regrading, and reseeding. The equalization pond would be reclaimed in accordance with procedures described for the water management pond.

Tram - Reclamation of the overhead tram would include removal of the structures, pipelines, cables, and concrete pads that comprise the facility. Following removal of the equipment, the disturbed areas within the tramline corridor would be graded and revegetated.

TWSF - The TWSF would be constructed in three phases with construction beginning on the eastern side (the lowest end) of the facility. As stacking on Phase I of the facility nears its ultimate capacity, Phase II would be constructed. Once material placement on Phase I is complete, that phase would be reclaimed. Likewise, as soon as material placement on Phase II is complete, it would be reclaimed. Incremental reclamation of the TWSF would reduce the

precipitation catchment area, reducing the amount of excess water captured each year. Reclamation of the TWSF would include grading, cover installation, topsoil placement, and revegetation.

Grading of the TWSF would require minor surface shaping to smooth corners to give a more natural appearance to the pile. The 100-foot setback benches would remain in place and would be backsloped into the pile and sloped to drain laterally. Slopes of the reclaimed pile would be at 4H:1V or less. Setback benches and the pile top would be graded at 3% to drain. If post closure water treatment were required, treatment waste would be shipped off-site or an alternative disposal plan would be developed. The TWSF cover installation would include placing a 60-mil HDPE cover, installing a geonet drainage layer over the HDPE cover, and placing 4 feet of soil cover material on top of the drainage layer. Soil would be placed loose and scarified along the contour to provide micro traps for moisture and seeds. Seeding would be by mechanical means where practical and safe, and by hand where necessary. Seeding would include grasses, forbs, and shrubs. Trees would not be planted to avoid tree root penetration into the cover.

During operation, drainage from the TWSF underliner would report to the water management ponds. Following active mining, for the duration of water pumpback and treatment at the Ram and Sunshine mines, TWSF drainage would continue to report to the water management ponds. After the ponds have been reclaimed, drainage from above the TWSF underliner would report to an infiltration field located east of the water management ponds. The DSM estimates long-term drainage at 0.4 gpm. The drainfield would be designed to accept up to 1 gpm.

Pipelines - Surface pipelines would be removed. To minimize re-disturbing revegetated areas, buried pipelines would be capped and abandoned in place.

1.2.13.2. Soil Salvage

During the construction of the Project, available soil would be stockpiled and stabilized in a discrete location adjacent to the area disturbed by mining-related activities. Soil removed during road and portal construction would be stockpiled downslope of those features. Soil removed during mill and TWSF construction would be stockpiled near the TWSF area (Appendix A, Figure 2). Total topsoil salvage is estimated to be 284,000 cubic yards. Approximately 7 acres would be required for the topsoil stockpile area. Precipitation run-on would be diverted around the stockpile area by perimeter ditches. As topsoil materials are placed in this area, the topsoil would be seeded with a mixture of non-native species (smooth brome, mountain brome, orchard grass, and timothy) at an application rate of 4 pounds per acre each to temporarily stabilize the stockpile.

Soil types and depths vary across the site. In the Ram and the Sunshine areas, the salvageable soil depth is estimated to range from 0- to 8-inches. On the Big Flat, soil depths are estimated to provide between 12- and 14-inches of quality material suitable for reclamation purposes.

Following recontouring of the site, salvaged soil would be taken from the stockpiles and placed over the recontoured surfaces. Prior to placement on disturbed sites, the selected growth medium

would be tested for comparison with pre-selected reference sites. Testing would include pH, electrical conductivity, lime, organic matter content, texture, saturation percent, nitrate–nitrogen, phosphorus, potassium, zinc, iron, manganese, and copper. The FCC would review testing results and propose a soil amendment program (if needed) to the USFS. Decomposition of organic matter while growth medium is in stockpile has been documented. Nitrogen fertilizer and organic materials would be added as necessary to ensure adequate plant development.

Seedbed conditioning would consist of ripping or disking the recontoured surface with notched or straight edged discs set together in rows or “gangs” combined with harrows. This step would break up seedbed clods, and turn under and cut brush, limbs, and weeds. Additionally, it would break up surface compaction and anchor any straw or hay mulch that has been applied.

Following grading (or contouring), growth medium placement, and seedbed conditioning, the areas would be revegetated with species appropriate for the specific site and climate. Species used in revegetation would stabilize the area and allow the natural incursion of indigenous species. Lodgepole pine (*Pinus contorta*) is expected to regenerate naturally over the Big Flat and other areas as a result of the 2000 Clear Creek fire. The FCC would collect serotinous lodgepole pine cones from nearby sources and place those cones over the replaced soils for subsequent opening and seed germination.

Grass seed application would be performed with a seed drill, hydroseeding, or hand broadcasting depending upon the terrain. Broadcast seeding would be done in the fall prior to freeze up to produce the optimum germination. Areas seeded to grass would receive a light application of weed-free straw mulch at the time of seeding followed by the application of fertilizer in the spring prior to summer rains.

1.2.13.3. Post-Closure Reclamation Monitoring

All reclaimed sites would be monitored twice a year for a period of 3 years to evaluate the success of the reclamation work. Any areas not meeting the vegetation success criteria would be analyzed to determine the problems and the areas would be revegetated with a modified plan.

In addition, there would be monitoring of ground and surface water for a minimum of 5 years following cessation of pump back. Results of this monitoring would be used to evaluate the success of the measures taken to protect the water resources. Any changes in water quality would be evaluated to determine whether the changes are related to the reclaimed mining facilities. Monitoring must demonstrate that water quality meets established standards and is stable over time and a range of hydrologic events prior to bond release.

1.2.14. Financial Assurance

As part of the approval of a plan of operations for the ICP, the USFS would require FCC to post a financial assurance package. This package would ensure that adequate funding is provided to allow the USFS to complete reclamation, post-closure operation, maintenance activities, and

necessary monitoring for as long as required to return the site to a stable and acceptable condition. The amount of financial assurance would be determined by the USFS and would be adequate to allow the USFS to complete all necessary reclamation of the ICP at any stage if FCC were to abandon the project. The financial assurance would also cover potential costs to capture and treat water following closure to meet effluent or instream limits. The financial assurance may be in the form of a bond or other financial instrument and would be payable to the USFS in the event that FCC does not perform reclamation actions as required by the ICP POO. The amount of the financial assurance would be calculated in accordance with USFS guidelines.

1.2.15. Design Modifications and Mitigation Measures

The proposed action contains a number of design and operational modifications, mitigation measures and monitoring plans intended to reduce impacts to the environment. An Interagency Oversight Task Force will be formed to provide oversight for the ICP. The Task Force would consist of all permitting agencies including IDEQ, IDWR, NMFS, FWS, USFS, and EPA. A subset of the proposed mitigation measures and monitoring requirements most pertinent to avoiding or minimizing potential adverse effects to ESA-listed species or critical habitat includes:

1. The operator shall obtain agreements for use of existing infrastructure (6850 adit and treatment facility), developed by BMSG as part of the CERCLA remediation action; to address the potential commingling of groundwater from the ICP and the BMSG capture system in Bucktail Creek that would be captured and treated prior to discharge into surface waters.
2. The ICP shall provide an annual report summarizing mining, reclamation, and monitoring activities and projecting proposed activities for the coming year. The ICP shall conduct an annual review with the USFS to determine if activities are in accordance with the approved Plan and if any changes to the Plan or financial assurance are needed.
3. The ICP shall provide notice to the USFS and make appropriate modifications to the POO if there are significant changes to project permits (such as NPDES, 404, or Air Quality).
4. Waste rock (slash) left underground in the Ram and Sunshine mines shall be amended to provide alkalinity to reduce potential for metals leaching.
 - a. The ICP shall provide a Waste Rock Amendment Plan as described in the FEIS and Water Resources Technical Report.
 - b. The ICP shall provide funding for the SCNF to obtain a third party contractor to assist SCNF in review of the Waste Rock Amendment Plan.
5. Waste rock and tailings materials will be tested throughout the life of the mine to evaluate potential for acid generation and metals leaching.

- a. The ICP shall provide a Geochemical Monitoring Plan as described in the FEIS and Water Resources Technical Report.
6. The ICP shall provide funding for the SCNF to obtain a third party contractor to assist SCNF in review of the Geochemical Monitoring Plan. The ICP shall provide engineering final design for the ponds that includes:
 - a. Spillways to reduce risk of failure if overtopping occurs.
 - b. Protection of pond liners from potential ice damage.
7. The ICP shall provide a Stormwater Pollution Prevention Plan that includes:
 - a. Those permanent water control structures that will exist beyond the life of mine will be designed to handle flow from the 100-year storm event;
 - b. Standard state and Federal BMPs will be utilized for Project sediment control;
 - c. Soil disturbing construction activities will be conducted during a set construction season to minimize impacts to soils and sediment production; and,
 - d. Sediment control monitoring.
8. Modifications to the water resources monitoring plan to provide adequate data to evaluate potential impacts to surface and groundwater.
9. The ICP shall provide a Post-mining Groundwater Capture Plan that includes:
 - a. Decision criteria and action (trigger) limits for post-mining water capture. Criteria shall include conditions that would lead to decisions regarding cessation of mine dewatering;
 - b. A plan for installation and evaluation of bedrock groundwater, alluvial groundwater and surface water capture systems for the Ram and Sunshine Mines; and,
 - c. The groundwater capture system shall be fully installed prior to construction of the mine adits.
10. Enhanced emergency management capabilities will be instituted for medical (including designating a helipad site), spill control and fire situations.
11. Native species and more detailed reclamation procedures will be used for reclamation to ensure achievement of self-sustaining vegetation following reclamation.

12. Additional access road improvements will be made to reduce sediment release and traffic accident risk.
13. Construction workers will be required to utilize van sharing or busing to minimize traffic during the construction period.
14. Any surface vegetation clearing or timber removal will be conducted following USFS guidelines and practices and following USFS approval;
15. The ICP shall institute a weed control plan that conforms to USFS and County guidelines;
16. The ICP will be required to submit a plan to monitor existing wetlands and constructed wetlands to determine impacts to wetlands functions, and shall modify the constructed wetlands as necessary to assure that they are providing suitable wetland habitat to compensate for Project impacts to natural wetlands.
17. The ICP shall submit a final engineering design for the TWSF that includes:
 - a. A closure cap that includes a minimum of 4 feet of soil cover material to protect the liner from potential damage from trees growing on the reclaimed surface;
 - b. A plan for placement of tailings into the TWSF during winter designed to maintain the design density and moisture content of the dry stack tailings;
 - c. Co-disposal of tailings and waste rock in the TWSF to reduce the oxidation rate of the higher permeability waste rock component and reduce long-term risk to the environment from metals release;
 - d. Design for construction of the 36 acre TWSF facility; and,
 - e. Post-mining monitoring of water quality in, and/or discharging from the TWSF for a period of not less than 5 years.
18. The ICP shall develop a waste rock disposal plan for any material disturbance on the Sunshine portal pad or any other location where preexisting wastes may be disturbed for USFS approval in accordance with all relevant Federal, state, and local laws.
19. The ICP shall submit a final engineering design for the water treatment system and provide SCNF with funding for a third party contractor to assist SCNF in review of the plan. At a minimum, the water treatment plan shall:
 - a. Provide treatment capable of meeting effluent limits in the NPDES permit; and,
 - b. Minimize the need for disposal of water treatment waste residues.

20. The ICP shall designate a reclamation coordinator who shall be responsible for the following:

- a. Being the primary contact with the SCNF on permit compliance, monitoring and mitigation;
- b. Describing how environmental protection standards contained in plans and permits would be implemented;
- c. Preparing reclamation plans for all proposed surface disturbance. These plans shall be submitted to the USFS and will include interim and final reclamation for the facilities along with an estimate of the costs to complete the work;
- d. The coordinator shall certify that all reclamation work was completed as planned for each facility. The USFS Administrator shall accompany the company coordinator in reviewing all proposed activities; and,
- e. Prior to the 8th year of operation the company shall summarize the results of all testing for closure purposes and submit its plans for final reclamation to the USFS and Interagency Task Force for review and approval.

21. The ICP shall reduce impacts of dust along primary access roads by watering, surfacing, or treating the surface of the road with an approved chemical amendment as directed by the SCNF.

22. The ICP shall comply with USFS Region 4 Reclamation Guidelines except where authorized by the SCNF:

- a. The ICP shall recover soil material from all areas of project disturbance in sufficient quantities to place a minimum of a 1 foot layer on features identified for reclamation in the Reclamation Plan;
- b. Earth fill construction will be confined to the normal operating season unless specifically authorized by the USFS;
- c. All exposed soil materials shall be stabilized and reclaimed in the same season as the disturbance, unless otherwise authorized by the SCNF;
- d. All slopes shall be kept to a minimum;
- e. Surface disturbances shall be recontoured; and,
- f. Reclaimed slopes shall be shaped to prevent the concentration of water except at points specifically designed to handle flows without erosion;

23. The ICP shall obtain a Forest RUP that specifies the conditions under which they can use the Forest roads. The ICP's POO and/or RUP shall include the following:

- a. Access road design shall meet USFS specifications (U.S. Department of Transportation Federal Highway Administration, 2003) for road width, grade, alignment, surfacing, drainage, quality control and signing. Exceptions to these standards may be used only with SCNF approval. Forest Plan requirements for road construction and natural resource protection will be followed. The ICP shall submit designs for road construction and improvements to the USFS for review and approval prior to initiating construction.
- b. Develop a plan for busing of all mine employees. The ICP shall monitor the use of the provided busing to establish the rate of use, and shall furnish an annual summary of use to the SCNF. If an 80% usage rate for all mine employees including management is not achieved on an annual basis, revisions to the plan may be required by the USFS.
- c. The ICP shall require contractors to comply with requirements for van pooling or busing of employees including the 80% participation goal. In addition, the ICP shall ensure that small deliveries or partial loads of materials are delivered to a staging area in Salmon, for consolidation prior to proceeding to the mine site to the extent practicable. Occasional site visitors such as salespeople shall be authorized access to the site as necessary.
- d. The ICP shall develop a written policy for compliance with all SCNF traffic rules and require that all contractors comply with state and Forest rules for oversize and overweight loads.
- e. The USFS must approve all location or design changes for access and haul roads on National Forest System lands.
- f. The ICP shall implement or provide payment to the USFS for deferred road maintenance (such as surface, culvert or bridge replacement), and recurrent (grading, cleaning culverts) maintenance based on road use, as specified in the Road Use Agreement.

24. The ICP transportation and/or spill control plan shall include training requirements for all drivers including a requirement that all new drivers transporting fuel, chemicals, or concentrate make their first trip to the site accompanied by a company representative.

- a. All fuel, chemical supply and concentrate trucks, all tractor-trailer units, and any single unit vehicles more than 24 feet in length shall be accompanied by a pilot car.
- b. No secondary trailers (pups) will be allowed for ICP or their suppliers.

- c. Fuel tankers shall contain no more than 4,500 gallons per load.
 - d. During the construction period, the ICP shall coordinate all use of approved and alternative access routes with the USFS under an approved RUP.
25. Road improvements of the entire 40 mile project access route (Section 1.2.2 of this Opinion, Appendix A, Figure 1 and Table 1).
26. Borrow Areas – Work on the Williams Creek Road would utilize borrow from the existing Leesburg East pit. The pit shall be reclaimed following its use.
27. Road reclamation – Approximately 7.58 miles of site roads shall be reclaimed during the construction phase. All new roads except those roads identified by the agencies as needed for administrative purposes shall be reclaimed at mine closure.

The conservation measures described here and in the consultation initiation package as parts of the proposed action are intended to reduce or avoid adverse effects on listed species and their habitats. NMFS regards these conservation measures as integral components of the proposed action and expects that all proposed project activities will be completed consistent with those measures. We have completed our effects analysis accordingly. Any deviation from these conservation measures will be beyond the scope of this consultation and will not be exempted from the prohibition against take as described in the attached incidental take statement. Further consultation will be required to determine what effect the modified action may have on listed species or designated critical habitats.

1.3. Action Area

‘Action area’ means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For purposes of this consultation, the action area includes the ICP mining site, and all waterbodies potentially affected by the mine site, the wastewater discharge, borrow areas, and/or the transportation corridor. The ICP mining site is located in the headwaters of Big Flat Creek, Bucktail Creek, South Fork Big Deer Creek, Little Deer Creek, and Blackbird Creek. Several unnamed tributaries, springs, and wetlands connected to each of these subwatersheds may also be influenced by mine site construction and operations. Each of these streams has been included in the action area for this project.

The proposed discharge pipe will empty into Big Deer Creek, a tributary of Panther Creek. Since the action will discharge treated mine wastewater into Big Deer Creek, the action area includes Big Deer Creek from the discharge pipe downstream to the confluence with Panther Creek. Considering estimated dilution factors outlined in the BA (pages 7-38 to 7-39), the action area also includes the Panther Creek mainstem from Big Deer Creek downstream to its confluence with the Salmon River. As described below in the effects analysis, dilution by the larger Salmon River is expected to reduce concentrations of potential pollutants to insignificant levels, levels unlikely to result in lethal or sublethal effects to ESA-listed species.

The action area also includes the three borrow areas used for the project, including one on the Williams Creek road near the Williams Creek summit (Leesburg East), one along Blackbird Creek, and the other in the Bucktail Creek drainage (Appendix A, Figure 2). All of these borrow areas are on USFS land and have been previously used as borrow sources.

The transportation route plans to use existing USFS roads along Blackbird, Panther, Deep, Moccasin, and Williams Creeks. The route also crosses Perreau Creek near its mouth, and the Salmon River at Shoup Bridge. Because of the potential for spills of mined ore, fuels, acids, and other potentially toxic substances along the route, the action area for the transportation route includes the following streams, and the immediate stream reaches downstream from where spills could occur: (1) Blackbird Creek from the mine site downstream to Panther Creek; (2) Panther Creek, from Blackbird Creek downstream to Big Deer Creek; (3) Deep Creek, from the uppermost road crossing (Forest Road [FR] 101) downstream to its confluence with Panther Creek (approximately 3.5 miles); (4) Moccasin Creek, from the headwaters downstream to the mouth; (5) Williams Creek, from the headwaters downstream to the mouth; (6) Perreau Creek, from the FR 021 bridge downstream to the Salmon River; and, (7) the Salmon River, for 2 miles downstream of the Shoup Bridge. Because of dilution, mixing, and application of the SPCC, effects from spills are not expected to extend beyond these stream reaches.

Snake River sockeye salmon, spring/summer Chinook salmon, Snake River Basin steelhead, and their designated critical habitats are found within the action area for the ICP (Table 3).

Table 3. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)			
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Sockeye salmon (<i>O. nerka</i>)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA Section 9 applies
Steelhead (<i>O. mykiss</i>)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Note: Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered.

2. ENDANGERED SPECIES ACT

The ESA establishes a national program to conserve threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the FWS, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. Section 7(b)(4) requires the provision of an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) to minimize such impacts.

2.1. Biological Opinion

This Opinion presents NMFS' review of the status of each listed species of Pacific salmon and steelhead² considered in this consultation, the condition of designated critical habitat, the environmental baseline for the action area, all the effects of the action as proposed, and cumulative effects (50 CFR 402.14(g)). For the jeopardy analysis, NMFS analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

The critical habitat analysis determines whether the proposed action will destroy or adversely modify designated critical habitat for listed species by examining any change in the conservation value of the essential features of that critical habitat. This analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 that sets forth the substantive protections and procedural aspects of consultation. The regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 is not used in this Opinion.

2.1.1. Status of the Species and Critical Habitat

This section defines the biological requirements of each ESA-listed species affected by the proposed action, and the status of each designated critical habitat relative to those requirements. Listed species facing a high risk of extinction and critical habitats with degraded conservation value are more vulnerable to the aggregation of effects considered under the environmental baseline, the effects of the proposed action, and cumulative effects.

2.1.1.1. Status of the Species.

NMFS reviews the condition of the listed species affected by the proposed action using criteria that describe a 'viable salmonid population' (VSP) (McElhany *et al.* 2000). Attributes associated with a VSP include abundance; productivity, spatial structure, and genetic diversity that maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced, in turn, by habitat and other environmental conditions.

Snake River Sockeye Salmon - The Snake River sockeye salmon, listed as endangered on November 20, 1991 (56 FR 58619), includes populations of sockeye salmon from the Snake River Basin, Idaho (extant populations occur only in the Salmon River drainage). Under the 2005 NMFS hatchery stock policy (June 28, 2005, 70 FR 37204), the progeny of fish from a

² An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (final steelhead FR notice) are considered to be 'species,' as defined in Section 3 of the ESA.

listed population that are propagated artificially are considered part of the listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, Snake River sockeye salmon produced in the captive broodstock program are included in the listed ESU.

Within the action area sockeye salmon only occur in the mainstem Salmon River, migrating through the action area during upstream and downstream migrations. Considering the short timeframe sockeye are present in the action area, combined with the very low probability of an accident and hazardous material spill occurring in the vicinity of the Shoup Bridge, the SCNF determined that the proposed action would have “no effect” on Snake River sockeye salmon.

Typically NMFS does not review or concur with “no effect” determinations, a determination made at the discretion of the action agency. However, NMFS has reviewed the determination in this case since sockeye were included in the BA and occur in the action area. A “no effect” determination is only appropriate when the proposed action will not affect a listed species or designated critical habitat. A “not likely to adversely affect” determination is appropriate when potential effects would be insignificant, discountable, or beneficial. Discountable effects are further defined as effects that are extremely unlikely to occur. Although very unlikely, the potential still exists for a spill to occur when sockeye are present in the action area. If sockeye are present near the Shoup Bridge and a spill occurs, adverse effects will occur. This potential for effect, although unlikely makes a “not likely to adversely affect” determination more appropriate. Upon sharing this information with the USFS, the USFS agreed with this and have amended their determination for sockeye salmon to “not likely to adversely affect.” Because potential effects to sockeye salmon can be considered discountable for this action due to the protective measures and BMPs included in the proposed action, as supplemented by the terms and conditions imposed in this Opinion, NMFS concurs with this determination and will not further address effects to sockeye salmon in this Opinion.

Snake River Spring/Summer Chinook Salmon - The Snake River spring/summer Chinook salmon ESU, listed as threatened on April 22, 1992, (67 FR 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha, and Grande Ronde hatcheries in Oregon and Washington, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for Snake River spring/summer Chinook salmon on December 28, 1993 (58 FR 68543) and was revised on October 25, 1999 (64 FR 57399).

The Snake River drainage is thought to have produced more than 1.5 million adult spring/summer Chinook salmon in some years during the late 1800s (Matthews and Waples 1991). By the 1950s the abundance of spring/summer Chinook had declined to an annual average of 125,000 adults and by the mid-1960s, further declined to an average of about 60,000 adults. Adult returns counted at Lower Granite Dam reached all-time lows in the mid-1990s, and numbers have begun to increase since 1997. Over a 10-year period from 1992 to 2001, which includes the year of listing (1992), returns of wild/natural fish ranged from 183 in 1994 to 12,475 in 2001, and averaged 3,314 salmon adults. The estimated smolt production capacity of 10 million smolts for rivers in Idaho, coupled with historic smolt to adult return rates of 2% to 6 %, indicate Idaho could produce wild/natural runs of 200,000 to 600,000 adults (Fish

Passage Center 2002; Fish Passage Center 2003). The relatively low numbers of the last decade are reflected throughout the entire distribution of Chinook salmon subpopulations scattered throughout the Grande Ronde, Imnaha, Tucannon, and Salmon River Basins. Redd counts and estimates of parr and smolt densities generally indicate that fish production is well below the potential, and continuing to decline.

Despite fluctuations in the number of adult returns, the general trend in adult returns since 1977 has been a gradual population decline with episodic oscillations (McClure et al. 2003). Chinook salmon numbers were higher since 2000 than during the 24 previous years of record (Fish Passage Center 2004). Although there were record returns in 2000 and 2001, and relatively high returns from 2002 to 2004, ESU numbers are in general very low in comparison to historic levels (Beven et al. 1994). Average returns of adult Snake River spring/summer Chinook salmon (averaging 3,314 over a recent 10-year period) are also low in comparison to interim target species recovery levels of 44,766 for the Snake River Basin. The low returns amplify the importance that a high level of protection be afforded to each adult Chinook salmon, particularly because a very small percentage of salmon survive to the life stage of a returning, spawning adult, and because these fish are in the final stage of realizing their reproductive potential (approximately 2,000 to 4,000 progeny per adult female) (Behnke 2002).

Habitat impairment is common in the range of this ESU. Spawning and rearing habitats are impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation (NMFS 2004a). Mainstem Columbia River and Snake River hydroelectric developments have altered flow regimes and estuarine habitat, and disrupted migration corridors (Raymond, 1979; NMFS 2000). Competition between natural indigenous stocks of spring/summer Chinook salmon and spring/summer Chinook of hatchery origin has likely increased due to an increasing proportion of naturally reproducing fish of hatchery origin (Behnke 2002).

Compared to the greatly reduced numbers of returning adults for the last several decades, exceptionally large numbers of adult Chinook salmon returned to the Snake River drainage in 2000 and in 2001. These large returns are thought to be a result of favorable ocean conditions (Logerwell *et al.* 2003; Meeings and Lackey 2005), and above average flows in the Columbia River Basin when the smolts migrated downstream. These large returns are only a fraction (5% to 10%) of the estimated returns of the late 1800s (Behnke 2002). Recent increases in the population are not expected to continue, and the long-term trend for this species indicates a decline. Detailed information on the range-wide status of Snake River spring/summer Chinook salmon under the environmental baseline is described in Chinook salmon status reviews (Myers *et al.* 1998; BRT 2003; NMFS 2004a). Habitat improvements would not necessarily correspond to increased salmon productivity because a myriad of other factors can still depress populations, but diminished quality would probably correspond to reduced productivity (Regetz 2003). Additional information on the biology, status, and habitat elements for Snake River spring/summer Chinook salmon is described in the status review updates (BRT 1998, 2003; NMFS 2004a; Good *et al.* 2005).

The status of Snake River spring/summer Chinook salmon in the Upper Salmon River Basin was evaluated in a comprehensive manner by the USFS, in the description of the environmental

baselines for the 1994 watershed-scale BAs for the anadromous salmonid fourth field hydrologic unit codes (HUCs) (USDA Forest Service [USFS]1993). More recently, NMFS and its Federal partners updated the status of the Snake River spring/summer Chinook salmon ESU by identified Interior Columbia Basin Technical Recovery Team (ICBTRT) populations and for each fifth field HUC for the remand of the Federal Columbia River Power Systems (FCRPS) Opinion (Cooney 2004; NMFS 2004a; ICBTRT 2005). The Idaho Department of Fish and Game (IDFG) conducts annual aerial and ground-based redd counts throughout the Upper Salmon River Basin and provides some estimates of parr-to-smolt survival from various pit-tag studies (StreamNet 2007).

Within the Snake River spring/summer Chinook salmon ESU, independent populations have been grouped into larger aggregates that share similar genetic, geographic (or hydrographic), and/or habitat characteristics (ICBTRT 2005; McClure et al. 2003). This ESU was broken down into five Major Population Groups (MPGs) with 31 extant independent populations. These MPGs consist of the Lower Snake, Grande Ronde/Imnaha, South Fork Salmon, Middle Fork Salmon, and the Upper Salmon. The project is located in the Upper Salmon MPG, which is further delineated into nine independent populations (Table 4).

Chinook salmon from Big Deer, Panther, Deep, and Moccasin Creeks are part of the historic Panther Creek population (ICBTRT 2005; NMFS 2006b). Williams Creek, Perreau Creek, and the mainstem Salmon River are included in the Lower Salmon Chinook salmon population (ICBTRT 2005; NMFS 2006b).

The ICBTRT determined that the Panther Creek Chinook salmon population was extirpated during the 1960s due to legacy mining and the heavy metal wastes deposited in Lower Panther Creek from the Blackbird Mine operations (ICBTRT 2003; ICBTRT 2005). Near the mouth of Panther Creek, a chemical barrier formed that prevented anadromous fish passage and eventually caused the demise of the Panther Creek Chinook salmon population. Recovery has been slow, but Chinook salmon redds were observed downstream of the Blackbird Mine again in Panther Creek in 1990 and 1991 (IDEQ 2001). In June and July 2001, the IDFG planted 1,064 Chinook salmon adults at four sites in Panther Creek for harvest. In the fall of 2001, over 80 redds were observed in Panther Creek and were suspected to be attributed to the planted fish. Chinook salmon have since been observed spawning in Panther Creek as far upstream as Moyer Creek in 2005, 2006, and 2007 (USDA Forest Service 2007).

The Lower Salmon River Chinook population contains both spring and summer run Chinook. This population does not currently meet viability criteria because neither abundance/productivity risk nor spatial structure/diversity risk meets the criteria for a viable population. The 20-year delimited recruit per spawner point estimate is above replacement (1.25), but less than the 1.45 required at the minimum threshold abundance. The 10-year geometric mean abundance (123) is only 6% of the minimum threshold abundance. Substantial improvements in abundance/productivity status (reduction of risk level) will need to occur before the population can be considered viable. Also, the population currently does not meet the criteria for a “maintained” population (NMFS 2006b).

The current status of the MPG was determined by applying the ICTRT's six MPG-level viability criteria (ICTRT 2005). Viability assessments for all populations in the MPG were completed before considering the MPG-level criteria. Assessment of abundance/productivity risk level has not been completed for the North Fork Salmon River and Panther Creek populations.

Table 4. Characteristics of independent populations in the Upper Salmon River Spring/summer Chinook MPG.

Population	Extant/ Extinct	Size	Threshold Abundance	Minimum Productivity
North Fork Salmon River	Extant	Basic	500	1.90
Lemhi River	Extant	Very Large	2,000	1.2
Salmon River Lower Mainstem	Extant	Very Large	2,000	1.2
Pahsimeroi River	Extant	Large	1,000	1.45
East Fork Salmon River	Extant	Large	1,000	1.45
Yankee Fork Salmon River	Extant	Basic	500	1.90
Valley Creek	Extant	Basic	500	1.90
Salmon River Upper Mainstem	Extant	Large	1,000	1.45
Panther Creek	Extinct	Intermediate	1,000	1.2

Note – Minimum abundance and productivity values represent levels needed to achieve a 95% probability of persistence over 100 years. Shaded populations or portions of those populations occur in non-wilderness portions of the SCNF and within the action area.

The Upper Salmon River MPG currently does not meet MPG-level viability criteria. For the MPG to be considered viable, a minimum of five of the nine independent populations in the MPG must be considered viable. Currently, none of the nine populations in the MPG meet population level viability criteria. For a detailed discussion and updates regarding the status and viability of Snake River spring/summer Chinook salmon and its independent populations, please refer to the following website: <http://www.idahosalmonrecovery.net/>.

Within the action area, Chinook salmon have only been documented in the mainstem Salmon River and Panther Creek (USDA Forest Service 2007; Kuzis 2004).

Snake River Steelhead - The Snake River Basin steelhead DPS, listed as threatened on August 18, 1997 (62 FR 43937), includes all natural-origin populations of steelhead in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. One of the hatchery stocks (originating from Dworshak Reservoir) in the basin is listed under the B-Run Program (Pollard, personal communications 2004), and six hatchery stocks are included in the DPS under the 2005 NMFS hatchery stock policy (June 28, 2005, 70 FR 37204). Although Snake River Basin steelhead were originally listed as a threatened ESU, they were recently reclassified as a threatened DPS (January 5, 2006; 71 FR 834).

The Snake River basin is believed to have produced up to half of the steelhead in the Columbia River basin historically, but natural runs have been declining in abundance over the past several

decades (BRT 2003). Counts of wild and hatchery-origin steelhead returning to the Snake River basin declined sharply in the early 1970s, increased modestly from the mid 1970s through the 1980s, and declined again during the 1990s (Fish Passage Center 2004).

With a few exceptions, recent annual estimates of steelhead returns to specific production areas within the Snake River are not available. Annual return estimates are limited to counts of the aggregate returns over Lower Granite Dam. Returns to Lower Granite Dam remained at relatively low levels through the 1990s. The 2001 run size at Lower Granite Dam was substantially higher relative to the 1990s. The 2002 through 2006 return years have declined annually but continue to remain higher than the 1990s return years. Although steelhead numbers have dramatically increased, wild steelhead have comprised only 10% to 23% of the total returns since 1994. Consequently, the large increase in fish numbers does not reflect a change in steelhead status based on historic levels. The long-term trend for this species indicates a decline. The recent 5-year (2002 to 2006) mean abundance (40,941 natural returns) is approximately 79% of the interim recovery target level. This is a dramatic increase over the previous 5-year (1997 to 2001) mean abundance level of 19,717 fish counted at Lower Granite Dam.

Significant factors contributing toward declining steelhead populations include mortality associated with the mainstem dams along the Columbia and Snake Rivers, losses from harvest, loss of access to more than 50% of their historic range, and degradation of habitats used for spawning and rearing (NMFS 2004b). Possible genetic introgression from hatchery stocks is another threat to this DPS since wild fish comprise such a small proportion of the populations (Behnke 2002). Detailed information on the current range wide status of Snake River Basin steelhead, under the environmental baseline, is described in the steelhead status review (Busby et al. 1996), the status review update (BRT 2003), and the DPS listing (January 5, 2006, 71 FR 834).

The ICBTRT identified 29 independent populations in the Snake River Basin steelhead DPS, grouped into six MPGs (NMFS 2006c). Of the 29 populations, 25 are extant, three extirpated, and one (North Fork Clearwater), blocked from its historic habitat. Steelhead in the action area are included in the Salmon River MPG, which includes twelve independent populations (Table 5). Eight of these populations are classified as supporting A-run steelhead and four are classified as supporting B-run steelhead. Population size designations, based on intrinsic potential habitat, range from Basic to Large (NMFS 2006c). The Panther Creek and Pahsimeroi populations occur within the action area.

The Panther Creek steelhead population is found in the Panther Creek drainage, an area encompassing Big Deer Creek, Deep Creek, and Moccasin Creek in the action area. As an intermediate sized population, the ICBTRT recommends a minimum abundance threshold of 1,000 naturally produced spawning adults to produce a sufficient intrinsic productivity to achieve a 5 % or less risk of extinction over 100 years. The ICBTRT has identified one major spawning area and three minor spawning areas within the Panther Creek steelhead population. Panther, Big Deer, Moccasin, and Deer Creeks are located within the major spawning area identified for the Panther Creek population. Although the ICBTRT does not document any of these streams in the current spawning range for the population, each of these streams has been identified as having high intrinsic potential for spawning (ICBTRT 2005).

Table 5. Characteristics of independent populations in the Salmon River steelhead MPG.

Population	Extant/ Extinct	Life History	Size	Threshold Abundance	Minimum Productivity
Little Salmon River	Extant	A-Run	Intermediate	1,000	1.2
South Fork Salmon	Extant	B-Run	Intermediate	1,000	1.2
Secesh River	Extant	B-Run	Basic	500	1.4
Chamberlain Creek	Extant	A-Run	Intermediate	1,000	1.2
Lower Middle Fork	Extant	B-Run	Large	1,500	1.13
Upper Middle Fork	Extant	B-Run	Large	1,500	1.13
Panther Creek	Extant	A-Run	Intermediate	1,000	1.2
North Fork Salmon	Extant	A-Run	Basic	500	1.4
Lemhi	Extant	A-Run	Intermediate	1,000	1.2
Pahsimeroi River	Extant	A-Run	Intermediate	1,000	1.2
East Fork Salmon	Extant	A-Run	Intermediate	1,000	1.2
Upper Salmon Mainstem	Extant	A-Run	Intermediate	1,000	1.2

Note – Minimum abundance and productivity values represent levels needed to achieve a 95% probability of persistence over 100 years. Shaded populations or portions of those populations occur in non-wilderness portions of the SCNF and within the action area.

Aquatic habitat in the Panther Creek drainage has been severely degraded through mining activity, substantially affecting the presence and distribution of steelhead within the population. The current range of the population is significantly reduced from historic conditions. Loss of occupancy in the single major spawning area, which contained approximately 67% of the historic intrinsic potential habitat, has reduced occupancy to only 33% of the historic range. The population does not currently meet the ICBTRT viability criteria for abundance/productivity risk (moderate risk) or spatial structure/diversity (high risk). However, because there is only one major spawning area in the population, the lowest risk level this population will be able to achieve is Moderate (ICBTRT 2005).

The Pahsimeroi River steelhead population includes the Pahsimeroi River, and the mainstem Salmon River and its tributaries from the Pahsimeroi River downstream to its confluence with the Lemhi River. Williams Creek and Perreau Creek are included in this population. The ICBTRT has identified three major spawning areas and two minor spawning areas within the Pahsimeroi River steelhead population. Williams Creek is classified as having a high intrinsic potential for steelhead spawning, and is located within one of the two identified minor spawning areas for the population. Neither the mainstem Salmon River reach in the action area nor Perreau Creek were included as part of a spawning area or rated as having any intrinsic potential for spawning (ICBTRT 2005).

Like Panther Creek, habitat is degraded in Perreau Creek due to historic and more recent mining during the 1980s (IDEQ 2001). The lower ends of Perreau and Williams Creeks are seasonally disconnected from the Salmon River due to water withdrawals and by agricultural irrigation

diversions. Although spawning has not been reported recently for this population in the action area, the population is rated at a moderate risk because of spawning activity in the three major spawning areas in the Pahsimeroi River watershed. The Pahsimeroi River steelhead population does not currently meet viability criteria because abundance/productivity risk has been rated as moderate risk. Improvement in abundance/productivity status will need to occur before the population can be considered viable (ICBTRT 2005).

Considering population viability assessments completed for all 12 populations in the MPG, the Salmon River steelhead MPG currently does not meet MPG-level viability criteria. For the MPG to be considered viable, a minimum of six of the 12 extant independent populations in the MPG must be considered viable. The current recovery planning objective for the MPG is for the Chamberlain Creek, Secesh River, South Fork Salmon, Upper Middle Fork Salmon River, and Upper Salmon River Mainstem populations (plus one additional Large or Intermediate population) to be rated as viable. One must be rated as highly viable. Currently, none of the 12 extant populations in the MPG meet population level viability criteria (NMFS 2006c). For a detailed discussion and updates regarding the status and viability of Snake River Basin steelhead and its independent populations, please refer to: <http://www.idahosalmonrecovery.net/>.

Within the action area, steelhead have been documented in the mainstem Salmon River, Deep Creek, Little Deer Creek, lower Big Deer Creek, Blackbird Creek, and Panther Creek (USDA Forest Service 2007; Kuzis 2004).

2.1.1.2. Status of Critical Habitat.

NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of primary constituent elements (PCEs) throughout the designated area. The PCEs consist of the physical and biological features identified as essential to the conservation of the listed species in the documents that designate critical habitat (Table 6).

At the time that each habitat area was designated as critical habitat, that area contained one or more PCEs within the acceptable range of values required to support the biological processes for which the species use that habitat. Of the six types of sites identified by NMFS and discussed above, the action area for this consultation provides freshwater spawning, rearing and migration habitat for Snake River spring/summer Chinook salmon and Snake River Basin steelhead.

The action area also provides adult and juvenile migratory habitat for Snake River sockeye salmon. Sockeye salmon spawning and rearing habitat in the action area is currently limited to Petit, Alturas, and Redfish Lakes and their inlet and outlet streams. Therefore, sockeye salmon spawning and rearing habitat will not be influenced by the proposed action. Sockeye salmon migratory critical habitat would only be affected if a spill occurs alongside the mainstem Salmon River. Because NMFS considers the risk of adverse effects from spills occurring along U.S. Highway 93 to be discountable, adverse effects to the migration PCE for sockeye salmon are not expected, and NMFS concurs with the USFS determination of “not likely to adversely affect” sockeye salmon designated critical habitat. Consequently, effects to sockeye salmon critical habitat will not be further discussed in this Opinion.

The essential features associated with the freshwater spawning, rearing and migratory sites potentially affected by this action include water quality, water quantity, substrate/spawning gravels, forage/food, riparian vegetation, and access/safe passage.

Table 6. Types of sites and essential physical and biological features designated as PCEs, and the species life stage each PCE supports.

Site	Essential Physical and Biological Features	ESA-listed Species Life Stage
Snake River Steelhead^a		
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity & floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
	Water quality and forage ^b	Juvenile development
	Natural cover ^c	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover ^c	Juvenile and adult mobility and survival
Snake River Spring/summer Chinook Salmon		
Spawning & Juvenile Rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation , and space	Juvenile and adult.
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food ^d , riparian vegetation, space, safe passage	Juvenile and adult.
Snake River Sockeye Salmon		
Spawning & Juvenile Rearing	Spawning gravel, water quality and quantity, water temperature , food, riparian vegetation , and access	Juvenile and adult.
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food ^d , riparian vegetation, space, safe passage	Juvenile and adult.

a Additional PCEs pertaining to estuarine, nearshore, and offshore marine areas have also been described for Snake River steelhead. These PCEs will not be affected by the proposed action and have therefore not been described in this Opinion.

b Forage includes aquatic invertebrate and fish species that support growth and maturation.

c Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

d Food applies to juvenile migration only.

Snake River Spring/Summer Chinook Salmon Critical Habitat - Critical habitat was designated for Snake River spring/summer Chinook salmon on December 28, 1993 (58 FR 68543), and was revised on October 25, 1999 (64 FR 57399). Critical habitat is designated in the Upper Salmon River basin to include all river reaches presently or historically accessible to

Snake River spring/summer Chinook salmon. Critical habitat includes the stream bottom, the water, and the adjacent riparian zone, which is defined as the area within 300 feet of the line of high water of a stream channel or from the shoreline of a standing body of water.

Habitat impairment is common in the range of this ESU, including the SCNF. Spawning and rearing habitats have been impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation. According to the ICTRT, the Panther Creek population was extirpated because of legacy and modern mining-related pollutants creating a chemical barrier to fish passage (Chapman and Julius 2005). Mainstem Columbia and Snake River hydroelectric developments have altered flow regimes and estuarine habitat, and disrupted migration corridors.

During all life stages spring/summer Chinook salmon require cool water that is relatively free of contaminants. Water quality impairments in the designated critical habitat of this ESU include inputs from fertilizers, insecticides, fungicides, herbicides, surfactants, heavy metals, acids, petroleum products, animal and human sewage, dust suppressants (e.g., magnesium chloride), radionuclides, sediment in the form of turbidity, and other anthropogenic pollutants. Pollutants enter the surface waters and riverine sediments from the headwaters of the Salmon River as contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in salmon tissue. This species also requires rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Within the action area, Chinook salmon designated critical habitat occurs in the mainstem Salmon River, mainstem Panther Creek, Blackbird Creek, lower Big Deer Creek, and Deep Creek.

Snake River Basin Steelhead Critical Habitat - Critical habitat for Snake River Basin steelhead was designated on September 2, 2005, with an effective date of December 31, 2005 (70 FR 52630). Critical habitat on the SCNF includes significant reaches in the Middle Fork Salmon and Upper Salmon River basins; Table 21 in Federal Register details the streams within the Snake River Basin steelhead geographical range but excluded from critical habitat designation. Designated critical habitat for the Snake River Basin steelhead only includes the stream channel, with a lateral extent as defined by the ordinary high-water line.

The Snake River Basin Critical Habitat Analytical Review Team (CHART) concluded that all occupied areas contain spawning, rearing, or migration PCEs for this species. The CHART concluded that many of the watersheds within the SCNF have high conservation values. The complex life cycle of steelhead gives rise to complex habitat needs, particularly during the freshwater phase (Spence *et al.* 1996). Spawning gravels must be of a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juvenile steelhead need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads and boulders in the stream, and

beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off channel areas) and from warm summer water temperatures (coldwater springs, cool tributaries, and deep pools). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juvenile steelhead, the adults also require cool water and places to rest and hide from predators.

Like Chinook salmon, steelhead require cool water that is relatively free of contaminants during all life stages. Water quality impairments previously identified for Chinook salmon also occur across the range of Snake River Basin steelhead. Steelhead require rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

The CHART identified several management activities that have affected the PCEs in the designated critical habitat on the SCNF, including grazing, irrigation impoundments and withdrawals, mineral mining, and road building and maintenance. Mining and roads have affected the PCEs in many parts of the basin including the action area (NMFS 2005).

Within the action area, steelhead designated critical habitat occurs in the mainstem Salmon River, mainstem Panther Creek, lower Williams Creek, lower Big Deer, lower Little Deer, and Deep Creek, from the mouth upstream to its confluence with Little Deep Creek.

A more thorough discussion of the present condition of PCEs within designated critical habitat areas and the human activities that affect PCE trends are further described in the environmental baseline section of this Opinion.

2.1.2. Environmental Baseline

The ‘environmental baseline’ includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). An environmental baseline that does not meet the biological requirements of a listed species may increase the likelihood that adverse effects of the proposed action will result in jeopardy to a listed species or in destruction or adverse modification of a designated critical habitat.

NMFS describes the environmental baseline in terms of the biological requirements for habitat features and processes necessary to support all life stages of each listed species within the action area. The biological requirements of salmon and steelhead in the action area vary depending on the life history stage present and the natural range of variation present within that system (Groot and Margolis 1991; NRC 1996; Spence et al. 1996). During spawning migrations, adult salmon generally require clean water with cool temperatures and access to thermal refugia, DO near 100% saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Fish select spawning areas based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling.

Embryo survival and fry emergence depend on substrate conditions (e.g., gravel size, porosity, permeability, and oxygen concentrations), substrate stability during high flows, and cold water temperatures (i.e., 55°F or less for most species). Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration of juveniles to rearing areas, whether the ocean, lakes, or other stream reaches, requires unobstructed access to these habitats. Physical, chemical, and thermal conditions may all impede migrations of adult or juvenile fish.

Each ESA-listed species considered in this Opinion resides in or migrates through the action area. Thus, for this action area, the biological requirements for salmon and steelhead are the habitat characteristics that support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development to smoltification. The habitat features likely to be affected by the proposed actions are water quality, water quantity, substrate, passage, and riparian vegetation.

The ICP site is mostly located on flat-topped mountains and moderate to steep V-shaped canyons at elevations ranging from 6,100 to 8,100 feet. The site is drained by Little Deer, Bucktail and Big Flat Creeks. Bucktail Creek flows into South Fork Big Deer Creek, Big Deer Creek, and Panther Creek. Big Flat and Little Deer Creeks flow directly into Panther Creek.

Most water sources in and around the ICP project area are affected by some degree by past mining activities and ongoing cleanup activities associated with the Blackbird Mine, an inactive mine located adjacent to the ICP (Appendix A, Figures 1 and 2). The Blackbird Mine site covers approximately 830 acres of private patented mining claims and 10,000 acres of unpatented mining claims within the SCNF. Mining activity resulted in about 14 miles of underground workings, a 12-acre open pit, 4.8 million tons of waste rock deposited in numerous piles, and 2 million tons of tailings disposed at a tailings impoundment (Hydrometrics 2006).

The Blackbird Mine site spans the Bucktail Creek and Meadow/Blackbird Creek drainages. These drainages flow into Panther Creek. Acid rock drainage from the waste rock piles, the underground workings, the tailings impoundment, and tailings deposited along streams have resulted in the release of elevated levels of hazardous substances to the environment (groundwater, surface water, and soils), including but not limited to copper, cobalt, and arsenic. These releases have contributed to elevated levels of dissolved copper and cobalt in Panther Creek and some of its tributaries. Contaminated soil, sediments, waste rock, and tailings were also released from the Blackbird Mine site during high water flows from thunderstorms and snowmelt and deposited in soil along the banks of downstream creeks (referred to as overbank deposits/soil) including Panther Creek and its tributaries (Hydrometrics 2006).

Several actions have been conducted and are ongoing at the Blackbird Mine site to address the release of contaminants and the effects to natural resources that resulted from the releases. Response actions at the site have included emergency actions to address imminent releases from the West Fork Tailings Impoundments; non time-critical removal actions conducted in the Bucktail Creek, Meadow/Blackbird Creek, and Panther Creek; and investigations and studies to complete the Remedial Investigations/Feasibility Study. A Record of Decision (ROD) for the site was issued in February 2003 by the EPA, and the BMSG is currently implementing the

remedy outlined in the ROD under a Unilateral Administrative Order issued by the EPA. Although there have been significant improvements in surface water and sediment quality as the result of ongoing cleanup actions, streams in the area of the Blackbird Mine and the ICP continue to exceed water quality standards as the result of historic mining at the Blackbird Mine Site (Hydrometrics 2006). The ICP POO does not authorize operations that will adversely affect the Blackbird Mine Superfund Site remedial or restoration activities, or damage to any Blackbird Mine Superfund Site remedial or restoration infrastructure by the plan operator or its agents, employees, or contractors. Actions that result in adverse impacts to the Blackbird Mine Superfund Site remedial or restoration activities shall constitute non-compliance with the POO.

In evaluating current condition and potential future trends, it's also important to note that in July, 2000, a lightning-caused wildfire began in the Clear Creek subwatershed that became one of the largest wildfires in Idaho's recent history. The Clear Creek Fire covered approximately 206,379 acres in the heart of the Panther Creek watershed. The fire was considered stand replacing within the proposed ICP project area including the upper Big Flat, Big Deer Creek, and Blackbird Mine areas (IDEQ 2001). Thus the current conditions are changing as the landscape recovers from the fire. In addition, following the fire, there was a series of high intensity rain/thunderstorm events that initiated a series of debris flows and slides affecting Panther Creek.

Aquatic habitat conditions have been extensively sampled in the ICP project area. The FCC funded Aquatic Baseline studies in 2001, 2002 and 2004, as well as summarizing existing aquatic information (Kuzis 2004). In addition, the BMSG-funded aquatic surveys completed in 2002, 2003, and 2005 (Stantec 2004; Ecometrix 2006). Baseline conditions within the action area were evaluated for the Project at the watershed scale. The SCNF based its evaluation of the environmental baseline on the "matrix of pathways and indicators" (NMFS 1996). This method assesses the current condition of instream, riparian, and watershed factors that collectively provide properly functioning aquatic habitat essential for the survival and recovery of the ESA-listed species. The environmental baseline will be described in more detail for each watershed in the action area below.

2.1.2.1. Panther Creek

Panther Creek is a fifth order stream draining about 529 square miles of the Salmon River Mountains in east-central Idaho. Stream flow patterns are typical snowmelt runoff driven, with peaks in May or June and lows in fall and winter. Average annual flow at the mouth of Panther Creek is about 265 cubic feet per second (cfs) with mean monthly flows ranging from 83 to 136 cfs (IDEQ 2001). There is a main access road paralleling most of the length of Panther Creek.

Historically, Chinook salmon spawned in Panther Creek. However, the Chinook runs began to decline about 1940 and dropped following development of the Blackbird Mine. Extensive fish kills occurred in Panther Creek during March, April, and July of 1954 (USFS 1993). An annual average of 51 Chinook redds were counted in Panther Creek between 1954 and 1962 (IDFG 1965). Redd counts were discontinued after 1967 and no redds were observed during periodic field checks from 1968 to 1977 (Platts et. al. 1979). In the late 1980's and early 1990's Chinook

salmon redds and juveniles were occasionally observed in the lower reaches of Panther Creek (USFS 1993), but water quality conditions from Blackbird Creek prevented migration to the upper portions of Panther Creek. Panther Creek from Blackbird Creek to Napias Creek is on the IDEQ 303(d) list of impaired surface waters for metal, copper and unknown toxicity (IDEQ 2003).

In June and July 2001 IDFG planted 1,064 adult Chinook salmon for harvest in four sites along Panther Creek. In the fall of 2001 IDFG and the Shoshone Bannock Tribe conducted spawning surveys and over 80 redds were observed (Kuzis 2004). It is likely the Chinook observed spawning were fish that had been planted in Panther Creek. Surveys completed in May 2003 found juvenile Chinook indicating there has been successful reproduction (Stantec 2004). In 2005, the IDFG conducted a helicopter redd survey in September. The survey was an index flight and not a total count of redds in the target area. Eighteen salmon redds were identified on Panther Creek in the survey, with seven located between Moyer Creek and Blackbird Creek, eight between Blackbird Creek and Big Deer Creek, and three between Big Deer and Clear Creek. The IDFG biologists noted that visibility conditions were not ideal, and that the actual number of redds present could be slightly greater than the 18 identified in the survey (Ecometrix 2006). Some of the spawning Chinook salmon observed in 2005 may have been returns from those produced by stocked adults in 2001.

The BA states that it's currently unknown if the rainbow trout in Panther Creek are actually steelhead. Historically, Panther Creek had Chinook salmon and steelhead habitat (USFS 2005). Therefore, rainbow trout in Panther Creek are assumed to be steelhead for purposes of this consultation.

Habitat is generally "functioning at unacceptable risk" in the Panther Creek watershed. Only streambank stability, floodplain connectivity, RHCAs, and the increase in drainage network matrix indicators are "functioning appropriately" in the watershed. Sediment, refugia, and peak/baseflows are "functioning at risk." All other matrix indicators were rated "functioning at unacceptable risk" for the Panther Creek watershed. Of note, Panther Creek is listed on the 303(d) list from Blackbird Creek to the confluence of Napias Creek for metals and copper contamination. Also, although there are no physical migration barriers in Panther Creek, water quality problems below Blackbird and Big Deer Creeks essentially blocked migration up and down Panther Creek in the past. Fisheries survey data and water quality monitoring results suggest that this situation is reportedly improving (USFS 2005).

2.1.2.2. Big Deer Creek

Big Deer Creek is a tributary to Panther Creek, draining an area of roughly 44 square miles. A natural cascade is located about 0.7 miles upstream from its mouth blocking upstream fish passage. The Big Deer Creek watershed is a third order stream draining Blackbird Mountain to the south and Gant Ridge to the north. South Fork Big Deer Creek and Bucktail Creek are also found within the watershed. The streams headwaters originate in the Frank Church River of No Return Wilderness. The average annual discharge in Big Deer Creek is approximately 36 cfs,

with peak flows averaging 144 cfs in June and low flows averaging 11 cfs in January (IDEQ 2001). Portions of lower Big Deer Creek between Panther Creek and South Fork Big Deer were burned in the Clear Creek fire.

This watershed has been impacted by historic mining activities. Waste rock and tailings from the Blackbird Mine site drain into Bucktail Creek which discharges chemically polluted water into South Fork Big Deer Creek. Copper and iron concentrations in Big Deer Creek below the South Fork have exceeded the lethal limits for most forms of aquatic life (USFS 1993). However, ongoing clean-up efforts and remediation activities including collection and storage of contaminated water from Bucktail Creek for treatment at the Blackbird Creek drainage collection pond have significantly improved water quality conditions. The 303(d) list identifies Big Deer Creek from the confluence of South Fork Big Deer Creek to Panther Creek as water quality limited for sediment, pH, and metals. Bucktail Creek is on the 303(d) list from its source to its confluence with South Fork Big Deer Creek for metals contamination (IDEQ 2003).

There are no roads along Big Deer Creek. However, there is a tertiary access road that parallels a short section of South Fork Big Deer Creek just upstream from the confluence of Bucktail Creek, and several old mining roads cross through the headwaters of Bucktail Creek. After a slide into Bucktail Creek, three dams were constructed across Bucktail Creek. Water from the upper impoundment is pumped back through the mountain to the water treatment plant located in the headwaters of Blackbird Creek. The lower two dams were constructed to trap sediment along Bucktail Creek during the construction of the upper pump back impoundment. Sediment from these dams is cleaned out every few years (USFS 2005).

Big Deer Creek above the confluence with the South Fork has had little if any disturbance and provides suitable spawning and rearing habitat for resident bull trout, redband/rainbow, and westslope cutthroat trout. Fish population sampling in Big Deer Creek in 2001 (Kuzis 2004), 2003 (Stantec 2004), 2005 (Ecometrix 2006; USDA Forest Service 2007) found only redband/rainbow trout or cutthroat trout. In general, there were very few fish downstream of the confluence with South Fork Big Deer Creek. The lack of fish below the South Fork reflects the ongoing impacts of chemically contaminated water. The 2005 USFS survey crew sampled above and below the Big Deer cascade and found westslope cutthroat trout above the falls, and rainbow/steelhead trout below the falls (USDA Forest Service 2007). Big Deer Creek is not considered spawning habitat for Chinook salmon due to the steep cascade/falls located 0.7 miles upstream from the mouth of Big Deer Creek and degraded water quality associated with the Blackbird mining activities (USFS 2005). It is not known if steelhead spawn in Big Deer Creek. However, due to the presence of rainbow/ steelhead, NMFS assumes that both Chinook salmon and steelhead can and do rear in this lower 0.7 miles.

Habitat is generally “functioning at unacceptable risk” in the Big Deer Creek watershed. Only physical barriers, streambank stability, floodplain connectivity, large woody debris (LWD), RHCAs, and the increase in drainage network matrix indicators are “functioning appropriately” in the watershed. Sediment and peak/baseflows are “functioning at risk.” All other matrix indicators were rated “functioning at unacceptable risk” for the Big Deer Creek watershed. The IDEQ 303 (d) listed segments include: (1) Big Deer Creek, from the confluence of the South

Fork downstream to Panther Creek for sediment, pH, and metals; (2) South Fork Big Deer Creek from its confluence with Bucktail Creek to Big Deer Creek for metals contamination; and (3) Bucktail Creek from its source to its confluence with the South Fork for metals contamination (IDEQ 2003).

2.1.2.3. Little Deer Creek

Little Deer Creek is a second order stream draining the ICP site which flows to the northeast into Panther Creek. The watershed has a drainage area of 6.2 square miles. There are no 303(d) listed stream segments for Little Deer Creek (IDEQ 2003). The entire upper portion of the Little Deer drainage was severely burned in the Clear Creek fire. As a result, during a storm event in October 2000, the Little Deer Creek channel destabilized and unraveled. Most of the streambank vegetation was burned in the fire and it appeared that woody debris jams in the channel had come apart. There were long stretches of deep (>5 foot) downcuts and areas of overland mud flows where the channel spread out and there was no distinct thalweg. In the 2004 sampling effort there had been significant regrowth of riparian vegetation and clear channels were becoming established (Kuzis 2004).

There are no roads or other development in the Little Deer drainage. The proposed ICP project would add less than 1/2 mile of new roads in the headwaters of Little Deer Creek. Activities proposed in this drainage would be located far from any channels and riparian areas in the watershed. Juvenile Chinook were collected in the lowest reaches of Little Deer Creek in 2002 (USFS 2005).

Habitat is generally “functioning at risk” in the watershed. Although sediment, physical barriers, floodplain connectivity, increase in drainage network, and RHCAs are “functioning appropriately,” all other indicators are either “functioning at risk” (LWD, peak/baseflows, road density/location, disturbance regime) or “not properly functioning” (all others).

2.1.2.4. Big Flat Creek

Big Flat Creek is a 3-mile long, second order tributary to Panther Creek, and the primary drainage from the ICP site. Big Flat Creek has a drainage area of 1.6 square miles, and an average stream gradient of 21%. Approximately a quarter of the total length of Big Flat Creek has a gradient of 30% or higher. In addition, over 80% of Big Flat Creek is a highly confined valley with steep valley walls.

Much of the Big Flat drainage was burned severely in the 2000 Clear Creek fire and almost all riparian vegetation was burned. There has been substantial recovery of understory shrubs as noted in the 2004 Macroinvertebrate Sampling report.

Big Flat Creek has one road crossing, located in the headwaters and within the project area. About 2,000 feet below the road crossing, near upper Big Flat Creek, the channel is covered with loose rock and scree from the canyon walls. Flows are almost entirely subsurface at this location

and, in some places, flowing water can be heard under the rocks for significant stretches (Kuzis 2005). Because of the subsurface flows, Big Flat Creek contains no fish habitat, and no matrix of pathways and indicators was created for this drainage. There are no stream segments for Big Flat Creek listed on the IDEQ 303(d) list.

2.1.2.5. Blackbird Creek

Blackbird Creek is a second order tributary to Panther Creek. Mean annual flow in Blackbird Creek is 12 cfs, with mean monthly discharge ranging from 4 cfs to 48 cfs (IDEQ 2001). Blackbird Creek is on the IDEQ 303(d) list from Blackbird Reservoir to its confluence with Panther Creek for sediment, pH, and metals contamination (IDEQ 2001).

The water quality in Blackbird Creek is impaired due to Blackbird Mine which was a major supplier of cobalt during World War II. Operations at the mine ceased in 1982 and the site is now undergoing regulated cleanup. The site is divided by a ridge into two drainage basins: the Big Deer Creek basin to the north, and the Blackbird Creek basin to the south (including Meadow, West Fork Blackbird, and Blackbird Creeks). Disturbance due to historic mining is spread over approximately 830 acres of primarily private patented mining claims but includes areas of unpatented claims on National Forest. The Blackbird Creek watershed has the highest density of roads in the entire Panther Creek drainage.

The area is undergoing a remediation cleanup, with the EPA as the lead agency, that includes removal of mill facilities, expansion of a water treatment facility, capping of waste rock, and removal of tailings from along streambanks and impoundments. Cleanup activities are still occurring and agreements between the agencies and companies are ongoing to meet cleanup goals. The majority of the activities for the cleanup have occurred on patented lands (784 acres).

Only the lower 2 miles of Blackbird Creek have suitable gradients for steelhead and Chinook salmon spawning and rearing. The habitat conditions in Blackbird Creek have historically been poor, due to chemical pollution from leaching, streambank degradation, low numbers of pools, low amounts of LWD, and high stream temperatures (USFS 1993). However, surveys completed in 2003 found juvenile Chinook salmon and bull trout in the lower 100 yards of Blackbird Creek indicating that conditions have improved significantly (Stantec 2004).

Habitat is generally “functioning at unacceptable risk” in the Blacktail Creek watershed. Only the increase in drainage network pathway is considered to be “functioning appropriately” in the watershed. The LWD, refugia, width to depth ratio, floodplain connectivity, and change in peak/base flow indicators are “functioning at risk” in the watershed. All other matrix indicators were rated “functioning at unacceptable risk” for the Blacktail Creek watershed.

2.1.2.6. Williams Creek

Williams Creek is a tributary to the Salmon River, with a mean annual flow of 10 cfs, and a range of mean monthly flows from 40 cfs (June) to 3 cfs. During the irrigation season the lower

reaches of the creek may be dewatered although in some years there may be sufficient flow for fish passage (IDEQ 2001). Williams Creek is 16.1 miles long with 4 miles of stream at less than 4% gradient (which are mostly private lands below the Forest boundary), 8.5 miles of stream at gradients between 4% and 10%, and 3.6 miles of gradient greater than 10%.

Forty percent of these stream miles were historically accessible to anadromous fish, including all portions below the Forest boundary and two additional miles on Forest lands. There is no information on the current extent of Chinook use. However, “natural” adult steelhead have been observed in the lower reaches of Williams Creek since the IDFG began planting hatchery outmigrants into the Salmon River at Shoup Bridge.

Habitat is generally “functioning at unacceptable risk” in the Williams Creek watershed, although habitat is generally in worse condition in the lower private reaches than on SCNF lands. Only the sediment, chemical contamination/nutrients, streambank condition, and floodplain connectivity pathways are “functioning appropriately” in the watershed. The temperature, refugia, change in peak/base flow, and increase in drainage network indicators are “functioning at risk.” All other matrix indicators were either trending toward or rated as “functioning at unacceptable risk” for the Williams Creek watershed.

2.1.2.7. Moccasin Creek

Moccasin Creek is a first order tributary to Napias Creek. Moccasin Creek is approximately 7 miles long with an average gradient of 15%. The main access road to the ICP project parallels about 2.5 miles of Moccasin Creek where the gradient averages about 8%. The road confines the creek in a narrow valley. Because the valley is so narrow, the roadfill functions as one of the banks of this small creek. During low flow years, portions of the creek flow subsurface, which has restricted the collection of sediment and water temperature data by the USFS (Kuzis 2004).

Bull trout were the only fish species sampled in Moccasin Creek during 2001 electrofishing surveys (Kuzis 2004). A falls in Napias Creek, located about 0.5 miles from the mouth, has been identified as a complete barrier to upstream distribution for anadromous fish, blocking access to Moccasin Creek.

2.1.2.8. Deep Creek

Deep Creek is a major tributary in the Panther Creek drainage. Mean annual flow in Deep Creek is 20 cfs, with a mean monthly maximum flow at 80 cfs and a minimum flow at 6 cfs (IDEQ 2001). Deep Creek is part of the Deep-Moyer watershed that has been designated in whole or part as a priority watershed in PACFISH for anadromous fish recovery during ESA section 7 consultation for amending the SCNF Forest Plan.

Deep Creek headwaters are fairly steep and transition into deeply cut canyons. Approximately 53% of the length of the 24.4 mile drainage has gradients between 4% and 10%, 43% of the drainage length has gradients less than 4%, and gradients in the remaining 3% exceeding 10%.

The ICP access road parallels the lowest 4.2 miles of Deep Creek. The channel morphology through the project location can be best described as a Rosgen type B2a. The channel is steep and moderately to deeply entrenched. Deep Creek is incised in predominantly small boulder/cobble bed material with lesser amounts of small cobble and gravel materials present. This channel type is a high energy and low sediment supply stream type, with corresponding low bedload transport rates. The channel bed and streambanks are normally stable and contribute little to sediment supply.

Deep Creek supports significant fisheries resources and has been identified as a historic producer of both Chinook salmon and steelhead (NPPC 1991). While numbers of Chinook salmon and steelhead spawners have declined dramatically within the Panther Creek drainage from historical numbers and no Chinook salmon have been observed in Deep Creek in recent years, the stream is still considered a potential anadromous fish production tributary of the Panther Creek system. Deep Creek, to a point near the mouth of Little Deep Creek, is thought to support habitat for steelhead/rainbow trout and Chinook salmon. Currently Deep Creek supports rainbow and/or steelhead trout. No Chinook were observed in lower Deep Creek following IDFG outplants in 2001. Adult steelhead have not been observed spawning in the watershed. Introduced brook trout (*Salvelinus fontinalis*) have been identified in the lowermost reaches of Deep Creek in recent years.

Habitat is generally “functioning at risk” in the Deep Creek watershed. Although temperature, sediment, chemical contamination/nutrients, physical barriers, LWD, width to depth ratio, streambank condition, change in peak/base flows, increase in drainage network, and RHCAs are “functioning appropriately,” all other indicators are either “functioning at unacceptable risk” (pool frequency/quality) or “functioning at risk” (all others).

2.1.3. Effects of the Action

“Effects of the action” means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Effects of the action that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

The potential for mine-related adverse effects on ESA-listed salmon, steelhead, and their critical habitat, varies depending upon a variety of factors. The potential for effects varies based upon site-specific features such as topography, location of the ore bodies, the mining method, toxicity of minerals present, chemicals used, mine management and engineering, haul road location and design, control and disposal of mine wastes, reclamation methods, monitoring effectiveness, proximity of critical habitat, and life stages of fish that may be affected.

The BA provides a detailed analysis of the effects of the proposed action on Snake River spring/summer Chinook salmon and Snake River Basin steelhead. The analysis in the BA uses

NMFS' Matrix of Pathways and Indicators (NMFS 1996) and the information in the BA to evaluate elements of the proposed action that have the potential to affect the listed fish or essential habitat features of their critical habitat.

The potential adverse effects of the proposed action on ESA-listed salmon and steelhead and their critical habitat can be broadly categorized into the following:

1. Fine sediment delivery to critical habitat during and after mine operation;
2. Accidental spill or discharge of toxic substances during and after mine operation;
3. Water quality and quantity issues during mine operation; and,
4. Effects to riparian vegetation in the project area.

2.1.3.1. Effects on Listed Species

Construction activities associated with installation of the NPDES Outfall along Big Deer Creek and the cable car crossing in Panther Creek are likely to mobilize sediments and temporarily increase downstream turbidity levels. Road construction, reconstruction, use, and maintenance also have the potential to affect water quality by increasing sediment delivery to streams along the transportation corridor. Although facility construction and reclamation will also generate sediment, the relatively flat nature of the construction site, application of erosion control practices, and the facilities' distance from streams occupied by ESA-listed salmon and steelhead (over 2 miles) are expected reduce the likelihood of effects from facility construction and reclamation to negligible levels.

Water quality could also be affected through increases in stream temperature and/or through chemical contamination. Clearing of riparian vegetation could result in stream temperature increases. Chemical contamination may occur any time construction equipment is working within or adjacent to the stream channel, should an accidental spill occur along the transportation corridor, or as a result of effluent discharge.

Suspended Sediment/Sediment Deposition. The most critical aspects of sediment effects are related to timing, duration, intensity, and frequency of exposure (Bash *et al.* 2001). Depending on the level of these parameters, turbidity can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen 1996). For salmonids, turbidity has been linked to a number of behavioral and physiological responses (i.e., gill flaring, coughing, avoidance, and increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982; Berg and Northcote 1985; Servizi and Martens 1987). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982; Servizi and Martens 1987; Gregory and Northcote 1993). Although turbidity may cause stress, it has been shown that moderate levels of turbidity (35 to 150 nephelometric turbidity units) accelerate foraging rates among juvenile Chinook salmon, likely because of

reduced vulnerability to predators (camouflaging effect). Turbidity and fine sediments can reduce prey detection, alter trophic levels, reduce substrate oxygen, smother redds, and damage gills, among other deleterious effects (Bjornn 1991; Spence *et al.* 1996).

Quantifying turbidity levels and their effect on fish species and their habitat is complicated by several factors. First, turbidity from an activity will typically decrease as distance from the activity increases. The time needed to attenuate these levels depends on the quantity of material in suspension (e.g., mass or volume), particle size, the amount and velocity of ambient water (dilution factor), and the physical/chemical properties of the sediments. Second, the impact of turbidity on fish is not only related to the turbidity levels but also to the particle size of the suspended sediments.

Cable Car and Outfall Construction - Turbidity is likely to exceed ambient levels and potentially affect ESA-listed fish species present during construction of the cable car crossing on Panther Creek and during construction of the NPDES outfall on Big Deer Creek. For the cable car crossing, a backhoe or excavator would be required to cross Panther Creek in order to install concrete for the deadman. The crossing would be installed in early spring prior to high flow. Equipment crossings would deliver two separate, temporary pulses (minutes) of sediment as the equipment crosses the creek. Machinery will not operate from the channel and no construction will occur in the active channel.

At the cable car crossing, turbidity is expected to be short-lived and highly localized due to the short work window, construction occurring outside the active channel, and low flow conditions during the construction period. The Project includes measures to reduce or avoid sediment delivery to streams, including using typical state and Federal erosion control measures. Both species are present in Panther Creek at and downstream from the construction area, but the temporary nature and small size of the sediment plumes should not result in prolonged exposure to listed salmonids. It is highly unlikely that sediment plumes will extend across the wetted stream width from an equipment stream crossing, which will allow fish to avoid exposure to undesirable turbidity levels by swimming to adjacent, less turbid habitat (i.e., behavioral response, similar to what might occur under natural high flow events). Based on sediment generating projects completed by the Nez Perce National Forest and others, sediment suspended as a result of this phase of the Project is not expected to extend any further than 300 feet downstream from this disturbance.

Construction details were not well described in the BA for installation of the effluent pipe. In Big Deer Creek, a backhoe/excavator will excavate a trench to a depth of 1- to 4-feet, extending across approximately 50% of the channel width. Although not specified in the proposed action, trenching will likely occur from the streambank, but trenching itself will occur within the active channel of Big Deer Creek. In addition, approximately 1 cubic yard of streambank will need to be removed to place the pipeline. Based on the small disturbance area and the short duration for this phase of the project, sediment-related effects are expected to be short-term, localized, and of reduced severity. Although any sediment generated is expected to settle within about 300 feet, and well before habitat occupied by anadromous fish (approximately 2.3 miles downstream). This sediment would later be mobilized at high flows and could potentially affect ESA-listed fish

or degrade instream habitat conditions. Because Big Deer Creek is currently on the 303(d) list for sediment, additional BMPs are warranted to ensure that sediment generated as a result of the diffuser installation is properly minimized.

Road Construction/Reconstruction – Construction of a road network can greatly accelerate erosion rates in a watershed (Haupt 1959; Swanson and Dyrness 1975; Swanston and Swanson 1976; Beschta 1978; Gardner 1979; Cederholm and Reid 1987). Sediment generated through road construction and reconstruction can reach streams through surface erosion and mass movements of destabilized soil, the effects of which can be both dramatic and long-lasting (Meehan 1991). Unpaved road surfaces continually erode fine sediments, adding significant amounts of sediment to streams (Reid and Dunne 1984; Swanston 1991). Roads and related ditch networks are often connected to streams, providing a direct conduit for sediment. On steep slopes, road construction or improper maintenance can greatly increase landslide rates relative to undisturbed forest (Swanson and Dyrness 1975; Swanston and Swanson 1976; Furniss et al. 1991), delivering large pulses of sediment to streams.

Increases in sediment supply beyond the transport capability of the stream can cause channel instability, aggradation (sometimes to the extent that perennial streams become intermittent) (Cederholm and Reid 1987), widening, loss of pools, and a reduction in gravel quality (Sullivan et al. 1987; Furniss 1991; Swanston 1991). For salmon, these changes can mean reduced spawning and rearing success when spawning areas are covered, eggs and fry suffocate or are trapped in redds, food abundance is reduced, and over-wintering habitat is reduced (Cederholm and Reid 1987; Hicks et al. 1991).

Roads built in riparian areas often eliminate part of the riparian vegetation (Furniss 1991), reducing large wood recruitment and shade. Riparian roads also constrain the natural migration of the stream channel where channel migration zones are present. Roads can intercept, divert, and concentrate surface and subsurface water flows, thereby increasing the watershed's drainage network (Hauge et al. 1979; Furniss et al. 1991; Wemple et al. 1996). This can change peak and base stream flows and increase landslide rates. Stream crossings can restrict channel geometry and prevent or interfere with migration of adult and juvenile anadromous fish (Furniss et al. 1991). Culverts also can be a source of sedimentation, especially if they fail or become plugged with debris (Furniss et al. 1991; Murphy 1995).

The ICP will require construction of 4.1 miles of new road and reconstruction/improvement of 11.3 miles of existing road (Appendix A, Figure 1). The Project will also decommission 7.5 miles of current site roads in order to achieve a net reduction of roads in the Big Flat and Bucktail Creek drainages. New road construction will occur in the vicinity of the portals, the mill, and the TWSF. New road segments will be located in the headwaters of the Big Flat and Bucktail Creek drainages, over 2 miles upstream from stream reaches occupied by listed anadromous fish. All roads will be constructed and improved in accordance with USFS guidelines for road construction. Stormwater ditches and sediment control measures will be constructed in accordance with IDL's BMPs for Mining in Idaho,³ which include but are not limited to rolling dips, road sloping, use of straw bales, sediment traps, silt fences, straw mulch, broadcast seeding, etc. The flat nature of this area, construction to USFS guidelines, IDL BMPs,

³ http://www.idl.idaho.gov/bureau/Minerals/bmp_manual1992/bmp_index.htm

and the location of the new roads over 2 miles away from occupied habitat make the likelihood of effects to anadromous fish from these new road segments unlikely. In addition, the obliteration and reforestation of the 7.5 miles of existing road should reduce the potential for long-term effects, while the obliteration of the 4.1 miles of new road upon completion of the project should help ensure that any adverse effects would not be long-term.

Roads along the transportation route will be reconstructed to improve safety and to reduce sediment delivery to the streams. The majority of roads along the transportation route parallel or cross fish-bearing streams, or drain directly into streams occupied by fish. Based on known distribution, effects from road-generated sediment on ESA-listed salmon and steelhead are most likely to occur in lower Deep Creek, Blackbird Creek, Panther Creek (between Deep Creek and Blackbird Creek), and lower Williams Creek (steelhead only). Although sediment inputs are expected to increase substantially during periods of road reconstruction, efforts to resurface the road, improve drainage, and elevate the road above the floodplain should improve effects from the haul road over its existing condition.

Two culverts will be removed from the Williams Creek Road during the road reconstruction phase. The existing culverts on North Fork Williams Creek will be removed and the channel restored as part of the reconstruction effort. No effects to steelhead are expected to occur from the culvert removal as the crossings are located high in the watershed, in a high gradient stream, several miles upstream from any documented distribution of steelhead in Williams Creek mainstem. However, specific details about the final design of the Williams Creek road and culvert removal have yet to be finalized and were therefore not included in the BA. Because this will potentially involve inwater work, NMFS will need to review the timing and engineering design for culvert replacements prior to project implementation to ensure that sufficient BMPs are established to ensure this phase of the project will not result in effects not considered in this Opinion.

The USFS used the Water Erosion Prediction Project (WEPP) model (Flanagan and Livingston 1995) to evaluate sediment related effects for the existing condition and the operational period from project hillslopes and site roads in the Bucktail and Big Flat Creek drainages, and from the access road between Williams Creek and Blackbird Creek. As described in the BA (USDA Forest Service 2007), sediment modeling of the planned road upgrades showed that sediment production should actually decrease along the transportation route. The model predicted that improvements to the transportation route from Williams Creek to the gate at Blackbird Creek would decrease sediment leaving the road by approximately 50% compared to existing conditions. From the gate up to the project site, sediment is predicted to decrease 82% over existing conditions. The decommissioning of the existing roads at the project site would also result in a net decrease in road density in the Big Flat and Bucktail Creek drainages. Considering the results of the model, the USFS concluded that these actions would actually result in long-term improvements to instream substrate conditions.

Road construction and reconstruction activities will increase the potential for turbidity and surface runoff. However, NMFS believes that the upgrades proposed and the conservation measures described should be adequate to keep turbidity and erosion to levels that should not cause lethal take during construction or reconstruction efforts. Turbidity levels may be high

enough to cause indirect, non-lethal take of juvenile steelhead and/or Chinook salmon from short-term harassment, feeding disruptions, and/or avoidance of the area. Based on the modeling and effects described above, it is reasonably likely that the proposed action will have very small, short-term negative effects caused by increased sediment yield, but should result in long-term positive benefits to the survival and recovery of ESA-listed species by reducing overall road density and reducing chronic sediment delivery.

Road Use and Maintenance – Road maintenance can have both short-term and long-term effects on Snake River steelhead and spring/summer Chinook salmon. Surface erosion from forest roads affect the fine sediment budget in streams and may impose a chronic condition of sediment inputs that directly affect the stream substrate and the health of aquatic life (Luce et al. 2001). Planned activities such as placement of cross drains, ditching, grading and graveling may result in disturbances that typically create short-term increases in sediment delivery that taper off after disturbed areas become compacted or after several runoff events occur. Maintenance can also correct problems with the road surface and drainage and thereby reduce levels of sediment delivery from an existing road (baseline condition). Beneficial effects of maintenance typically persist for one or more seasons, depending on a variety of factors such as amount of traffic, precipitation, and physical properties of the road surface. Benefits of proper maintenance include minimization of erosion or sediment delivery from ditches and road surfaces; however, improper maintenance can exacerbate erosion or sediment delivery to streams. Placement of dips (road drains) if installed properly, will reduce ruts and gullies along the roadbed and direct water flow and sediment away from streams. In contrast, removal of the material deposited at the base of the road-cut during maintenance operations interferes with the natural slope-forming process, removes a favorable site for vegetation growth, and initiates slope erosion processes (Megahan and Kidd 1972). Road maintenance also includes removal of roadside vegetation and can impair stream functions by decreasing shade and reducing recruitment of LWD along streamside roads.

Traffic will increase exponentially once construction begins and will continue through closure and reclamation. Daily traffic will include up to 10 vans and four pickup trucks to transport employees to and from the site. In addition, transportation of concentrate, equipment, reagents, and other freight will result in an additional estimated 1,084 round trips per year (Table 1). Without proper road maintenance, a traffic increase of this magnitude would certainly increase surface erosion beyond baseline levels.

Road maintenance for the ICP will be conducted in accordance with SCNF road maintenance procedures. Guidelines for road maintenance on the SCNF were independently consulted upon, receiving concurrence with a “not likely to adversely affect” determination in 2003 (I/NWR/2003/00526), and following amendment in 2007 (I/NWR/2007/01352). The SCNF Road Maintenance Programmatic was designed to limit the effect of road maintenance activities on ESA-listed species and correct “the legacy of landscape conditions that have accumulated over time.” The programmatic outlines protocols for: (1) Surface blading and replacement; (2) blasting; (3) ditch cleaning; (4) flood damage repair; (5) vegetation clearing; (6) sign, bridge, drainage culvert and cattle guard maintenance; (7) culvert replacement; (8) dust abatement; and (9) snow plowing.

The road maintenance programmatic includes measures designed to minimize sediment production and delivery, to maintain or improve road drainage, to avoid the introduction of dust abatement chemicals to streams, and to keep fuel storage areas outside of RHCAs. The programmatic further directs that authorized road maintenance by non-federal entities on public lands will meet the federal management agencies' standards and guidelines. NMFS expects that application of the general design criteria from the roads programmatic currently in place on the SCNF will effectively minimize the risk of adverse effects occurring from road use, maintenance, and deterioration on aquatic habitats in the action area.

Toxic Spills/Discharge. Water quality could be further affected through chemical contamination. Chemical contamination could occur: (1) when construction equipment is working within or adjacent to the stream channel; (2) should a spill occur in the transportation corridor; (3) as a result of effluent discharge; or (4) through groundwater contamination.

Cable Car and Outfall Construction - Heavy machinery operations adjacent to streams or in wetlands raises concern for the potential of an accidental spill of fuel, lubricants, hydraulic fluid or similar contaminant into the riparian zone, or directly into the water where they could adversely affect habitat, injure or kill aquatic invertebrates, or directly impact ESA-listed species. Petroleum-based contaminants such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons, which can cause chronic sublethal effects to aquatic organisms (Neff 1985). Ethylene glycol (the primary ingredient in antifreeze) has been shown to result in sublethal effects to rainbow trout at concentrations of 20,400 mg/L (Staples 2001). Brake fluid is also a mixture of glycols and glycol ethers, and has about the same toxicity as antifreeze.

As previously described, work will occur in the active channel for both the cable car and discharge pipe installation, increasing the potential for this form of chemical contamination to occur. However, it's unclear in the proposed action if equipment used on this project will be clean and free of fuel and lubricant leaks, or whether the equipment will be inspected prior to beginning and during this work. It's also unclear what provisions will be in place regarding the fueling and maintenance of equipment in RHCAs. NMFS believes that additional fuel spill and equipment leak contingencies and preventions will be necessary to effectively minimize the risk of negative impacts to ESA-listed fish and fish habitat from toxic contamination during this phase of the operation. However, because of the short duration of each project and the need for only one piece of equipment at each site, it's highly unlikely that antifreeze, brake, or transmission fluid, will be present on-site or spilled in volumes or concentrations large enough to harm salmonids in or downstream from project sites.

Accidental Spills - Toxic spills have the potential to enter streams in the action area either through a spill occurring during transport, or through an on-site spill and subsequent discharge into nearby waterbodies. An accidental spill of fuels or toxic chemicals being transported to or on-site at the ICP could adversely affect ESA-listed salmon and steelhead if the spill reached any of the action area streams. The potential for and magnitude of those effects would be dependent upon a number of variables, such as: (1) proximity to streams; (2) whether the spill reached a stream; (3) accident severity; (4) amount of material spilled; (5) volume and attributes of receiving waters at the time of the spill; (6) type of chemical; (7) form of chemical (dry or

liquid); (8) transportation container; (9) weather; (10) spill response time; (11) effectiveness of spill containment; and (12) salmonid life stage(s) present and exposed. In addition to considering each of these variables in the BA, the potential for spill for each chemical was analyzed in relation to the number of trips per year each chemical would be transported to the site.

As bulk liquids, the USFS determined that diesel, gasoline, and antiscalant, presented the highest risk of release should an accident occur (Table 7). As containerized liquids in containers <100 gallons, Aerofroth 65 Frother, polymer flocculent, methanol, hydrochloric acid, oils, lubricants, grease, and antifreeze presented a moderate risk of release should an accident occur.

The transportation route plans to use existing USFS roads along Blackbird, Panther, Deep, Moccasin, and Williams Creeks. The route is approximately 40 miles long, and crosses Perreau Creek near its mouth and the Salmon River at Shoup Bridge. Although not all currently occupied, all streams along the transportation route, except Moccasin Creek, historically provided habitat for Snake River spring/summer Chinook salmon and steelhead. Except for Moccasin Creek, steelhead could be affected by spills into any of these stream systems. Chinook would most likely be affected by spills alongside the Salmon River, Panther Creek, or Blackbird Creek, but could also be affected by large spills or spills near the mouths of the smaller tributaries.

The likelihood of a spill occurring along U.S. Highway 93 and entering the Salmon River has been estimated to be relatively small (USDA 2007). Similarly, spills into Williams or Perreau Creeks are not expected to result in hazardous conditions in the mainstem Salmon River. Although the potential for direct effects to ESA-listed salmon and steelhead from a transportation spill exists at the Shoup Bridge, the bridge has good approach visibility and is sufficiently wide that the probability of a spill is small. The distance traveled from Salmon along the highway is relatively short. Although the distance from Challis is longer, the highway road is in good condition and is relatively safe to drive along. NMFS considers the risk of adverse effects from spills occurring along U.S. Highway 93 to be negligible.

The Beartrack Mine, which utilized the same transportation route as proposed for the ICP, had no accidents associated with the transportation of hazardous materials to the mine site. There were two incidents with hazardous materials transport. The first incident involved a fuel truck that pulled off the road at Mile Post 12 onto a false shoulder of snow to avoid an oncoming vehicle that did not yield to the pilot car. The fuel truck did not tip over, but approximately 4 gallons of fuel were spilled from the truck's fuel tank. This material was cleaned up with absorbent pads and removed to an approved disposal site. The second incident involved a Lime truck at Mile Post 8. While negotiating a switchback the right rear wheels of the truck went off the road shoulder above the culvert. There was no vehicle turnover and no material spilled. As a result of this incident additional barriers were installed on the inside of this curve above the culvert and the curve was widened.

Table 7. Risk of a material release in case of an accident during transport to the ICP project.

Material	Amount Transported per Trip	# Trips per Year	Form	Container Type/Size	Risk of Release in Event of Spill¹
AERO 343 Xanthate	40,000 lbs	14	Dry	Flo Bin/ 1 ton	Low
AERO 350 Xanthate	40,000 lbs	16	Dry	Flo Bin/ 1 ton	Low
AEROFROTH 65 Frother	28,000 lbs	3	Liquid	Plastic Barrel/ 55 gal	Moderate
Sodium Sulfide	20-100 tons	5	Dry	Sacks/ 50 lbs	Low
Superfloc	8	3	Dry	Sacks 50 lbs	Low
Diesel	4,470 gal	167	Liquid	Fuel Truck/ 4,500 gal.	High
Gasoline	30 gal	150	Liquid	Fuel Truck/4,500 gal	High
Lime	37,500 lbs	4	Dry	1000 Super Sack	Low
Cement	4,4000	115	Dry	Dry Bulk 22 tons	Low
Oils, Lubricants, Grease, Antifreeze	60 gal	150	Liquid	Barrel/ 55 gal	Moderate
Propane	9,400 gal	5	Gas	Fuel Truck/ 9,400 gal	Low
Antiscalant	4,000 gal	1	Liquid	250 gal. tote/ 4,000 gal	High
Ammonium Nitrate	10 tons	40	Dry	Bulk Container/ 10 tons	Low
Bulk Concentrate	16 tons	700	Dry	Sealed Container/ 16 tons	Low
Water Treatment Chemicals & Reagents					
Polymer Flocculent	20 gal	1	Liquid	Sealed Pail/ 5 gal	Moderate
Hydrated Lime	2 tons	1	Dry	Super Sack/ 1000 lbs	Low
Methanol	500 gal	2	Liquid	Plastic Drum/ 55 gal	Moderate
Hydrochloric Acid	200 gal	2	Liquid	Plastic Drum/ 55 gal	Moderate
Zeolites	3 tons	1	Dry	Super Sack	Low

¹ Containerized Solid= Low Risk, Containerized Liquids=Mod Risk, Bulk Liquids = High Risk

Considering the number of times a chemical would be transported to the mill site each year, the USFS used annual truck miles and accident frequency to further refine the likelihood that each chemical would be involved in an accident and potentially spilled during the lifetime the mine. Estimated accident frequencies along the access routes were based on a general figure of 9.8 accidents per million miles traveled on Forest Service roads (USFS 1997). This figure is based on historic accident records for general traffic conditions without special accident control or mitigative measures (e.g., use of pilot cars). An estimated 1,083 trips per year of hazardous materials is equivalent to 43,320 miles per year for transport of hazardous substances. Of those miles, 18,628 miles (43%) are in close proximity to a stream.

The analysis revealed that only seven of the 18 different materials transported to the mine would be expected to have an accident occurring near a stream in less than 1,000 years. Only three of these materials were expected to have a risk of occurring once in less than 100 years. Spills of cement, bulk concentrate, and diesel, gasoline, oil, lubricant, grease, and antifreeze⁴ were considered the most likely to occur. Table 8 identifies the seven materials determined most likely to be spilled during the life of the project.

⁴ Diesel, gasoline, and other oils will be shipped on the same trucks. Gasoline, oils, etc. will be in small quantities.

The USFS conducted a literature review for toxicity data for each material being transported to the site. Review included EPA's Ecotox Database (<http://cfpub.epa.gov/ecotox/>), the Pesticide Action Network Database (<http://www.pesticideinfo.org/Index.html>), the Material Safety Data Sheets (MSDS) from the chemical manufacturer, and other refereed literature. Considering the spill response plan in place, exposure was assumed to be short-term (i.e., lasting a few hours at most, for sub-acute to acute durations), making their use of the 96-hour LC₅₀ a conservative approach to gauging toxicity.

Table 8. Transported materials with a risk of accidents near stream of less than once in one thousand years.

Material	Amount Transported per Trip	Number of Trips per Year	Annual Truck Miles	Annual Accident Frequency	Years Between Accident	Accident Frequency Near Stream	Years Between Accidents Near Streams
Bulk Concentrate	16 tons	700	26,705	0.2617	4	0.1125	9
Diesel Gasoline Oils, Lubricant, Grease, Antifreeze ¹	4,470 gal 30 gal 60 gal	150	5,723	0.0561	18	0.0241	41
Cement	44,000	115	4,387	0.0430	23	0.0185	54
Ammonium Nitrate	10 tons	40	1,526	0.0150	67	0.0064	156
AERO 350 Xanthate	40,000 lbs	14	534	0.0052	191	0.0023	444
AERO 343 Xanthate	40,000 lbs	16	610	0.0060	167	0.0026	389

¹ Diesel, gasoline, oil, lubricant, grease, and antifreeze will be shipped on the same trucks. Gasoline, oils, etc. will be in small quantities.

Spill effects analyses in the BA were conducted specifically for, gasoline, diesel, and antiscalant, which were classified as high-risk materials. A spill analysis was also conducted for cement, ammonium nitrate, and bulk concentrate since they are associated with higher accident probabilities; and for sodium sulfide, and SUPERFLOCTM, because of their higher toxicities. The effects of the remaining transported materials, including AERO 343 and 350 xanthate, AEROFROTH 65 Frother, lime, propane, polymer flocculant, hydrated lime, methanol, zeolites, and hydrochloric acid were not analyzed because of their low accident probabilities, and because none were categorized as being highly toxic to fish or as having a high spill risk (Table 9). NMFS believes that the approach used by the USFS in the BA is conservative one, and has therefore followed a similar approach for this Opinion.

Table 9. Materials selected for toxic effects analysis.

Material	Years between Accidents near Streams	Spill Risk	Toxicity
Gasoline	40	High	moderately toxic
Diesel	40	High	slightly toxic
Antiscalant	1,244	High	not acutely toxic
Bulk Concentrate	9	Low	insoluble – not toxic
Cement	54	Low	slightly toxic (pH)
Ammonium Nitrate	156	Low	moderately toxic
Sodium Sulfide	1,244	Low	highly or moderately toxic depending on source
SUPERFLOC™	2,073	Low	highly toxic

A detailed summary of the potential effects of each transported material is presented in the BA (USDA Forest Service 2007) for listed salmon and steelhead. Toxicity levels are specified for each material, as are the quantities needed to reach toxic levels in receiving waters of Williams Creek, the Salmon River below Williams Creek, Deep Creek, Blackbird Creek, Panther Creek below Blackbird Creek, and in the Salmon River below Panther Creek. Several of the transported materials would require relatively small amounts to be spilled into the receiving waters to reach toxic levels. SUPERFLOC™ would require the least amount of material to be spilled to achieve toxic conditions (Table 10).

The actual probabilities for spills of any transported material may be lower than predicted in the spill risk analysis due to mitigation (safety) measures proposed for transport of hazardous materials and fuels. The proposed action includes notification of the ICP facility prior to transport of fuels or chemicals, travel only during daylight hours, use of single frame trucks, use of pilot vehicles, and continuous radio contact between the pilot vehicle and the facility during transport. Pilot cars would lead tractor-trailer loads and fuel trucks to the site to reduce accident risk. All vehicles transporting hazardous materials will be accompanied from U.S. Highway 93 to the mine site by a pilot vehicle equipped with a two-way radio to warn both the transport vehicles and oncoming traffic. The pilot vehicle will also carry a spill response kit designed to contain spills. Spill boxes will also be located at various points along the route where the road runs adjacent to streams. Compliance with precautionary measures to reduce the probability of an accidental spill of hazardous material during transport or storage at the project site listed in the Spill Prevention and Response Plan (FCC 2002) should both minimize the potential for and the severity of adverse affects on Snake River spring/summer Chinook salmon, steelhead, and their habitat. This considered, adverse impacts to streams from spills of hazardous materials were not predicted by the USFS in the BA (USDA Forest Service 2007). The following section will discuss in more detail those materials either most likely to be spilled or those that would be most toxic to fish should a spill occur.

Table 10. Toxic thresholds for key materials at risk of release in the event of a one minute spill at low flow.

			Blackbird Creek	Williams Creek	Deep Creek	Panther Creek below Blackbird Creek	Salmon River below Williams Creek	Salmon River below Panther Creek
<i>Low Flow cfs</i>			2.5	3	4.1	20	700	1,300
Material	Toxicity (mg/l)							
LIQUIDS								
Gasoline	2.7	gallons	0.004	0.005	0.006	0.031	1.102	2.046
Diesel	18		0.02	0.03	0.04	0.20	6.98	12.97
	25		0.03	0.04	0.06	0.28	9.70	18.01
Antiscalant	2,660		2.60	3.11	4.26	20.76	726.76	1,349.70
SOLIDS								
Cement	92	lbs	0.86	1.03	1.41	6.89	241.22	447.98
Ammonium Nitrate	8.01		0.08	0.09	0.12	0.60	21.00	39.00
Sodium Sulfide, Hydrated	0.55		0.0052	0.0062	0.0084	0.041	1.44	2.68
SUPERFLOC™	0.22		0.0021	0.0025	0.0034	0.0165	0.58	1.07

Note: Bulk concentrate not considered toxic so excluded from this table.

Diesel – Of the substances being transported, diesel has been identified as posing the highest risk of a spill affecting ESA-listed salmonids and critical habitat (USDA Forest Service 2007). This is because diesel is delivered in large quantities (4,500 gallons), will be hauled to the mine site about 150 times per year, containers are aluminum and easily ruptured, and the substance is a liquid that can rapidly flow down gradient into nearby streams. In addition, diesel has a high accident probability for locations near streams, with a spill estimated to occur once every 40 years (USDA Forest Service 2007). Because of its relatively high probability for an accident due to the frequent delivery and its high risk of spill, the USFS determined that diesel was the material with the highest potential for adverse impacts to the aquatic environment.

The 96-hour LC₅₀ reported in the BA for diesel and rainbow trout was a range of 18 to 25 mg/L (Conoco 2000). NMFS agrees that this is an appropriate range for evaluating acute effects on ESA-listed salmonids. The wide range of toxicity for diesel reflects variations in the petroleum compounds which occur for each source of crude, where it was refined, and the time of year the petroleum was produced. Petroleum products which are refined for use during the summer have different toxicity than products refined during the winter because the additives used to maintain the desired viscosity are applied in different proportions.

Table 10 shows that a relatively small spill of 0.28 gallons, if not contained, would cause toxicity in Williams, Blackbird, Deep, or Panther Creeks. In the Salmon River diesel below Williams Creek, a spill of as little as 10 gallons would be toxic. Diesel spills have the potential to affect

listed salmon, steelhead, and their habitat. Diesel spills are not uncommon in Idaho, including but not limited to: (1) Little Salmon River (1993, 900 gallons diesel + 900 gallons gasoline), 133 dead rainbow trout and brook trout; (2) Lochsa River (2003, 6,300 gallons diesel), no documented fish kill or effect to critical habitat; and the (3) Middle Fork Clearwater River (2002; 10,000 gallons diesel), no documented fish kill or effect to critical habitat.

Two additional spills in the Salmon River basin warrant further discussion. On August 19, 1983, the IDFG reported a diesel fuel spill of 2,800 gallons into the Little Salmon River. The IDFG calculated that approximately 30,000 fish total (all species) died in the kill and also reported aquatic insect mortality. On September 6, 1989, a diesel spill occurred on Johnson Creek that resulted in 400 gallons of diesel reaching Johnson Creek. The precise effects of this spill and the emergency response to it were not well documented. However, depressed populations of aquatic insects were reported for 3.5 miles downstream and diesel odor was evident in stream substrates a year after the spill. The IDFG notes do indicate seeing Chinook salmon and steelhead showing obvious signs of stress.

A large diesel spill of 4,500 gallons in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek, or the Salmon River would kill Chinook salmon and steelhead juveniles, adults, alevins, and eggs downstream of the accident, depending on the time of year. Any diesel spilled into action area streams would tend to travel downstream in a slug and dissipate slowly. Diesel from a spill could mix with spawning gravels and sand and be retained in the stream substrate for a year or more, and thereby negatively affect salmon and steelhead eggs, alevins, and juveniles for several years. Large amounts of petroleum products can suffocate aquatic organisms by coating their gills. Diesel fuel, like most petroleum products, contains toxic organic compounds that adversely affect water appearance and odor.

The effects of a diesel spill on Chinook salmon and/or steelhead would occur from disrupting the uptake of oxygen at the gill interface. At toxic concentrations mortality would occur as the result of suffocation. Direct mortality of ESA-listed salmon and steelhead, as well as other aquatic organisms, can also occur from physical coating, entanglement, or ingestion of fine oil droplets. Some of the compounds used in diesel are not readily biodegradable and settle into the sediments of the affected stream. This can result in sublethal exposure, which may or may not be fatal, as hydrocarbons are incorporated into the food chain (USDA Forest Service 2007).

Based upon information presented in Table 10, the effects of a 4,500 gallon diesel spill into occupied streams would be extreme and would likely result in mortality of all life stages of ESA-listed salmon or steelhead present at that time. A diesel spill of this magnitude would likely continue to affect salmon and steelhead eggs, alevins, and juveniles for several years should it be allowed to settle into stream substrates. The magnitude and extent of effect would vary tremendously depending upon the amount of material spilled. Although a higher likelihood of spill and higher risk of delivery to streams than other materials hauled to the site, accidents near streams are not expected to occur but once every 41 years (Table 8), well beyond the proposed life of the ICP. In addition, proposed improvements to the transportation corridor (turnout construction, removal of switchbacks, etc.), transport during daylight hours only, use of

pilot cars, and application of the proposed spill and response measures (FCC 2002) should effectively limit the severity and the likelihood that a spill would occur. Consequently, NMFS does not anticipate a large spill of diesel fuel to occur as a result of the project.

Gasoline – CITGO (2007) reported that various grades of gasoline exhibited a range of lethal toxicity (LC_{100}) from 40 mg/L to 100 mg/L in ambient stream water for rainbow trout. CHEVRON identifies a 96-hour LC_{50} for rainbow trout and unleaded gasoline at 2.7 mg/L (Chevron 2005); this is the concentration used in the BA effects analysis. A gasoline spill would require a loading of only 0.004, 0.005, 0.006, 0.031, 1.102, and 2.046 gallons/minute for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

Transported with diesel, gasoline poses both a high risk of accident and a high risk of delivery to streams should an accident occur. Approximately 30 gallons of gasoline will be hauled to the mine site about 150 times per year in a separate compartment of the diesel fuel trailers. As with diesel, containers will be aluminum and easily ruptured, and, as a liquid, it will be able to rapidly flow down gradient into nearby streams. Gasoline has the same accident probability as diesel, with a spill near streams estimated to occur once every 40 years (USDA Forest Service 2007).

The bulk of the available literature on gasoline relates to the environmental impact of monoaromatic (benzene, toluene, ethylbenzene, xylenes: BTEX) and diaromatic (naphthalene, methylnaphthalenes) constituents. In general, non-oxygenated gasoline exhibits some short-term toxicity to freshwater and marine organisms, especially under closed vessel or flow-through exposure conditions in the laboratory. The components which are the most prominent in the water-soluble fraction and cause aquatic toxicity, are also highly volatile and can be readily biodegraded by microorganisms. This material is expected to be readily biodegradable following a spill (USDA Forest Service 2007; CHEVRON 2005).

Based upon information presented in Table 10, the effects of a 30-gallon gasoline spill into occupied streams would be extreme and would likely result in mortality of all life stages of ESA-listed salmon or steelhead present immediately downstream from the spill. The magnitude and extent of effect would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. Although there is a higher likelihood of spill and higher risk of delivery to streams than with other materials hauled to the site, accidents near streams are not expected to occur but once every 41 years (Table 8), well beyond the proposed life of the ICP. In addition, proposed improvements to the transportation corridor, transport during daylight hours only, use of pilot cars, and application of measures proposed to prevent spills from occurring and to respond to a spill to limit the severity (FCC 2002), NMFS does not anticipate a gasoline spill to occur as a result of the project.

Antiscalant – The USFS reported the 96-hour LC_{50} value for rainbow trout of 2,660 mg/L for CYQUEST DMA (anionic polyacrylamide) (USDA Forest Service 2007). To achieve this concentration, an antiscalant spill would require a loading of approximately 2.60, 3.11, 4.26,

20.76, 726.76, and 1,349.70 gallons/minute for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

Antiscalant will be transported to the mill in loads of 16 250-gallon totes (4,000 gallons total), but will only be transported to the site once per year. Due to the very low transport rate, the estimated accident interval for this material near a receiving waterbody is estimated to occur only once every 6,220 years. However, because antiscalant is transported as a liquid, it remains a high risk to be delivered to streams in the event of an accident. Based upon information presented in Table 10, the dumping of one tote of antiscalant would be sufficient to result in mortality of ESA-listed salmonids in the smaller streams (i.e., Blackbird, Williams, or Panther Creeks). Multiple totes would need to be ruptured before toxic thresholds would be reached in the Salmon River. In either case, the magnitude and extent of effects would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. Considering the spill analysis, combined with only one trip per year, and the fact that the proposed spill prevention and control measures (FCC 2002) should further reduce the likelihood and severity of a spill, NMFS expects that antiscalant will not likely be spilled during the life of the project. Therefore, the risk of an antiscalant spill into action area streams is negligible.

Cement – The USFS reported the 96-hour LC_{50} for rainbow trout at 92 mg/L for cement (USDA Forest Service 2007). To achieve this concentration, a cement spill would require a loading of approximately 0.86, 1.03, 1.41, 6.89, 241.22, and 447.98 lbs. for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

Cement will be transported to the mill in loads of 4,000 lbs. (22 tons) per trip, with roughly 115 trips per year. Due to the higher transport rate, the estimated accident interval for this material near a receiving waterbody is higher than most materials at once every 54 years. Because cement is transported in bulk and dry, it's a low risk to be delivered to streams in the event of an accident. However, based upon information presented in Table 10, the effects of dumping of one truckload of concrete into occupied streams would be extreme and would likely result in mortality of all life stages of ESA-listed salmon or steelhead present. The magnitude and extent of effect would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. However, considering the spill analysis, combined with the fact that the proposed spill prevention and control measures (FCC 2002) should further reduce the likelihood and severity of a spill, NMFS expects that cement will not likely be spilled during the life of the project, making the risk of a cement spill into action area streams negligible.

Ammonium Nitrate – The USFS reported the 96-hour LC_{50} for rainbow trout at 8.01 mg/L for ammonium nitrate. To achieve this concentration, a spill of ammonium nitrate would require a loading of only 0.08, 0.09, 0.12, 0.60, 21.00, and 39.00 lbs. for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

Ammonium nitrate will be transported to the mill in a bulk container in loads of 10 tons each, transported to the site roughly 40 times per year. Due to a moderate transport rate, the estimated

accident interval for this material near a receiving waterbody is estimated at once every 156 years. Because this material is transported in bulk and dry, it's a low risk for delivery to streams in the event of an accident. However, based upon information presented in Table 10, the effects of dumping of one truckload of ammonium nitrate into occupied streams would be extreme and would likely result in mortality of all life stages of ESA-listed salmon or steelhead present. The magnitude and extent of effect would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. Considering the spill analysis and the proposed spill prevention and control measures (FCC 2002), NMFS does not expect a spill of ammonium nitrate to occur during the life of the project, making the risk of effects from ammonium nitrate negligible.

Sodium Sulfide, Hydrated – The USFS reported 96-hour LC₅₀ values for rainbow trout ranging from 0.55 mg/L to 1.64 mg/L (USDA Forest Service 2007). At the more toxic concentration, a spill of this material would require less than a pound of material to reach toxic levels in the smaller tributaries. A loading of only 0.0052, 0.0062, 0.0084, 0.041, 1.44, and 2.68 lbs. for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

Sodium sulfide will be transported in loads of 20- to 100-tons, contained in individual 50-pound sacks. This material will be delivered to the site approximately five times per year, resulting in an estimated accident interval near a receiving waterbody only once every 1,244 years. Because sodium sulfide is shipped dry and in 50-pound sacks, the risk of delivery to a stream should an accident occur is considered low risk. Based upon information presented in Table 10, the dumping of only one sack of sodium sulfide into an occupied stream would likely result in mortality of all life stages of ESA-listed salmon or steelhead present. As with other materials, the magnitude and extent of effect would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. However, considering the spill analysis, combined with the fact that the proposed spill prevention and control measures (FCC 2002) should further reduce the likelihood and severity of a spill, NMFS expects that this material will not likely be spilled during the life of the project, making the risk of a spill into action area streams negligible.

SUPERFLOC™ 330 Flocculant – CYTEC (2001) reported the 96-hour LC₅₀ value for rainbow trout at 0.022 mg/L for SUPERFLOC™ (water flea [*Daphnia magna*] 0.17 mg/L). However, according to CYTEC customer service, SUPERFLOC™ 330 flocculant was discontinued about 10 years ago, and has been replaced by SUPERFLOC® 577 Flocculant. The MSDS for SUPERFLOC® 577 does not reference an acute toxicity for rainbow trout, but does identify a 96-hour LC₅₀ range of >10 to 100 mg/L for zebrafish (*Danio rerio*), and >10 to 100 mg/L for water flea. Lacking information specific to rainbow trout for SUPERFLOC® 577, the USFS analysis used the more specific and more conservative value of 0.022 mg/L in their analysis.

A SUPERFLOC® spill would require a loading of only 0.0021, 0.0025, 0.0034, 0.0165, 0.58, and 1.07 lbs. for toxicity to be observed in Blackbird Creek, Williams Creek, Deep Creek, Panther Creek below Blackbird Creek, Salmon River below Williams Creek, and Salmon River below Panther Creek, respectively (Table 10).

SUPERFLOC® will be transported in loads of eight, 50-pound sacks per trip, with only three trips per year. Therefore, the corresponding estimated accident interval involving this material near a receiving waterbody was only once every 2,073 years. In addition, SUPERFLOC® has been assigned a low spill risk level because it's transported dry, in 50-pound sacks. Based upon information presented in Table 10, the effects of dumping of one sack of SUPERFLOC® into occupied streams would be extreme and would likely result in mortality of all life stages of ESA-listed salmon or steelhead present. The magnitude and extent of effect would vary dependent upon the amount of water in the receiving waterbody and the amount of material spilled. Considering the spill analysis, combined with the fact that the proposed spill prevention and control measures (FCC 2002) should further reduce the likelihood and severity of a spill, NMFS expects that SUPERFLOC® will not likely be spilled during the life of the project, making the risk of a spill into action area streams negligible.

During the analysis of SUPERFLOC® it became clear that specific reagents and formulas are subject to change over time. It also became clear that the toxicity of certain reagents and formulas varies dependent upon the manufacturer. Therefore, this analysis only applies to the specific brand or formulation specified in the BA and this Opinion. A switch to a different product by FCC will require an additional evaluation to ensure that the new product is not any more toxic than products analyzed in this Opinion.

Outfall Discharge – ICP's NPDES permit will include discharge limitations for 16 potential pollutants, including eight metallic elements, arsenic, ammonia, sulfate, sulfide, TSS, pH, DO, and temperature. The outfall will discharge effluent into Big Deer Creek approximately 3 miles upstream from its confluence with Panther Creek. Although remediation of the Blackbird Mine Site has reduced the legacy pollutant concentrations in Big Deer Creek, background concentrations still need to be considered when evaluating the Project's effect on water quality.

The ICP effluent has the potential to adversely affect ESA-listed Chinook salmon or steelhead downstream from the outfall. However, neither species occurs in the immediate vicinity of the outfall because access is blocked by the barrier 2.3 miles downstream on Big Deer Creek. Since they are not present at the outfall, neither species will be exposed to concentrations as toxic as those coming directly out of the pipe. Because Big Deer Creek is already on EPA's list of 303(d) waterbodies for metal contaminants, it's important to consider background levels of metals in Big Deer Creek before analyzing potential effects to fish. Table 11, summarizes this information, along with the estimated pollutant discharge concentrations and limits both at the outfall, and downstream from the falls on Big Deer Creek where ESA-listed salmonids are present.

Except for sulfates, EPA effluent limits are set at end-of-pipe and without a mixing zone. The ICP water treatment plant has been designed to meet the more restrictive limits with no dilution planned for the discharge. For many potential pollutants, the estimated concentration is less than the effluent limits specified in the NPDES permit, providing a potential cushion of safety over the estimated discharge concentration. Nevertheless, this analysis assumes effluent concentrations at the limits specified in the NPDES permit. Effluent limits were established to meet State of Idaho water quality criteria. For toxic chemicals of concern, these limits are

computed on the basis of acute and chronic effects to coldwater aquatic biota. Where EPA has not developed criteria specific to aquatic life, limits were designed to meet the needs of other beneficial uses. For example, the criterion for thallium was set to limits for human health and fish consumption, for nitrates to protect agricultural water supply, and for sulfate as a secondary drinking water supply.

Table 11. Outfall Estimates of Pollutant Discharge, Effluent Limits, Acute/Chronic Water Quality Criteria, and Big Deer Creek Background/Expected Concentrations.

Parameter	Effluent Estimates		Effluent Limits & Monitoring Requirements		EPA WQ Criteria		Background Conc. Big Deer Creek ^{1,3}	Estimated Conc. Big Deer Creek @ Cascades ^{2,3}
	Max. Daily Value	Avg. Daily Value	Max. Daily Limit	Avg. Monthly Limit	Acute	Chronic		
Arsenic (µg/L)	<50	<50	100	50	340	150	0.0008	2.8
Cadmium (µg/L)	<0.1	<0.1	0.52	0.26	0.52	0.37	0.00006	0.01
Cobalt (µg/L)	<50	<50	141	70.4	--	86	0.021	3.9
Copper (µg/L)	<2.0	<2.0	4.80	2.40	4.6	3.5	6.9	6.6
Lead (µg/L)	<0.3	<0.3	0.90	0.45	13.88	0.54	0.00062	0.03
Mercury (µg/L)	0.0018	0.001	0.02	0.01	--	0.012	0.00005	0.001
Nickel (µg/L)	<5.0	<5.0	26.52	13.22	145	16.1	0.001	0.74
Selenium (µg/L)	4	2	--	--	20	5	--	--
Thallium (µg/L)	<0.2	<0.2	0.95	0.47	--	10	0.00001	0.03
Zinc (µg/L)	<10	<10	37.02	18.45	36.2	36.5	0.006	1.0
Ammonia (as N)(mg/L)	1	1	4.1	1.6	5.6	2.34	0.022	0.1
Nitrate + Nitrite (mg/L) ⁴	<100	<100	100	--	--	--	--	--
Sulfate (mg/L) ⁵	<840	<840	250	--	--	--	7.3	53.6
Sulfide (µg/L)	--	--	2	--	--	--	--	--
TSS (mg/L)	30	15	30	20	--	--	--	--
pH (s.u.)	9	7.5	6.5 - 9.0 at all times		--	--	--	--
Dissolved O ₂ (mg/L)	--	--	> 6.0 at all times		--	--	--	--
Temperature (Summer/winter) (°F)	55/35	55/40	66	--	Max. Daily 66.2		--	--
Iron (µg/L)	300	30	--	--	--	--	--	--
Aluminum (µg/L)	200	20	--	--	--	--	--	--
Magnesium (mg/L)	100	10	--	--	--	--	--	--
Manganese (µg/L)	50	.005	--	--	--	--	0.0127	2.8

¹ Background concentrations were collected at Water Quality Site 24, on Big Deer Creek, below confluence with South Fork Big Deer Creek (collected May 2001 to October 2005).

² Big Deer Creek at the cascades is the upstream distribution limit of anadromous fish, 2.3 miles downstream from the outfall.

³ Concentrations assume the maximum outfall flow of 0.33 cfs, the 7Q10 flow statistic of 5.6 cfs for Big Deer Creek, and the NPDES average monthly limit.

⁴ Limit is based on EPA water quality criteria value for agricultural water supply, no limit has been defined for cold water aquatic life.

⁵ A mixing zone has been requested for sulfate. End-of-pipe concentration is estimated to be less than 840 mg/L. End of mixing zone effluent limit is 250 mg/L.

Toxicity of cadmium, copper, lead, nickel, and zinc is hardness dependent. Therefore, Idaho's aquatic life water quality criteria for metals are expressed as a function of hardness measured in mg/L of calcium carbonate (CaCO₃). As water hardness of the receiving water increases, the

toxicity of the metals decreases and the numerical value of the criteria increases. Idaho Water Quality Standards stipulate minimum and maximum hardness values of 25 mg/L and 400 mg/L, respectively [IDAPA 58.01.02.210.03(c)(i)]. For the purposes of calculating a conservative value for metals criteria, the Technical Support Document for Water Quality-based Toxics Control (EPA 1991) recommends using the 5th percentile of hardness values measured in the receiving water. In the case of the ICP, the 5th percentile of 16 hardness measurements collected from Water Quality Site 24 on Big Deer Creek is 20.5 mg/L (i.e., soft water). Accordingly a hardness value of 25 mg/L was used in calculating numeric criteria for hardness dependent metals for the ICP. In estimating background concentrations and pollutant concentrations in Big Deer Creek below the falls, the USFS used a worst-case scenario (USDA Forest Service 2007). Concentrations for the last two columns in Table 11 assume the maximum outfall flow of 0.33 cfs, and the 7Q10 flow statistic of 5.6 cfs for Big Deer Creek. The following section will discuss in more detail those effluent parameters most likely to result in adverse effects to ESA-listed fish species.

Arsenic – Mining of ore containing arsenic can pollute surface waters as the metalloid leaches from tailings ponds and waste piles. It can later be mobilized in acid drainage from abandoned mines (Nelson et al. 1991). The discharge of mining wastes into freshwater systems has resulted in high concentrations of arsenic in sediments and benthic invertebrates (Pedlar et al. 2002). Although elemental arsenic is insoluble in water, many arsenates are highly soluble. Therefore, arsenic compounds occur naturally in western streams and lakes (Nelson et al. 1991). Arsenic is highly persistent in water, with a half-life > 200 days (Vincoli 1997). Typical concentrations for background freshwater streams and rivers are less than 1 µg/L (USDA Forest Service 2007). According to water quality monitoring data from 2001 until 2005, background concentrations of arsenic in Big Deer Creek are currently estimated at 0.0008 µg/L (Table 11).

Arsenic toxicity can be altered by a number of factors including pH, redox potential (Eh), organic matter, phosphate content, suspended solids, presence of other toxicants, speciation of the chemical itself, and the duration of exposure to arsenic. Although the BA states that arsenic does not readily bioconcentrate in aquatic species, a literature review conducted as part of this analysis suggests that this may not be accurate. Rainbow trout exposed to 60 to 240 mg/L of arsenic resulted in increases in whole-body arsenic concentrations ranging from 8.1 to 13.5 µg/g (McGeachy and Dixon 1991). After feeding rainbow trout a diet of four dietary arsenicals over an eight-week period, Cockell and Hilton (1998) found that carcass arsenic concentration showed a dose-response relationship to dietary arsenic concentration and exposure rate. Following aqueous and dietary exposure of lake whitefish (*Coregonus clupeaformis*) to arsenic, Pedlar and Klaverkamp (2002) noted significant accumulation of arsenic in the stomach, pyloric caeca, intestines, liver, kidney, and scales. They also found increased concentrations of arsenic in the gallbladder, gonads, spleen, gill, and bone.

Similarly, metals have also been found to accumulate in aquatic invertebrates (Woodward et al. 1994; Beltman et al. 1999). Metal accumulation occurs via uptake across the gills, through the gut, and through adsorption to the exoskeleton (Beltman et al. 1999). Woodward et al. (1994) noted a study where metal concentrations in aquatic invertebrates in Clark Fork River were

two to fourteen times greater than for the same taxa in other less-contaminated rivers. Although susceptible to bioaccumulation, aquatic invertebrates appear to be more tolerant of arsenic than fish, with concentrations of 3.0 to 14.0 mg/L and 10 to 20 mg/L reported as non-toxic to mayfly and dragonfly nymphs respectively (Nelson et al 1991). Rainbow trout fed a diet of metal-contaminated aquatic invertebrates from the Clark Fork resulted in 6- to 10-fold greater tissue concentrations of arsenic than control groups (Woodward et al. 1994). Considering this information, it's possible that indirect effects could potentially occur to ESA-listed salmon and steelhead feeding on arsenic-contaminated macroinvertebrates.

Acute toxicities have been reported at a 96-hour LC_{50} of 10.8 mg/L for arsenic and rainbow trout (Hale 1977). Nelson et al. (1991) described significant chronic effects to coho salmon (*O. kisutch*) from a six-month exposure to 300 µg/L of arsenic trioxide, where the normal increase in plasma thyroxine was delayed causing a transitory reduction in gill sodium-potassium ATPase activity. Although treated coho showed no direct effects in growth or survival, treated fish were less successful in seaward migration than control fish. However, Cockell and Hilton (1988) noted altered feeding behavior, and reduced growth and feed consumption by rainbow trout exposed to four dietary arsenicals. Rankin and Dixon (1994) observed significant reductions in growth at 9.64 mg/L of waterborne arsenite. Reduced appetite and direct metabolic impact were believed to be the cause for the reduced growth. It's also important to note that trout exposed to this concentration also suffered 10% mortality, mainly due to erosion of the mandibular and olfactory regions of the head. All fish exposed to this concentration also showed inflammation of the gallbladder wall.

The EPA has identified acute water quality criteria for arsenic of 340 µg/L and chronic water quality criteria of 150 µg/L. The NPDES permit limits effluent to 100 µg/L maximum daily load and 50 µg/L average monthly load. The FCC estimates effluent concentrations of arsenic of < 50 µg/L at the end-of-pipe. Both the effluent limits and estimated concentration at the outfall are below EPA's acute and chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are well below the 96-hour LC_{50} value of 10.8 mg/L reported by Hale (1977) for rainbow trout, and well below the 9.64 mg/L concentration of waterborne arsenite identified by Rankin and Dixon that led to reduced growth and mortality. Furthermore, considering dilution, mixing, and background concentrations of 0.0008 µg arsenic/L in Big Deer Creek, arsenic concentrations instream are estimated to be even lower at approximately 2.8 µg/L downstream of the falls where anadromous fish reside (Table 11). Therefore, NMFS does not expect the discharge of arsenic to result in direct effects to Chinook salmon or steelhead in Big Deer Creek. However, the potential for indirect effects is less certain. Although arsenic concentrations are not expected to rise to a range toxic to aquatic invertebrates, increased arsenic entering Big Deer Creek via the effluent could lead to bioaccumulation of arsenic in macroinvertebrates. Contaminated aquatic invertebrates later preyed upon by salmon and steelhead could then lead to potential accumulation of arsenic in salmonid tissues and organs. Although there is some degree of uncertainty regarding indirect effects of arsenic on salmon and steelhead in Big Deer Creek, stream surveys suggest that Chinook are absent and steelhead are only present in low numbers in lower Big Deer Creek (Kuzis 2004). Because indirect effects, if any, would be localized only to individual fish in

lower Big Deer Creek, it's highly unlikely that enough fish would be affected that bioaccumulation will rise to a level sufficient to appreciably reduce species abundance/productivity at the larger population, MPG, or ESU scales.

Cadmium – Cadmium occurs naturally in the aquatic environment as a sulfide salt, often in association with zinc and lead ores (Nelson et al. 1991). Natural concentrations are often in the range of 0.002 to 0.08 µg/L, with background concentrations of dissolved cadmium in Idaho waters generally in a range of less than 0.02 to 0.1 µg/L (Mebane 2006). Cadmium has no known biological use and is considered one of the most toxic metals. While released through natural processes, anthropogenic cadmium emissions have greatly increased levels of cadmium in the environment. In aquatic systems, cadmium quickly partitions to sediment, but is readily remobilized through a variety of chemical and biological processes (USDA Forest Service 2007). The half-life of cadmium in water is relatively short because, once in water, cadmium is considered highly soluble and highly mobile (Mebane 2006). According to water quality monitoring data from 2001 until 2005, background concentrations of cadmium in Big Deer Creek are currently estimated at 0.00006 µg/L (Table 11).

Cadmium is a known teratogen, carcinogen, and probable mutagen to which freshwater organisms are considered the most sensitive (Vincoli 1997; Eisler 1985a). Acute toxic effects may include the death of animals, birds, or fish, and death or low growth rate in plants. In freshwater organisms, effects of cadmium toxicity include decreased growth, inhibited reproduction, and population alterations (Vincoli 1997). Cadmium is extremely toxic to aquatic animals. In comparative acute toxicity testing of all 63 atomically stable heavy metals in the periodic table, cadmium was the most toxic metal (Mebane 2006). The acute toxicity of cadmium is due to its role as a calcium antagonist. It's pathological effects tend to be less severe at higher water calcium levels (i.e., harder water) (Scott et al. 2003; Vincoli 1997). In other words, the harder the water, the lower the toxicity. Toxicity of cadmium can also be influenced by pH; becoming more toxic in low-alkalinity water. Because the carbonate and hydroxide forms of cadmium are insoluble, cadmium is precipitated out at high pH values, reducing its overall toxicity to fish (Nelson et al. 1991). Uptake of cadmium from waterborne exposure occurs primarily through the gills, versus dietary uptake which occurs in the gastrointestinal tract (Scott et al. 2003; Szebedinszky et al. 2001). It's been conservatively estimated that adverse effects to fish or wildlife are either pronounced or probable when cadmium concentrations exceed 3 µg/L in freshwater or 100 µg/g (parts per billion) in diet (Eisler 1985a).

Cadmium salts (chlorides and sulphates) in stream sediments can be mobilized and made bioavailable if pH is lowered (more acidic) or because of high oxidation (redox potential). If rooted aquatic macrophytes or adjacent wetland plants are present in freshwater systems, cadmium bound in sediments may be transferred to the plant tissue and, when the plants die and decompose, become bioavailable in the aquatic ecosystem to other biota (Eisler 1985a).

Although the BA states that cadmium does not bioconcentrate in aquatic species, a literature review conducted as part of this analysis suggests that this is not the case. The concentration of cadmium found in fish tissues is expected to be much higher than the average concentration of cadmium in the water from which the fish was taken (Vincoli 1997). Benoit et al. (1976) found residues of cadmium in brook trout kidney, liver, gill, gonad, spleen, muscle, and red blood cells

following exposure. Hamilton et al. (1987) described a close dose-response relationship between exposure concentrations and free-cadmium concentrations in brook trout liver and kidneys. They also found that whole-body residues of cadmium increased significantly in brook trout at all exposures from 3.6 to 60.6 µg/L, demonstrating a dose-dependent response to cadmium concentrations. Residues were highly correlated with both cadmium exposure concentrations and mortality after 30 days of exposure. Cadmium has been documented to accumulate in tissue from both waterborne and dietary exposure, and has also been shown to enter circulation and accumulate significantly in the liver and kidney (Scott et al. 2003; Szebedinszky et al. 2001; McGeer et al. 2000).

Eisler (1985a) reported the bioconcentration factor for cadmium in rainbow trout to be 260 times (x) for gill tissue, 17x for liver tissue, 26x for kidney, and zero for spleen and heart tissues over ambient concentrations in the aquatic environment. Biomagnification from one trophic level to another in aquatic systems has also been demonstrated for cadmium, going from phytoplankton to zooplankton. However, fish fed cadmium-contaminated cladocerans for four days showed no change in body burdens. For the whole organism, the bioconcentration factor for rainbow trout was 33x, was 2,550x for *Chlorella vulgaris* (a species of green algae), 2,200x for chironomids, and 1,630x for mayflies in the genus *Ephemerella* (Eisler 1985a).

As summarized by Thurston et al. (1979), Davies found a no effect concentration for rainbow trout in hard water (hardness 326 mg/L) between 13.5 µg/L (no effect) and 21 µg/L (20% mortality), versus a no effect concentration in soft water (hardness 31 mg/L) between 0.7 µg/L (no effect) and 1.5 µg/L (10% mortality). Nelson et al. (1991) reported acute and chronic lowest observed effect levels for cadmium of 3.9 µg/L and 1.1 µg/L respectively. After exposing three generations of brook trout to 0.06 to 6.4 µg/L of cadmium, Benoit et al. (1976) noted significant mortality of first- and second-generation spawning males at 3.4 µg/L. This concentration also significantly retarded the growth of second and third generations.

Lethal concentrations of cadmium ranging from 0.8 to 9.9 µg/L have been identified for several species of aquatic insects, crustaceans, and fishes. According to Mebane (2006), chronic and acute toxicity of cadmium in the aquatic environment is dependent on water hardness. For example, using a hardness correction, Mebane (2006) calculated LC₅₀s of 467 µg/L for a species of caddisfly (*Arctopsyche* species), 150.86 µg/L for the blue-winged olive mayfly (*Baetis tricaudatus*), and 15.29 µg/L for a species of Cladocera (*Ceriodaphnia dubia*). For acute exposure to cadmium, fish in the genus *Oncorhynchus* were found to be the most sensitive of 58 genera evaluated. Mebane reported Chinook salmon hardness-corrected LC₅₀s ranging from 2.27 to 49.90 µg/L for acute cadmium exposures (dependent on life stage). For rainbow trout/steelhead, hardness-corrected LC₅₀s ranged from 0.55 to 9.13 µg/L. For chronic exposures to cadmium, hardness-corrected LC₅₀s were identified as 1.72 µg/L for Chinook salmon, and 1.36 to 2.22 µg/L for rainbow trout/steelhead (Mebane 2006). The author also identified lowest-observed-adverse effect concentrations (LOECs) for chronic exposure to cadmium at 1.3 µg/L for Chinook salmon, and a range of 1.3 to 7.02 µg/L (not corrected for water hardness) for rainbow trout.

Eisler (1985) reported that sublethal aquatic effects of cadmium are associated with concentrations of 0.7 to 570 µg/L, noting decreased growth, inhibited reproduction, and population alterations. Studies by Scott et al. (2003) and Riddell et al. (2005) have also revealed that exposure to low levels of cadmium can result in sublethal effects to salmonids. Scott et al. (2003) found that exposure to sublethal levels of cadmium can result in cadmium accumulation in the olfactory rosette, nerve, and bulb, impairing olfactory function of juvenile rainbow trout. This accumulation in the olfactory system from waterborne exposure was greater than any other organs of accumulation other than the gill. Exposure inhibited normal behavioral and physiological responses of rainbow trout to alarm substance (a chemical signal released from specialized epidermal cells in fish skin when attack by a predator causes sufficient skin damage), disrupting their predator-avoidance strategy. Normal behavioral responses to alarm substance were eliminated by waterborne exposure to 2 µg/L cadmium for 7 days (moderate hardness of 120 mg/L hardness as CaCO₃). Scott cited an addition study by Tjälve and Gottofrey that used similar waterborne cadmium concentrations (1 µg/L and 10 µg/L for one week in 40 mg/l hardness as CaCO₃), where cadmium accumulated in the olfactory system of brown trout (*Salmo trutta*). Inhibition of a predator avoidance strategy has the potential to affect survival of ESA-listed salmonids at both the individual and population scale.

Riddell et al. (2005) noted a change in foraging preference, behavior, and fish condition factor following exposure to sublethal levels of cadmium (0.5 µg/L and 5.0 µg/L for 30 days; 156 mg/l hardness as CaCO₃). Brook trout exposed to elevated levels of cadmium switched from a preference for the more mobile and nutritious *B. tricaudatus* to the non-mobile, less nutritious *Chironomus tetans* (bloodworm head). Independent of prey choice, the capture efficiency of cadmium-stressed trout decreased by 20% to 55% with increasing cadmium concentrations. Fish condition factor, determined by the length and width of the fish pre- and post-treatment, was also negatively affected, declining by 12% to 18% in exposed fish as opposed to increasing by 34% in control fish. In this study, alteration of diet and reduced capture efficiency associated with exposure to sublethal levels of cadmium negatively affected fish growth, a condition that would decrease the likelihood that these fish would survive in the wild. Sloman et al. (2003) also noted a behavioral response in rainbow trout exposed to cadmium. Rainbow trout exposed to sublethal concentrations (150 µg/L [15% of 96-hour LC₅₀ of 1,000 µg/L]) of cadmium for 24 hours became subordinate when paired with non-exposed fish, severely confounding the ability of exposed fish to become dominant.

The EPA has identified acute water quality criteria for cadmium at 0.52 µg/L, and chronic water quality criteria at 0.37 µg/L. The NPDES permit limits effluent to 0.52 µg/L maximum daily load, and 0.26 µg/L average monthly load. The FCC estimates effluent concentrations of cadmium at < 0.1 µg/L at the end-of-pipe. Both the effluent limits and estimated concentration at the outfall are at or below EPA's acute and chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are below the no effect concentration of 0.7 µg/L reported by Thurston et al. (1979) for rainbow trout in soft water, and well below the 3.64 µg/L concentration identified by Benoit et al. (1976) that led to significant mortality. Furthermore, considering dilution, mixing, and background concentrations of 0.00006 µg cadmium/L in Big Deer Creek, cadmium concentrations instream are estimated to be even lower at approximately 0.01 µg/L downstream of the falls where anadromous fish reside (Table 11). Although it is less certain that the EPA water quality criteria for cadmium are set

low enough to avoid bioaccumulation in potential prey species or to avoid sublethal effects to ESA-listed salmonids, the mixing and subsequent dilution to concentrations of 0.01 µg/L by the time cadmium-laden water reaches waters inhabited by salmon and steelhead makes it less likely that exposure to cadmium would result in lethal or sublethal effects.

Cobalt – Although naturally occurring in uncontaminated waters at no more than a few micrograms per liter, cobalt can occur in elevated concentrations in water affected by runoff from mines containing cobalt-bearing ores (Marr et al. 1998; Nagpal 2004). In the United States, concentrations of cobalt in freshwater streams range from <1 µg/L in undisturbed natural streams, to levels between 11 and 50 µg/L in streams passing through mining districts and regions with heavy agricultural land use (Nagpal 2004). Background concentrations of cobalt in Big Deer Creek are currently estimated at 0.021 µg/L (Table 11). Cobalt and its salts are highly persistent in the aquatic environment, with a half-life >200 days (Vincoli 1997). The concentration of cobalt has been reported to significantly correlate to pH (inverse) and suspended solids (positive) in water (Nagpal 2004).

Cobalt is a known carcinogen, and has been documented as mutagenic in humans. Although little data exists on the toxicity of cobalt, acute exposure can result in death to animals, birds, or fish. Cobalt and its salts reportedly have high chronic toxicity to aquatic life, resulting in effects such as shortened life spans, reproductive problems, lower fertility, and potential changes in appearance or behavior (Vincoli 1997). Nagpal (2004) suggested that aquatic invertebrates are more sensitive to cobalt exposure than either plants or fish. Cobalt may bioconcentrate, with cobalt concentrations in fish expected to be somewhat higher than the average concentration in the water from which the fish was taken (Vincoli 1997).

Nagpal (2004) found that rainbow trout were the most sensitive fish species to cobalt exposure. Studies reviewed by Nagpal identified chronic LC₅₀s of 470 to 490 µg/L for 28-day embryo-larval toxicity tests, and a 144-hour LC₅₀ of 520 µg/L (Marr et al. 1998) for fry. Marr et al. (1998) also identified 14-day no observed effect concentrations (NOEC) and LOEC for rainbow trout fry growth and survival of 132 and 255 µg/L respectively. Marr et al. identified a 96-hour LC₅₀ of 1,406 µg/L for rainbow trout, but also identified a time-independent incipient lethal level (ILL) of 346 µg/L. Because cobalt concentrations high enough to eventually lead to 100% mortality caused no mortality until after 72-hours of exposure, with most fish dying between 72- and 192-hours, the study suggested that the 96-hour LC₅₀ would not likely be sufficient to adequately protect rainbow trout from cobalt exposure.

ESA-listed salmon and steelhead could be indirectly affected through effects to prey items. Effects of metals have been shown to affect invertebrate communities by decreasing plecopteran and trichopteran densities, decreasing total taxa richness, decreasing biomass, and increasing the relative abundance of chironomids (Beltman et al. 1999). Nagpal (2004) found that *D. magna* and *C. dubia* exhibited chronic effects when exposed to low cobalt concentrations, noting an LOEC of roughly 8 µg/L was sufficient to cause reproductive effects in these invertebrates. To protect aquatic life from cobalt exposure, Nagpal (2004) recommended acute concentrations <110 µg/L and chronic concentrations <4 µg/L (30-day average).

Sublethal effects have also been noted for both Chinook salmon and steelhead in the form of avoidance behavior. Hansen et al. (1999b) found that Chinook salmon were more sensitive to elevated cobalt concentrations than steelhead, avoiding concentrations of 24 µg/L versus 180 µg/L. This study suggests that every day behavior and habitat use would be affected at concentrations much lower than those reported for acute or chronic mortality.

Mebane (2007) recently completed a white paper at the request of NMFS to evaluate the protectiveness of a site-specific cobalt concentration of 86 µg/L for Chinook salmon and steelhead in Panther Creek, Idaho (Appendix B). In this effort, Mebane conducted an extensive literature review for cobalt and its potential effects on aquatic biota, including a detailed review of a 2004 study of toxicity of cobalt to fish and invertebrate species for Blackbird Mine cleanup targets (Pacific EcoRisk 2005). Acute and chronic cobalt toxicity levels were tested for rainbow trout, mottled sculpin (*Cottus bairdi*), two mayflies (*Serratella tibialis* and *Centroptilum conturbatum*), one caddisfly (*Brachycentrus americanus*), and one midge (*C. tentans*). In rainbow trout, acute testing revealed 96-hour LC₅₀s ranging from 800 to 1,360 µg/L, NOECs ranging from 750 to 950 µg/L, and LOECs ranging from 290 to 470 µg/L. Chronic toxicity tests revealed a NOEC of 101 µg/L, and a LOEC of 242 µg/L. *C. conturbatum* was determined to be the most sensitive of all species tested to cobalt concentrations with LC₅₀s ranging between 2,000 and 9,400 µg/L. *C. tentans* was the most sensitive invertebrate to chronic cobalt exposure, with an EC₂₀ (concentration adversely affecting 20% of test population) of 2,370 µg/L. Considering this data and literature reviewed, Mebane (2007) concluded that appreciable adverse effects to steelhead and Chinook salmon populations or their habitat associated with sustained concentrations of cobalt up to 86 µg/L would be unlikely.

The EPA has not identified an acute water quality criterion for cobalt, but has identified a chronic water quality criterion of 86 µg/L. The NPDES permit limits effluent to 141 µg/L maximum daily load, and 70.4 µg/L average monthly load. The FCC estimates effluent concentrations of cobalt at < 50 µg/L at the end-of-pipe. Both the effluent's chronic limit and estimated concentration at the outfall are at or below EPA's chronic water quality criteria. At the end-of-pipe, maximum concentrations of cobalt allowed by the NPDES permit limits are in a range are well below LC₅₀s reported by Nagpal (2004), and also well below the NOEC, LOEC, and ILL toxicity levels reported by Marr et al. (1998). Although EPA's maximum daily limit of 141 µg/L is higher than the acute recommendation of 110 µg/L by Nagpal (2004), dilution in Big Deer Creek is expected to lower cobalt concentrations below the falls to approximately 7.9 µg/L (acute) and 3.9 µg/L (chronic) (Table 11). This concentration is also below Nagpal's recommended 4.0 µg/L for chronic cobalt exposure. Therefore, both the EPA water quality criteria for cobalt and the estimated concentrations from the ICP effluent appear to be set low enough to avoid adverse effects to potential prey species and to avoid sublethal effects to ESA-listed salmonids.

Copper – Copper is naturally occurring, plentiful, and essential to the normal growth and metabolism of all living organisms. At low concentrations it's an essential element for both plants and animals, but at slightly higher concentrations can be toxic to aquatic life (Eisler 1998a; Vincoli 1997). Although copper is relatively insoluble in water, it becomes more soluble as pH drops and can thereby be introduced into streams via acid mine drainage (Nelson et al. 1991). Once in aquatic systems, it can dissolve or bind to organic and inorganic materials either

in suspension or in sediment. Ambient monitoring studies by the USGS for dissolved copper at 811 sites across the United States have revealed background copper concentrations ranging from 1 to 51 µg/L, with a median of 1.2 µg/L (Hecht et al. 2007). Background concentrations of copper in Big Deer Creek are currently estimated at 0.0456 µg/L (Table 11). Copper is highly persistent in the aquatic environment, with a half-life >200 days (Vincoli 1997). Scientific literature indicates that copper toxicity decreases as water hardness and alkalinity increases (Nelson et al. 1991). It can also be influenced by sodium (Welsh et al. 2008).

Dissolved copper is highly toxic to a broad range of aquatic species, including algae, macrophytes, aquatic invertebrates, and fishes (Hecht et al. 2007). Copper is a sodium antagonist (Sloman et al. 2003), and acute exposure can result in death to animals, birds, or fish. Chronic exposure can affect life spans, reproduction, fertility, growth, osmoregulation, sensory function, metabolism, carcinogenicity, mutagenicity, teragenicity, appearance and behavior (Vincoli 1997; Hecht et al. 2007; Eisler 1998a). Mortality to fish from copper occurs when insoluble copper-protein compounds form on gill surfaces, causing the sloughing of gill epithelia and eventual suffocation (Nelson et al. 1991). Copper may also bioconcentrate in organisms, with concentrations in fish expected to be considerably higher than the average concentration in the water from which the fish was taken (Vincoli 1997). Loss of invertebrate taxa richness has been reported to occur at copper concentrations as low as 5 µg/L. Direct exposure to dissolved copper can impair and destroy olfactory sensory neurons which are important for finding food, avoiding predators, migration, recognizing kin, reproducing, and avoiding pollution (Hecht et al. 2007).

Hecht et al. (2007) conducted a comprehensive literature review regarding copper and its effects on fish. Table 12 is an excerpt from that publication, summarizing both acute and chronic effect concentrations reported in the literature. As summarized in Table 12, acute mortality of various life stages of salmon and steelhead exposed to dissolved copper occur at low concentrations, with 96-hour LC₅₀s ranging from 9 to 57 µg/L. A growing body of literature reviewed demonstrates that low levels of dissolved copper result in sublethal effects to salmon and steelhead as well. Dissolved copper is a neurotoxicant that can directly damage the sensory capabilities of salmonids at low concentrations, concentrations at or slightly above ambient levels. Sensory system effects are generally among the more sensitive fish responses and underlie important behaviors involved in growth, reproduction, and ultimately survival (i.e., predator avoidance, migration, etc.). Salmonids begin actively avoiding dissolved copper at concentrations as low as 0.75 µg/L, experience reduced growth from concentrations as low as 1.9 µg/L, experience delayed outmigration at 5 µg/L, and experience problems homing and spawning at concentrations in the 10 to 25 µg/L range (Table 12).

As reported by Hecht et al. (2007), several recent studies highlight some important aspects of dissolved copper olfactory toxicity (Baldwin et al. 2003; Sandahl et al. 2004; Sandahl et al. 2007). Impairment of olfaction (i.e., smell) can be measured by an electrophysiological technique called the electro-olfactogram (EOG). The EOG measures olfactory response of a population of receptor neurons in fish. Reductions in the EOG amplitude of copper-exposed fish compared to unexposed fish reflect functional losses in sensory capacity. Dissolved copper's toxic effect to olfactory sensory neurons is observable as a reduction in or elimination of the EOG amplitude to a recognizable odor. Baldwin et al. (2003) found that the neurotoxic effects

of copper in coho salmon manifest over a timescale of minutes. At 10 minutes, EOG amplitude reductions were observed in juvenile coho exposed to 2, 5, 10, and 20 µg/L dissolved copper above experimental background (3 µg/L). After 30 minutes at 2 µg/L dissolved copper above experimental background, the EOG amplitude from juvenile coho to odors was reduced by approximately 25% compared to controls; after 30 minutes in 20 µg/L dissolved copper amplitude was reduced by 80%. Sandahl et al. (2004) reported similar effects following 7 days of exposure (both in EOG reductions and copper concentrations). This result indicated that the juvenile olfactory system does not appear to be able to adapt or otherwise compensate for continuous copper exposure for durations up to 7 days.

Table 12. Selected examples of adverse effects with copper to salmonids or their preya (from Hecht et al. 2007)

Species (life stage)	Effect	Effect Conc. (µg/L) ^b	Effect Statistic	Hardness (mg/L) ^c	Exposure Duration	Sources
Sensory and behavioral effects						
Coho salmon (juvenile)	Reduced olfaction & compromised alarm response	0.18 –2.1	EC10 to EC50	120	3 hours	Sandahl et al. 2007
Chinook salmon (juvenile)	Avoidance in laboratory exposures	0.75	LOEC	25	20 minutes	Hansen et al. 1999a
Rainbow trout (juvenile)	Avoidance in laboratory exposures	1.6	LOEC	25	20 minutes	Hansen et al. 1999a
Chinook salmon (juvenile)	Loss of avoidance ability	2	LOEC	25	21 days	Hansen et al. 1999a
Atlantic salmon (juvenile)	Avoidance in laboratory exposures	2.4	LOEC	20	20 minutes	Sprague et al. 1965
Atlantic salmon (adult)	Spawning migrations in wild interrupted	20	LOEC	20	Indefinite	Sprague et al. 1965
Chinook salmon (adult)	Spawning migrations in wild apparently interrupted	10 – 25	LOEC	40	Indefinite	Mebane 2000
Coho salmon	Delays & reduced downstream migration dCu-exposed juveniles	5	LOEC	95	6 days	Lorz and McPherson 1976; 1977
Rainbow trout	Loss of homing ability	22	LOEC	63	40 weeks	Saucier et al. 1991
Ecosystem effects						
N/A ^d	Ecosystem function: Reduced photosynthesis	2.5	LOEC	49	≈ 1 year	Leland and Carter 1985
N/A ^d	Ecosystem structure: loss of invertebrate taxa richness in a mountain stream	5	LOEC	49	≈ 1 year	Leland et al. 1989
Other sublethal effects						
Chinook salmon	Reduced growth (as weight)	1.9	EC10	25	120 days	Chapman 1982
Rainbow trout		2.8	EC10	25	120 days	Marr et al. 1996
Coho salmon		21 – 22	NOEC	24–32	60 days	Mudge et al. 1993
Steelhead		45 to >51	NOEC	24–32	60 days	Mudge et al. 1993
Direct Lethality ^e						
Chinook salmon (fry)	Death	19	LC50	24	96 hours	Chapman 1978
Coho salmon (fry)	Death	28 – 38	LC50	20–25	96 hours	Lorz and McPherson 1976
Steelhead/ rainbow (fry)	Death	9 – 17	LC50	24–25	96 hours	Chapman 1978; Marr et al. 1999

Species (life stage)	Effect	Effect Conc. (µg/L) ^b	Effect Statistic	Hardness (mg/L) ^c	Exposure Duration	Sources
Coho salmon (adult)	Death	46	LC50	20	96 hours	Chapman and Stevens 1978
Steelhead (adult)	Death	57	LC50	42	96 hours	Chapman and Stevens 1978
Coho salmon (juvenile)	Death	21 – 22	NOEC	24–32	60 days	Mudge et al. 1993
Steelhead (juvenile)	Death	24 – 28	NOEC	24–32	60 days	Mudge et al. 1993
Steelhead (egg-to-fry)	Death	11.9	EC10	25	120 days	Chapman 1982

a Abbreviations: LOEC = Lowest observed adverse effect concentration (and most LOEC values given are not thresholds, but were simply the lowest concentration tested); NOEC = No observed adverse effect concentration; LC50 = the concentration that kills 50% of the test population; EC_p = effective concentration adversely affecting (p) percent of the test population or percent of measured response, e.g., 10% for an EC10, etc.; and Indefinite = field exposures without defined starting and ending times. NA = not applicable.

b Effects and exposure durations stem from laboratory and field experiments, therefore in some experiments multiple routes of exposure may be present (i.e., aqueous and dietary) and water chemistry conditions will likely differ (see reference for details).

c Hardness is reported, as it can influence the toxicity of copper.

d This study examined ecosystems consisting of a number of species or unidentified species.

e Acute sensitivity of salmonids to copper probably varies by life stage, and the swim-up fry stage is probably more sensitive than older juvenile life stages such as parr and smolts or adults.

Using EOG measurements in combination with a predator avoidance assay, Sandahl et al. (2007) presented the first evidence that impaired olfaction resulted in a direct suppression of predator avoidance behavior (alarm response) by juvenile coho salmon at environmentally relevant dissolved copper exposures (≥ 2.0 µg/L; 3 hour exposure). Another fish sensory system, the lateral line, is also a target for the neurotoxic effects of dissolved copper. It's composed of mechanosensory neurons (hair cells) that respond to surface water vibrations, flow, and other types of mechanical cues in the aquatic environment. The lateral line system thereby mediates shoaling, pursuit of prey, predator avoidance, and rheotaxis (orientation to flow). In a recent study, dissolved copper killed 20% of hair cells in zebrafish following 3 hours of exposure to ≥ 20 µg/L (Linbo et al. 2006, as cited in Hecht et al. 2007).

Review of water quality data in Big Deer Creek show seasonal increases in copper during peak runoff that have been decreasing over time. However, these peaks appear to reflect increases in total copper with the dissolved fraction remaining relatively constant. Since total copper is not bioavailable to fish, these seasonal peaks are not anticipated to affect ESA-listed salmonids.

In addition, prior to the commencement of discharge, the permittee must provide a copper loading demonstration plan demonstrating to EPA and IDEQ that there will be no net increase in copper mass loading to the Big Deer Creek watershed as a consequence of mining activity. This demonstration must be approved by IDEQ. As described in the State's certification of the permit, the permittee must demonstrate to IDEQ, prior to the commencement of discharge, that there will be no net increase in copper mass loading to the Big Deer Creek watershed as a consequence of mining activity. Because Big Deer Creek is listed as a "high priority" waterbody under the total maximum daily load program, this requirement is necessary in order to comply with State water quality standards at IDAPA 58.01.02.054.04. Prior to discharge, the permittee

must prepare a written plan that: (1) describes the measures that will be implemented (if any) to ensure that, notwithstanding the addition of copper from the discharge, the total mass load of copper remains constant or decreases in the Big Deer Creek watershed; and, (2) includes a schedule for the implementation of these measures. The written plan must be submitted to EPA and the IDEQ regional office. The plan must be approved by IDEQ prior to discharge, and implemented in accordance with the approved plan.

The EPA has identified acute water quality criteria for copper at 4.6 µg/L, and chronic water quality criteria at 3.5 µg/L. The NPDES permit limits effluent to 4.8 µg/L maximum daily load, and 2.4 µg/L average monthly load. The FCC estimates effluent concentrations of copper of < 2.0 µg/L at the end-of-pipe. Both the effluent limit and estimated concentration at the outfall are below EPA's acute and chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are below the 96-hour LC₅₀ values of 9 to 57 µg/L previously discussed, but above the 0.75 µg/L concentrations resulting in avoidance, the 1.9 µg/L concentrations affecting growth, and within the 5 to 25 µg/L range where copper concentrations have been shown to affect migration and spawning behaviors. These concentrations are also in excess of the 5 µg/L level where copper has been shown to begin to result in loss of invertebrate taxa. Considering dilution, mixing, and background concentrations of 6.9 µg copper/L in Big Deer Creek, copper concentrations instream are estimated to be approximately 6.6 µg/L downstream of the falls where anadromous fish reside (Table 11). However, because FCC will be required meet the no net increase standard for copper and submit a copper loading plan to achieve this standard for approval prior to first discharge, NMFS does not expect concentrations of copper contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Lead – Lead is a relatively rare mineral (Eisler 1998b), occurring naturally as the mineral galena (Nelson et al. 1991). Lead is neither essential nor beneficial to living organisms, negatively affecting survival, growth, reproduction, development, behavior, learning, and metabolism (Eisler 1998b). Lead has high acute toxicity to aquatic life and birds (Eisler 1998b; Vincoli 1997; Nagpal 1987). It and its compounds are soluble in water, with bioavailability increasing in waters with low pH, low organic content, and low metal salt content (USDA Forest Service 2007). Background concentrations of lead in Big Deer Creek are currently estimated at 0.00062 µg/L (Table 11). Lead is highly persistent in water, with a half-life >200 days (Vincoli 1997). Waste associated with lead mining activities has directly affected fish through toxic exposure and indirectly affected fish through poisoning of prey items (Eisler 1998b).

Lead is most often precipitated to sediments in aqueous environments. Adsorption of lead by aquatic animals is affected by the age, gender, and diet of the organism, as well as the particle size, chemical species and presence of other compounds in the water. Species sensitive to lead are more affected by dissolved lead than total lead (USDA Forest Service 2007). In aquatic organisms, concentrations of lead are greatest in algae and benthic organisms and lowest in predators; showing no real evidence of biomagnification in the food chain (Eisler 1998b). Nelson et al. (1991) reported that toxicity of lead to rainbow trout is inversely related to oxygen concentration. Toxic effects are more pronounced at higher water temperatures, reduced pH, in comparatively softer waters, in younger life stages, and after longer exposures (Eisler 1998b). Mortality of fishes from lead occurs from exposure to waters containing lead salts which causes

resulting from a suffocating film of coagulated mucus to form over the body and gills (Nelson et al. 1991). Like cadmium, lead is a calcium antagonist and neurotoxin and has been documented to have significant effects on behavior (Sloman et al. 2003).

Lead is more toxic to fish in soft water than hard water, although 96-hour LC_{50} s vary greatly (Nagpal 1987). For rainbow trout, Nagpal (1987) cited studies by Davies et al. (1976) where 96-hour LC_{50} acute toxicities ranged from a high of 471,000 $\mu\text{g/L}$ in hard water (290 mg/L CaCO_3) to a low of 1,179 $\mu\text{g/L}$ in soft water (32 mg/L CaCO_3). Hale (1977) reported a 96-hour LC_{50} of 8,000 $\mu\text{g/L}$ for rainbow trout. Nagpal also summarized results for studies conducted by Holcombe et al. (1976) with brook trout in soft water (44 mg/L CaCO_3), where 96-hour LC_{50} acute toxicities ranged from 4,100 $\mu\text{g/L}$ total lead to 3,362 $\mu\text{g/L}$ dissolved lead. However, when exposed to tetramethyllead, Eisler (1998b) reported acute toxicities to rainbow trout at only 3.5 $\mu\text{g/L}$.

Fish chronically exposed to waterborne lead exhibit various signs of lead poisoning, including: (1) Spinal curvature, (2) anemia; (3) darkening of the dorsal tail region; (4) degeneration of the caudal fin; (5) destruction of spinal neurons; (6) ALAD (delta-aminolevulinic acid dehydratase) inhibition in blood, bone, gill, liver, and renal tissues; (7) reduced ability to swim against a current; (8) destruction of the respiratory epithelium; (9) basophilic stippling of erythrocytes; (10) elevated lead concentrations in blood, bone, gill, liver, and kidney; (11) muscular atrophy; (12) paralysis; (13) renal pathology; (14) growth inhibition; (15) retardation of sexual maturity; (16) altered blood chemistry; (17) testicular and ovarian histopathology; and (18) death (Eisler 1998b).

Davies et al. (1976) reported chronic effects in the form of black tails and spinal deformities in early life-stage (embryo to 19 month) rainbow trout in soft water (28 mg/L CaCO_3). Pre-hatch rainbow were affected at concentrations between 4.1 and 7.6 $\mu\text{g/L}$, while effects were noted in fry at concentrations as low as 7.2 to 14.6 $\mu\text{g/L}$. Only 5% of the fish were reportedly affected at these lower concentrations. However, 32% of the fish were reported to have spinal deformities where rainbow trout were exposed to lead concentrations of 27 $\mu\text{g/L}$. While studying long-term effects on rainbow trout fry and fingerlings, Davies et al. (1976) noted that rainbow developed spinal deformities in soft water at much lower lead concentrations than in hard water. In soft water (28 mg/L CaCO_3), spinal deformities were observed in 44% of the fish exposed to 31 $\mu\text{g/L}$ and 97% of the fish exposed to 62 $\mu\text{g/L}$. In hard water (353 mg/L CaCO_3), no spinal deformities were observed in fish exposed to 190 $\mu\text{g/L}$, while 10% of the fish exhibited spinal deformities when exposed to 380 $\mu\text{g/L}$.

Two additional studies cited by Nagpal (1987) suggested similar results for spinal deformities. Holcombe et al. (1976) noted spinal deformities in brook trout exposed to concentrations of 58 to 119 $\mu\text{g/L}$ (total lead), and at 39 to 84 $\mu\text{g/L}$ (dissolved lead) (hardness 44 mg/L CaCO_3). Two month exposure of juvenile rainbow trout to lead resulted in spinal deformities at concentrations ranging between 48 and 83 $\mu\text{g/L}$ lead (hardness 34 mg/L) (Sauter et al. 1976, as cited in Nagpal 1987).

Lead has been shown to bioconcentrate in aquatic species, accumulating more in invertebrates than vertebrates. Inorganic lead is poorly accumulated in fish, with larger organic lead

compounds such as tetraalkyllead more toxic than smaller compounds like trialkyllead (USDA Forest Service 2007). In vertebrates, concentrations of lead tend to localize in hard tissues such as bone or teeth (USDA Forest Service 2007; Eisler 1998b), but can also accumulate in liver and kidney tissues (Nelson et al. 1991). Although lead has been shown to concentrate in aquatic species, there is little evidence for biomagnification (USDA Forest Service 2007; Eisler 1998b; Nagpal 1987).

Nagpal (1987) used data by Davies et al. (1976) that identified maximum acceptable lead concentrations for rainbow trout ranging from 4.1 to 7.6 µg/L in setting British Columbia chronic water quality standards for lead exposure. Based on this study, Nagpal recommended a maximum concentration of 4.0 µg/L for moderately soft water (i.e., 20 to 40 mg/L CaCO₃).

The acute toxicity of lead to aquatic invertebrates varies tremendously, reported in concentrations ranging between 100 and 100,000 µg/L. Nagpal (1987) reported 48-hour LC₅₀s ranging from 450 µg/L to 1,910 µg/L for *Daphnia*, with toxicity increasing as water softened. *Daphnids* were found to be 11 times more sensitive to lead in soft water than in hard, where chronic toxicity limits ranged from 9 to 16 µg/L in soft water (52 mg/L CaCO₃), to 85 to 193 µg/L in hard water (151 mg/L CaCO₃). However, prey species important to rearing salmonids do not appear to be as sensitive to lead, with 7-day LC₅₀s of 16,000 and 32,000 µg/L in soft water (44 mg/L CaCO₃) for the mayfly (*Ephemerella subvaria*) and the caddisfly (*Hydropsyche bettine*), respectively. For other species of stonefly, caddisfly, and mayfly studied, 14-day LC₅₀s in soft water (50 mg/L CaCO₃) ranged from 3,500 µg/L to 64,000 µg/L (Nagpal 1987).

The EPA has identified acute water quality criteria for lead at 13.88 µg/L, and chronic water quality criteria at 0.54 µg/L. The NPDES permit limits effluent to 0.90 µg/L maximum daily load, and 0.45 µg/L average monthly load. The FCC estimates effluent concentrations of lead at < 0.3 µg/L at the end-of-pipe. Both the effluent limit and estimated concentration at the outfall are below EPA's acute and chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are well below the lowest 96-hour LC₅₀ acute values, and below the 3.5 and 4.1 µg/L previously discussed for the onset of chronic toxicities to rainbow trout and aquatic invertebrates. Furthermore, considering dilution, mixing, and background concentrations of 0.00062 µg lead/L in Big Deer Creek, lead concentrations instream are estimated to be even lower at approximately 0.03 µg/L downstream of the falls where anadromous fish reside (Table 11). Therefore, NMFS does not expect concentrations of lead contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Mercury – Mercury and its compounds have no known normal metabolic function and its presence in living organisms is undesirable and usually hazardous. Mercury contamination in the environment has been associated with; (1) mining and smelting operations; (2) fungicides used in agriculture; (3) the manufacturing of chlorine and sodium hydroxide; (4) use as a slime control agent in the pulp and paper milling processes; (5) the production of plastics and electrical operations; (6) the byproduct of producing electricity from coal; and (7) careless waste disposal practices (including incineration and landfilling of certain mercury-containing products) (Eisler

1987). Mercury is insoluble but highly persistent in water, with a half-life > 200 days. Once released into water, microorganisms convert mercuric salts into methyl-mercury, which is then taken up by algae and enters the food chain (Vincoli 1997).

Mercury can enter the aquatic environment from aerial deposition, surface runoff and spills, and via contaminated groundwater. Elevated levels of mercury in living organisms in mercury-contaminated areas may persist for as long as 100 years after the source of pollution has been discontinued (Eisler 1987). While the residence time of atmospheric mercury is relatively short at about 11 days, it's relatively much longer in oceanic waters, soils, and sediments (at least 1,000 years). In general, the number of mercury-contaminated fish and wildlife habitats has progressively increased, almost all as a direct result of anthropogenic activities. Eisler (1987) reported that mercury levels in river sediments have increased fourfold since pre-cultural times, and twofold to fivefold in sediment cores from lakes and estuaries. Background concentrations of mercury in Big Deer Creek are currently estimated at 0.00005 µg/L (Table 11).

Mercury is a heavy metal, which as an element is a liquid near room temperature and pressure. Mercury is a known mutagen, teratogen, and carcinogen, causing embryocidal, cytochemical, and histopathological effects. Forms of mercury with relatively low toxicity, such as insoluble mercuric sulfide, can be transformed into forms of very high toxicity such as methylmercury or mercuric chloride by some biological processes (Eisler 1987). Microorganisms can convert inorganic and organic mercury compounds into highly toxic methylmercury or dimethylmercury in the water column or sediments and under aerobic or anaerobic conditions (Eisler 1987). In contaminated waters, almost all mercury in fish is methylmercury (Nagpal 1989). Nutrient content of the water, pH, redox conditions, suspended sediment load, sedimentation rates, and microbial activity all affect the methylation of mercury in aquatic ecosystems (Eisler 1987).

Inorganic and methylmercury have high acute and chronic toxicities to aquatic life. Chronic effects can include shortened life span, reproductive problems, lower fertility, and changes in appearance or behavior in exposed animals. These effects can be seen long after first exposure(s) to mercury (Vincoli 1997). In testing of rainbow trout and inorganic mercury, acute 96-hour LC₅₀s ranged from 155 to 200 µg/L for juvenile fish, to 28-day LC₅₀s of 4.7 µg/L and <0.1 µg/L for embryo-larva in static and flow through tests respectively. For organic mercury, acute 96-hour LC₅₀s ranged from 5 to 42 µg/L for juvenile rainbow trout, to 24 µg/L for rainbow trout larva, to 65 µg/L for juvenile brook trout (Eisler 1987). Hale (1977) reported a 96-hour LC₅₀ of 33.0 µg mercury/L for rainbow trout. In yearling coho salmon, Lorz et al. (1978) reported a 96-hour LC₅₀ of 240 µg/L for inorganic mercury, and 38.9 µg/L for methylmercury. Additional studies have reported acute toxicities for rainbow trout exposed to mercuric chloride ranging from 10 µg/L to 1,000 µg/L (Illiopoulou-Georgudaki and Kotsanis 2001).

Mercury has a tendency to both bioconcentrate (Vincoli 1997) and biomagnify through food chains (Eisler 1987). Fish and shellfish have a strong tendency to concentrate mercury in their bodies, often in the form of methylmercury, a highly toxic organic compound of mercury. Because of biomagnification, species of fish high in the food chain (e.g., piscivorous fishes like northern pike, bull trout, northern pike-minnow, and lake trout), contain higher concentrations of mercury than herbivorous or insectivorous fishes. Consequently, salmon and most trout species are characterized by relatively lower levels of mercury in their tissues. At relatively low

concentrations, mercury has been shown to affect reproduction, growth, behavior, metabolism, blood chemistry, osmoregulation, and oxygen exchange of marine and freshwater biota. Organomercury compounds, especially methylmercury, are significantly more likely to result in sublethal effects and/or bioaccumulation than inorganic mercury (Eisler 1987).

Bioaccumulation of mercury is markedly enhanced by higher water temperatures, softer water, reduced pH, organism age, reduced organic content of the water, and in the presence of zinc, cadmium, or selenium in solution. Summarizing a study by Ribeyre and Boudou (1984) 30-day exposure to 0.1 µg/L methylmercury, Eisler (1987) reported increased bioconcentration factors ranging from 28,300 in the brain to 238,000 in the spleen. Although whole body levels up to 100 mg/kg are reportedly not lethal to rainbow trout, levels of 20 to 30 mg/kg have been associated with reduced appetite, loss of equilibrium, and hyperplasia of gill epithelium. However, brook trout were more sensitive, showing a toxic response and death by whole body residues of only 5 to 7 mg/kg mercury (Eisler 1987).

Significant adverse sublethal effects of mercury have been observed among various aquatic species at water concentrations as low as 0.03 µg/L. In trout, reductions in growth of rainbow trout occurred when exposed to mercury for 64-days at concentrations of 0.04 µg/L methylmercury, and 0.11 µg/L of phenylmercury. Brook trout growth was affected when exposed to 0.79 µg/L organomercury for 21 days, and enzyme disruption occurred in embryos immersed for 17 days in water containing 0.88 µg/L methylmercury (Eisler 1987).

Nagpal (1989) summarized both acute and chronic toxicity data for macroinvertebrates. Acute toxicity for invertebrates was found to be dependent upon species, developmental stage, and overall environmental conditions. For inorganic mercury, *Daphnia* sp. were found to be the most sensitive invertebrate, with LC₅₀s of 1.4 to 4.4 µg/L for *D. magna* and 2.2 µg/L for *D. pulex*. In chronic toxicity tests of inorganic mercury and *D. magna*, adverse effects occurred at concentrations ranging from 0.72 to 1.82 µg/L. In chronic tests for methylmercury, adverse effects were observed in *D. magna* at concentrations less than 0.04 µg/L.

The EPA has not identified an acute water quality criterion for mercury, but has identified a chronic water quality criterion at 0.012µg/L. The NPDES permit limits effluent to 0.02 µg/L maximum daily load, and 0.01 µg/L average monthly load. The FCC estimates effluent concentrations of mercury at 0.0018 µg/L daily maximum, and 0.001 µg/L average daily value at the end-of-pipe. Both the chronic limit and estimated concentration at the outfall are at or below EPA's chronic water quality criteria. At the end-of-pipe, concentrations allowed by the NPDES permit limits are well below the lowest 96-hour LC₅₀ values of 0.1 µg/L previously discussed for the onset of acute toxicities to rainbow trout, and below the 0.03 µg/L value reported for onset of chronic toxicities for various aquatic species. Furthermore, considering dilution, mixing, and background concentrations of 0.00005 µg mercury/L in Big Deer Creek, mercury concentrations instream are estimated to be even lower at approximately 0.001 µg/L downstream of the falls where anadromous fish reside (Table 11). Consequently, NMFS does not expect concentrations of mercury contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Nickel – Elemental nickel is one of the most common metals found in surface waters, occurring naturally due to the weathering of rocks. Nickel is a transition metal, and is generally considered to be an essential macronutrient (Pane et al. 2003). Anthropogenic sources of nickel include mining, combustion of coal, petroleum and tobacco, manufacture of cement and asbestos, food processing, textile and fur fabrication, laundries, car washes, electroplating, and smelting (Forest Service 2007; Vincoli 1997). Background levels of nickel in unaltered freshwater waterbodies are generally in the range of 1 to 10 µg/L, but can range as high as 1,000 µg/L in highly contaminated waterbodies (Pane et al. 2003; Eisler 1998b). Background concentrations of nickel in Big Deer Creek are currently estimated at 0.001 µg/L (Table 11). Unlike other divalent metals, nickel has not been well studied in terms of toxicity, mode of action, or bioavailability (Keithly et al. 2004; Brix et al. 2004).

Nickel is a confirmed carcinogen in animals causing lung and nasal tumors. It has also been shown to cause teratogenic and mutagenic effects in test animals. Nickel is highly persistent in water, with a half-life >200 days. Both it and its compounds have high acute toxicity to aquatic life, with toxicity increasing as water softens (Vincoli 1997). Recent studies suggest that acute toxicity to nickel is primarily due to issues with respiration in rainbow trout, occurring at levels approximating the 96-hour LC₅₀ (Pane et al. 2003; Brix et al. 2004).

Hale (1977) reported a 96-hour LC₅₀ for nickel of 35,500 µg/L for rainbow trout. More recently, Pane et al. (2003) identified a 96-hour LC₅₀ for rainbow trout and nickel at 15,300 µg/L in moderately hard water (approximately 140 mg/L CaCO₃). This value is similar to 96-hour LC₅₀s reported for coho salmon alevins (16,700 µg/L) and juveniles (18,000 µg/L), and rainbow trout alevins (25,100 µg/L), juveniles (7,800 – 10,900 µg/L), and adults (31,700 µg/L) from earlier studies (Eisler 1998b). Referencing recent studies for rainbow trout, Brix et al. (2004) reported a geometric mean median LC₅₀ of 13,000 µg/L. In their own study, they arrived at a 96-hour LC₅₀ concentration of 20,800 µg/L (hardness of 91 mg/L CaCO₃) for nickel and rainbow trout. The authors felt that this result was comparable to that reported by Nebeker et al. (1985), who had reported a 96-hour LC₅₀ of 10,000 µg/L (33 mg/L CaCO₃) for nickel and rainbow trout. Normalizing these two studies to a hardness of 50 mg/L, results in 96-hour LC₅₀s of 12,800 and 14,200 µg/L respectively.

Nickel also bioconcentrates, with nickel concentrations in fish expected to be somewhat higher than the average concentration in the water from which the fish was taken (Vincoli 1997). However, there is little evidence that biomagnification of nickel occurs along food chains (Eisler 1998b). The USFS (2007) reported that chronic effects have been noted for fish in soft water at concentrations as low as 2,000 µg/L. Giattina et al. (1982) identified an avoidance threshold of roughly 23.9 µg/L for nickel and rainbow trout. In chronic exposures, Brix et al. (2004) summarized studies reporting a NOEC of 35 µg/L and a LOEC of <35 µg/L for nickel and rainbow trout. However, in their own study, Brix et al. (2004) found no significant effects to rainbow trout embryo survival, swim-up, hatching, or fingerling survival and growth when subjected to concentrations up to 466 µg/L. The authors noted that although nickel accumulated on the gill in an exponential manner, it appeared to plateau in trout plasma at concentrations around 118 µg/L.

Pane et al. (2004) exposed rainbow trout to nickel concentrations ranging from 243 to 2,034 µg/L for 42 to 99 days to study chronic effects. No mortalities occurred in chronic exposures up to 394 µg/L, versus 33% mortality in chronic exposures of 2,034 µg/L. Results from this study indicated that the greatest accumulations of nickel in the gill, kidney, and plasma, noting that the plasma was the primary sink for nickel in rainbow trout. Noting that most previous studies exposed fish to nickel concentrations much higher than would be expected to occur in natural stream systems (3,200 to 14,000 µg/L), Pane et al. (2004) exposed rainbow trout to much lower concentrations to observe potential chronic effects. Rainbow trout were exposed to concentrations that fall within the range often found in watersheds heavily impacted by mining and industrial activity (243 to 394 µg/L). Concentrations in this range were reportedly near 1% of 96-hour LC₅₀s reported in previous acute exposure studies. These levels impaired the exercise physiology of rainbow trout, and acting as a limiting stressor by decreasing maximal rates of oxygen consumption during strenuous exercise. Based on these results, the authors determined that respiratory effects of chronic exposure to low levels of nickel were quite subtle and only noticed after strenuous aerobic exercise. In summary, they suggested that chronic impairment of a critical organ like the gill could depress the overall fitness of the fish, potentially leading to impaired predator avoidance, prey capture, and/or migration success.

ESA-listed salmon and steelhead could be indirectly affected through effects to prey items. Long-term exposure of aquatic invertebrates to nickel has been shown to have adverse effects at concentrations as low as 500 µg/L (USDA Forest Service 2007). Keithly et al. (2004) summarized studies reporting NOEC's ranging from 10 to 220 µg/L for *D. magna*, in water hardness ranging from 51 to 205 mg/L. For the amphipod *Hyaella azteca*, the Keithly et al. (2004) reported a 96-hour LC₅₀ of 3,045 µg/L, a NOEC of 29 µg/L, and a LOEC of 58 µg/L. However, the caddisfly *C. dubia* was found to be more sensitive to nickel, with 48-hour LC₅₀s ranging between 81 to 400 µg/L, NOEC's ranging from <3.8 to 5.8 µg/L, and LOEC's ranging from <3.8 to 9.6 µg/L (50 to 253 mg/L CaCO₃). Toxicity decreased with increasing water hardness. Nickel bioconcentration increased in *H. azteca* with increasing test concentrations.

The EPA has identified acute water quality criteria for nickel at 145 µg/L, and chronic water quality criteria at 16.1 µg/L. The NPDES permit limits effluent to 26.52 µg/L maximum daily load, and 13.22 µg/L average monthly load. The FCC estimates effluent concentrations of nickel at < 5.0 µg/L at the end-of-pipe. Both the effluent limit and estimated concentration at the outfall are below EPA's acute and chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are well below the lowest 96-hour LC₅₀ value of 7,800 µg/L previously discussed for the onset of acute toxicities to juvenile rainbow trout. They are also below concentrations reported for onset of chronic toxicity to rainbow trout (i.e., avoidance at 23.9 µg/L, NOEC at <35 µg/L). Furthermore, considering dilution, mixing, and background concentrations of 0.001 µg nickel/L in Big Deer Creek, nickel concentrations instream are estimated to be even lower at approximately 0.74 µg/L downstream of the falls where anadromous fish reside (Table 11). Although below concentrations acutely and chronically toxic to *C. dubia* by the time the mixed effluent reaches waters occupied by ESA-listed salmonids, effluent up to 26.52 µg/L at the end-of-pipe could result in chronic effects to various prey items for listed salmonids. However, because the effluent will quickly mix and become diluted upon entrance to Big Deer Creek, NMFS does not expect prolonged exposure of

aquatic invertebrates to nickel concentrations this high in Big Deer Creek. Consequently, NMFS does not expect concentrations of nickel contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Selenium – Selenium is a widely available and naturally occurring metalloid, generally available in the environment due to the weathering of rocks. It's particularly abundant with sulfide minerals of various metals, such as iron, lead, and copper (Eisler 1985b). In uncontaminated waters, selenium is typically found in concentrations of 0.1 to 0.4 µg/L (Palace et al. 2004; Kennedy et al. 2000). Selenium is an essential element, that can bioconcentrate and become toxic at concentrations slightly above the homeostatic requirement (Miller et al. 2007; Eisler 1985b). Selenium is highly persistent in water, with a half-life greater than 200 days (Vincoli 1997).

Selenium and its compounds have high acute toxicity to aquatic life (Vincoli 1997), with the major symptom of toxicity in fish occurring in the form of larval teratogenic deformities (Miller et al. 2007; Palace et al. 2004). Teratogenesis is restricted to the egg-larval stage of development as the larvae utilize selenium-contaminated yolks (Palace et al. 2004). Toxicity of selenium varies among fish species, varying by the form of selenium and the life stage of the fish. It can exist in four oxidation states, with sodium selenite (Na_2SeO_3) generally found to be the most toxic (Miller et al. 2007; Eisler 1985b). Selenite is generally more toxic to early life stages and the magnitude of effects increases with temperature (Eisler 1985b). Other documented effects of selenium on salmonids include decreases in egg incubation period, hatch rate, post swim-up juvenile survival, and juvenile growth (Van Kirk and Hill 2007). Miller et al. (2007) cited studies documenting 96-hour LC_{50} s for rainbow trout ranging from 4,200 to 9,000 µg/L for sodium selenite, and 3,200 to 4,700 µg/L for selenate. Other studies have reported similar 96-hour LC_{50} s for selenium and rainbow trout, ranging from 4,200 to 12,500 µg/L (Eisler 1985b).

Selenium bioconcentrates in fish, with the concentration of selenium found in fish tissues expected to be somewhat higher than the average concentration of selenium in the water from which the fish was taken (Vincoli 1997). When available in both diet and water, teleosts have been shown to accumulate selenium in the liver, kidney, gills (Eisler 1985b), eggs, and muscle (Kennedy et al. 2000). However, selenium is generally thought to accumulate in fish tissues more through the diet than through the waterborne exposure, and is later transferred to offspring through the egg (Kennedy et al. 2000; Van Kirk and Hill 2007). Miller et al. (2007) suggested that the most significant effect of exposure to excess selenium occurs in the form of egg accumulation and the subsequent larval deformities. Kennedy et al. (2000) further supported this concept, noting that bioaccumulation of selenium in fish can cause reproductive failure, egg and embryo mortality, and embryonic deformities and malformations. Skin lesions, cataracts, swollen gill filament lamellae, myocarditis, and liver and kidney necrosis have also been documented in fish from chronic exposure to selenium (Miller et al. 2007). Studies suggest that there's an extremely narrow margin between normal and toxic concentrations of selenium in tissues (Kennedy et al. 2000).

For chronic exposure, anemia and reduced hatch success of rainbow trout has been documented at selenium concentrations ranging from 47 to 83 µg/L, while growth inhibition has been documented after 21 days of exposure to 250 µg/L selenium (Eisler 1985b). Because of the bioaccumulative nature of selenium, transferring selenium from the female parent to offspring through the egg (Kennedy et al. 2000; Van Kirk and Hill 2007), it has been suggested that the concentration of waterborne selenium is not a good predictor of selenium toxicity to fish. Replacement of EPA's selenium freshwater criterion by whole-body tissue concentration has been recommended and is currently being evaluated by EPA (Van Kirk and Hill 2007). Currently, EPA's draft freshwater chronic criterion is expressed as a concentration in whole-body fish tissue of 7.91 µg/g, dry weight. If fish tissue samples exceed 5.85 µg/g during summer or fall, fish should be monitored during the winter to determine if selenium exceeds 7.91 µg/g (EPA 2004). However, because the concentrations in the draft criterion were based on juvenile bluegill, a debate currently exists on whether these concentrations can be directly related to salmonids. Mortality has been reported for rainbow trout, Chinook salmon, striped bass (*Morone saxatilis*), and bluegill (*Lepomis macrochirus*) when selenium tissue concentrations increase to 4 to 10 µg/g (Kennedy et al. 2000). The authors, citing other research efforts, noted additional effects of selenium concentration on growth at 3 to 6 µg/g, smoltification at 9.5 µg/g, teratogenic effects at 15 µg/g, and effects on reproduction at 8 to 16 µg/g.

It has been found that selenium salts can be converted to methylated forms by microorganisms. These forms are readily accumulated by aquatic invertebrates. At concentrations of 47 to 53 µg/L, selenium has been shown to retard growth of freshwater green algae, and shift the species composition of freshwater algal communities (Eisler 1985b).

Currently, EPA has identified acute water quality criteria for selenium at 20 µg/L, and chronic water quality criteria at 5 µg/L. The NPDES permit does not propose effluent limits for selenium, but FCC estimates effluent concentrations of 4.0 µg/L maximum daily, and 2.0 µg/L average daily at the end-of-pipe. The estimated concentration at the outfall is below both EPA's acute and chronic water quality criteria, which are also well below the lowest 96-hour LC₅₀ value of 3,200 µg/L previously discussed for the onset of acute toxicities to juvenile rainbow trout. These concentrations are also below those reported for onset of chronic toxicity to rainbow trout (i.e., anemia and reduces hatch success at 47 µg/L). However, because of its tendency to bioaccumulate, it's unclear whether the water quality criteria established for selenium are low enough to sufficiently keep selenium from accumulating in steelhead and/or Chinook salmon tissue. Tissue samples from non ESA-listed resident salmonids downstream from the discharge and upstream from the falls would provide a better indicator of the potential effects of selenium on ESA-listed anadromous fish. Although there is some degree of uncertainty regarding indirect effects of selenium on salmon and steelhead in Big Deer Creek, stream surveys suggest that Chinook are absent and steelhead are only present in low numbers in lower Big Deer Creek (Kuzis 2004). Because indirect effects, if any, would be localized only to individual fish in lower Big Deer Creek, it's highly unlikely that bioaccumulation will rise to a level sufficient to appreciably reduce species abundance/productivity at the larger population, MPG, or ESU scales.

Thallium – Thallium is naturally found in trace amounts in the earth's crust. Thallium and its compounds may enter the environment during mining and smelting operations, through industrial discharges, or spills (Vincoli 1997). As a byproduct of burning coal and smelting other metals,

such as cobalt, thallium is a trace contaminant of the raw materials and may be released into the environment. Once released into the environment, thallium remains in air, water and soil as a contaminant for a long time and is not broken down (Agency for Toxic Substances and Disease Registry [ATSDR] 1995). Thallium is insoluble in water, but readily forms soluble compounds when exposed to air or water (Vincoli 1997). Water concentrations of thallium in rivers in the United States and Canada that receive mining operations effluents range from 0.7 to 88.3 µg/L (ATSDR 1992; Pickard et al. 2001). Thallium concentrations in tailings ponds in New Brunswick, Canada ranged from 27 to 1,620 µg/L (Zitko et al. 1975). Background concentrations of thallium in Big Deer Creek are currently estimated at 0.00001 µg/L (Table 11).

Thallium is a non-volatile, heavy metal that was used in the manufacture of rat, ground squirrel, roach, and ant poisons (ATSDR 1992). Thallium and its compounds have high acute toxicity to aquatic life (Vincoli 1997). In general, aquatic invertebrates are more sensitive to thallium than fish, with a 96-hour LC₅₀ for daphnids at 2,200 µg/L, while freshwater fish demonstrate a 96-hour LC₅₀ of 120 mg/L (WHO 1996). Zitko et al. (1975) found information was limited regarding the toxicity of thallium to aquatic fauna, but summarized earlier studies reporting mortality of fish and aquatic invertebrates after 72 hours of exposure to thallium concentrations of 10,000 to 60,000 µg/L, and 2,000 to 4,000 µg/L respectively. Although Pickard et al. (2001) estimated a 96-hour LC₅₀ of 3,200 µg/L for thallium and rainbow trout, they found 100% mortality of rainbow trout in 24-hour exposure to concentrations as low as 2,500 µg/L. Rainbow trout mortality was also noted in their study at concentrations as low as 1,560 µg/L, the lowest concentration used in their study.

For the fathead minnow (*Pimephales promelas*), LeBlanc and Dean (1984) reported a 96-hour LC₅₀ of 860 µg/L for thallium. In that same study, the authors also reported that no fathead minnow embryos survived thallium concentrations >720 µg/L. Survival increased to 22% at 350 µg/L and 75% at 200 µg/L. Embryos were not affected at thallium concentrations <200 µg/L. Post-hatch, no fathead minnow larvae survived concentrations over 350 µg/L, and larvae survival was significantly reduced at concentrations as low as 40 µg/L (LeBlanc and Dean 1984).

According to the ATSDR, thallium is a known carcinogen that bioaccumulates in fish and shellfish (ATSDR 1995). The bioconcentration factors for thallium in aquatic organisms are presented in Table 13, with the highest factor of 1,430 reported for juvenile Atlantic salmon (*Salmo salar*) (Zitko et al. 1975) and 50,000 for the freshwater diatom, *Stephanodiscus hantzschii*. On a weight basis, thallium may be as toxic to fish and other aquatic organisms as copper (Zitko et al. 1975).

According to Twiss et al. (2004), bioconcentration factors for thallium vary with the species of freshwater phytoplankton, the type of thallium compounds in the water, and the concentration of potassium in the water affected. This study found that: (1) *Chlorella* species concentrated less thallium than freshwater diatoms; (2) inorganic thallium had higher bioconcentration factors than organic thallium compounds; and (3) bioconcentration factors for both species of freshwater phytoplankton declined as potassium concentrations in the water increased.

Table 13. Bioconcentration factors for thallium in aquatic organisms.

Aquatic Taxon	Bioconcentration Factor	Reference
Marine clams	18.2	Zitko and Carson 1975
Marine mussels	11.7	Zitko and Carson 1975
Atlantic salmon (juveniles)	27 - 1,430	Zitko and Carson 1975
Bluegill	34	Barrows et al. 1978
Higher Plants (Riparian & Aquatic)	0.05-594	Cataldo and Wildung 1983; Wallwork-Barber et al. 1985
Freshwater Phytoplankton	780 - 50,000*	Twiss et al. 2004

* Depends on species of phytoplankton and concentration of potassium in the water

Thallium is readily absorbed by plants and can enter the food chain, including aquatic food chains (Cataldo and Wildung 1983; Wallwork-Barber et al. 1985). Heit and Klusek (1985) demonstrated that concentrations of thallium in the omnivorous white sucker (*Catostomus commersoni*), carnivorous yellow perch (*Perca flavescens*), and brook trout were similar in their axial muscle tissue (<0.07 to 3.0 mg/kg dry weight), independent of the water pH. In New Brunswick, Canada, Atlantic salmon in waters contaminated by mining wastewater contained from 1.2 to 89 mg thallium/kg fish tissue, with the highest concentration found in the gills (Zitko et al. 1975).

Sublethal effects of thallium include deleterious effects to the prey supply of juvenile anadromous salmonids. Using a rotifer (*Brachionus calyciflorus*), Zeleznock (2004) calculated LD₅₀s for thallium exposures at different concentrations of potassium. Increased levels of potassium saturate the uptake sites in the rotifer cell membranes and protect the aquatic invertebrate from toxic thallium intake. At 8 µg/L, thallium can reduce the growth of aquatic plants including algal cells, the base of the aquatic food web (WHO 1996).

The EPA has not identified an acute water quality criterion for thallium, but has identified a chronic water quality criterion of 10 µg/L. The NPDES permit limits effluent to 0.95 µg/L maximum daily load, and 0.47 µg/L average monthly load. The FCC estimates effluent concentrations of thallium at < 0.2 µg/L at the end-of-pipe. Both the effluent limits and estimated concentration at the outfall are well below EPA's chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit levels are well below effect levels reported for acute or chronic adverse effects to aquatic biota summarized in this analysis. Furthermore, considering dilution, mixing, and background concentrations of 0.00001 µg thallium/L in Big Deer Creek, thallium concentrations instream are estimated to be approximately 0.03 µg/L downstream of the falls where anadromous fish reside (Table 11). Therefore, NMFS has concluded that levels of thallium from the effluent should not rise to concentrations that will result in direct, indirect, or sublethal effects to ESA-listed salmonids.

Zinc - Zinc is a naturally occurring, common metallic element that exists as a variety of salts. Solubility ranges from low to high, depending on the salt formed (Vincoli 1997), the pH, and the alkalinity (Eisler 1993). Most zinc salts are both highly soluble and persistent in water, with half-lives >200 days (Vincoli 1997). Zinc is a trace element, essential to all living biota (Holcombe et al. 1979; Eisler 1993). Background zinc concentrations rarely exceed 40 µg/L in natural waters, but can be found as high as 99 mg/L in heavily contaminated waters. Most zinc

introduced into aquatic systems is eventually partitioned into the sediment, where its release is enhanced by conditions of high DO, low salinity, and low pH (Eisler 1993). Background concentration of zinc are estimated to be 0.006 µg/L in Big Deer Creek (Table 11).

Zinc and its salts have high acute toxicity to aquatic life (Vincoli 1997). Zinc speciates into the toxic aquo ion $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$, other dissolved chemical species, and various inorganic/organic complexes. Zinc is most toxic to aquatic species in softer water (Vincoli 1997), and conditions of low pH, low alkalinity, low DO, and higher stream temperatures (Eisler 1993). Zinc uptake can occur via the gill or through the digestive tract (Köck and Bucher 1997; Galvez et al. 1998). The gill epithelium can be physically damaged by zinc, and is the primary target of zinc toxicity in fish (Skidmore 1970; Eisler 1993).

In soft water (20 mg/L CaCO_3), Sprague et al. (1965) identified an ILL for rainbow trout of 600 µg Zn/L. However, salmonids may be able to at least partially acclimate to increased concentrations of zinc (Chapman 1978; Stubblefield 1999; Alsop et al. 1999). At levels acutely toxic to non-acclimated fish, Chapman (1978) noted markedly decreased mortality in sockeye salmon (*O. nerka*) acclimated to 242 µg/L zinc. Stubblefield et al. (1999) reported similar results, documenting an ILL of 695 µg/L for non-acclimated adult rainbow trout at 131 hours of exposure, versus 2,025 µg/L at 168 hours for fish acclimated at half the ILL or 324 µg/L. After 30 days of exposure to concentrations ranging from 50 to 450 µg/L of zinc (hardness 20 to 120 mg/L CaCO_3), all rainbow trout acclimatized with no apparent effect on growth, whole-body sodium or calcium concentrations, zinc tissue levels, metabolic rate, or fixed velocity swimming performance (Alsop et al. 1999). However, critical swimming velocity (U_{crit}) was significantly reduced in fish exposed to zinc.

In a review of existing literature, Eisler (1993) described an even wider range of acute toxicities to zinc for freshwater fish, describing 96-hour LC_{50} s ranging from 60 µg/L to 40,900 µg/L. Hale (1977) reported a 96-hour LC_{50} for zinc at 550 µg/L for rainbow trout, while Lorz and McPherson (1977) reported a 96-hour LC_{50} for zinc at 4,600 µg/L for coho salmon. Chapman (1978) described a 96-hour LC_{50} for zinc at 140 µg/L for rainbow trout, 460 µg/L for Chinook salmon, and 750 µg/L for sockeye salmon. In brook trout, 96-hour LC_{50} s for zinc have been reported at 960 µg/L (Chapman 1978) and 2,000 µg/L (Holcombe et al. 1979). Alsop et al. (1999) found that zinc was 5.4 times more toxic to rainbow trout in soft water than hard water, as evidenced by 96-hour LC_{50} s of 869 µg/L in hard water (120 µg/L CaCO_3) and 162 µg/L in soft water (20 µg/L CaCO_3).

Several recent studies have found that elevated levels of calcium significantly decrease zinc uptake in both the gill and whole body tissues of rainbow trout (Alsop et al. 1999; Barron and Albeke 2000; De Schamphelaere and Janssen 2004). De Schamphelaere and Janssen (2004) found that toxicity of zinc to rainbow trout was influenced by both pH and concentrations of Ca^{2+} , Mg^{2+} , Na^+ , and H^+ . Depending upon pH and various concentrations of Ca^{2+} , Mg^{2+} , Na^+ , and H^+ , the authors reported 96-hour LC_{50} 's ranging from 130 and 2,280 µg Zn/L. In these tests, survival was more sensitive than growth, suggesting that toxicity of zinc is primarily acute in nature.

After exposing three generations of brook trout to elevated levels of zinc, Holcombe et al. (1979) couldn't find any significant harmful effects from zinc concentrations ranging from 2.6 to 534 µg/L. Neither growth nor survival was significantly reduced in first-generation brook trout after 28 weeks of exposure to zinc concentrations of up to 1,360 µg/L. However, the study did conclude that the embryo-larval and early juvenile stages of brook trout were the most sensitive to zinc. As cited in Holcombe et al. (1979), Sinley et al. (1974) similarly found that zinc did not affect the growth of rainbow trout in either hard or soft water at concentrations of 2,200 or 547 µg/L respectively. De Schamphelaere and Janssen (2004) reported a 30-fold variation in zinc toxicity and rainbow trout (NOEC 32.7 – 974 µg/L), where increased concentrations of Ca^{2+} , Mg^{2+} , Na^+ , and H^+ decreased chronic toxicity by factors of 12, 3, >2, and 2, respectively. In these tests, calcium, magnesium, and sodium all reduced chronic zinc toxicity. Similarly, Barron and Albeke (2000) also determined that zinc uptake was significantly reduced at the gills in rainbow trout following acclimation or exposure to calcium.

Zinc can bioconcentrate in fish, with the concentration of zinc found in fish tissues expected to be considerably higher than the average concentration of zinc in the water from which the fish was taken (Vincoli 1997). Holcombe et al. (1979) found that the greatest amount of zinc accumulated in the gills, liver, kidney, and opercular bone tissues in brook trout. Bioavailability of zinc from sediments is enhanced in waters with high DO, low salinity, low pH, and high levels of inorganic oxides and humic substances (Eisler 1993).

In a review of existing literature, Eisler (1993) described a wide range of acute toxicities to zinc in freshwater aquatic invertebrates, with 96-hour LC_{50} s ranging from a low of 32 µg/L to a high of 40,930 µg/L. In chronic exposure, a gradual decrease in growth rate has been noted in mayfly larvae (*Epeorus latifolium*) after four weeks of exposure to zinc in concentrations of 30 µg/L (Eisler 1993). Zinc is readily bioaccumulated in aquatic invertebrates, an important food source for rearing juvenile salmonids (Bowen et al. 2006).

The EPA has identified acute water quality criteria for zinc at 36.2 µg/L, and chronic water quality criteria at 36.5 µg/L. The NPDES permit limits effluent to 37.02 µg/L maximum daily load, and 18.45 µg/L average monthly load. The FCC estimates effluent concentrations of zinc at < 10 µg/L at the end-of-pipe. The estimated concentration at the outfall is below EPA's acute and chronic water quality criteria, but the maximum daily load is not. This considered, at the end-of-pipe, maximum concentrations allowed by the NPDES permit limits are well below levels identified above as likely to be acutely or chronically toxic to ESA-listed salmonids or their food source. Furthermore, considering dilution, mixing, and background concentrations of 0.006 µg zinc/L in Big Deer Creek, zinc concentrations instream are estimated to be even lower at approximately 1.0 µg/L downstream of the falls where anadromous fish reside (Table 11). Therefore, NMFS does not expect concentrations of zinc contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Mixed Metals – When combined in solution, certain combinations of metals have been shown to have different toxic effects on aquatic biota than when considered individually. In combination, certain combinations of metals can act in an antagonistic, additive, or synergistic manner. Additive toxicity occurs where the overall toxicity of a mixture is exactly equal to that predicted from the individual toxicities of the metals in solution (Finlayson and Verrue 1982). As

described by Nelson et al. (1991), antagonistic metal reactions, which reduce the toxicity of metals primarily through precipitation, result in solutions that are less toxic than simple metal solutions. For example, calcium markedly counteracts the toxic effects of copper, lead, magnesium, and zinc through an antagonistic reaction. Conversely, combinations of metals can also be synergistic, where their joint effect is actually greater than the sum of the separate effects. For example, copper, cobalt, zinc, and cadmium, all of which occur in the effluent, are known to act synergistically. Of the metals in the effluent, the metals of primary concern with potential synergistic effects are cobalt and copper, particularly because copper loading is an issue in the watershed from past mining activities.

In studies with Chinook salmon in soft water (20-22 mg/L CaCO_3), mixtures of copper and zinc were shown to be antagonistic, while mixtures of copper/cadmium and zinc/cadmium both acted in an additive manner. Mixtures of the three metals displayed antagonistic toxicity (Finlayson and Verrute 1982). Marr et al. (1998) exposed rainbow trout fry to cobalt, copper, and mixtures of the two metals. In this study, they found that cobalt acted as an antagonist when first mixed with copper, but later acted in an additive or slightly synergistic manner, making it difficult to predict short-term mortality from this mixture.

As described in the BA (USDA Forest Service 2007), behavioral avoidance of metals has been demonstrated both in the laboratory and field at very low concentrations. The avoidance response is a species-specific form of adaptive fish behavior occurring at sublethal concentration levels (Svecevičius 1999). Avoidance behavior has been documented in salmonids to a variety of metals and mixture of metals. However, the response is highly variable depending on water chemistry, species studied, and mixture of metals encountered. Hansen et al. (1999b) reported that behavioral avoidance to copper and cobalt mixtures in soft water differed greatly between rainbow trout and Chinook salmon. Rainbow trout avoided 1.6 $\mu\text{g/L}$ copper and 180 $\mu\text{g/L}$ cobalt individually, but the response was noted for a mixture of the two metals at significantly lower concentrations, a mix of 2.6 $\mu\text{g/L}$ copper and 2.4 $\mu\text{g/L}$ cobalt. Chinook salmon were more sensitive than rainbow trout, avoiding mixtures of 1.0 $\mu\text{g/L}$ copper and 0.9 $\mu\text{g/L}$ cobalt (Hansen et al. 1999b).

Studies in the Clark Fork and Coeur d'Alene Rivers, both of which have been impacted by metals from mining activities, have demonstrated the avoidance response in salmonids. In the Clark Fork River, metal contamination is considered the primary cause of reduced fish populations. Studies of avoidance behavior to metal mixtures found that rainbow trout were more sensitive than brown trout, which in part may explain why rainbow trout populations appear to be more severely affected than brown trout populations (Woodward et al. 1995a; Hansen et al. 1999c). Cutthroat trout (*O. clarki*) avoided a metals mixture of 6 $\mu\text{g/L}$ copper, 0.3 $\mu\text{g/L}$ cadmium, 0.6 $\mu\text{g/L}$ lead, and 28 $\mu\text{g/L}$ zinc (Woodward et al. 1997). Rainbow trout avoided all metal concentrations tested from 10% to 1,000 % of a fixed ratio of ambient metal concentrations (12 $\mu\text{g/L}$ copper, 1.1 $\mu\text{g/L}$ cadmium, 3.2 $\mu\text{g/L}$ lead, and 50 $\mu\text{g/L}$ zinc) (Hansen et al. 1999c). In the Coeur d'Alene River study (Goldstein et al. 1999), adult Chinook salmon avoided the South Fork (mining impacted) versus the North Fork (the control) due to the higher ambient concentration of a mixture of heavy metals; cadmium, lead, and zinc. The findings indicate that natural fish populations will avoid tributaries with high metals contamination.

Fish can also be affected indirectly by the combined effects of metals. As previously stated, metals accumulate in aquatic invertebrates, occurring via uptake across the gills, through the gut, and through adsorption to the exoskeleton (Woodward et al. 1994; Beltman et al. 1999). Consequently, indirect effects are likely to occur to ESA-listed salmon and steelhead feeding on metals-contaminated macroinvertebrates. Woodward et al. (1994) found that both survival and growth were significantly reduced in rainbow trout fed metal-contaminated invertebrates from the Clark Fork River. By day 42, rainbow trout fed contaminated invertebrates were 15% smaller than the control group; by day 91, survival was 50% that of control fish. A follow up study with young-of-the-year rainbow trout and brown trout also revealed reduced growth and elevated whole body metal concentrations following 88 days exposure to simulated Clark Fork River water and a diet of aquatic invertebrates collected from the river (Woodward et al., 1995b). Rainbow trout fed the contaminated diet exhibited constipation and reduced feeding activity.

The potential combined effect of metals is addressed in the EPA draft permit through the requirement for WET testing. WET testing is used to assess aggregate toxic effects to aquatic organisms from all pollutants contained in a facility's wastewater (effluent). The EPA uses WET testing to implement the Clean Water Act's prohibition of the discharge of toxic pollutants in toxic amounts, measuring wastewater's effects on specific test organisms' ability to survive, grow and reproduce. The draft permit requires chronic toxicity testing using standard test organisms, the water flea (*C. dubia*) and the fathead minnow. Toxicity testing is required to be completed twice a year during low flow conditions in September and February. The chronic tests for daphnia reproduction and fathead minnow growth provide a sensitive test for the combined effects of metals and other potentially toxic constituents in the effluent. Although not anticipated to occur, provided NPDES permit effluent limits are met, effects observed in the test species would be an indication of potential chronic effects to ESA-listed salmonids found in Big Deer Creek. The outcome of the test is interpreted in chronic toxicity units (TU_C). TU_C are equal to the reciprocal of the effluent concentration that causes no observable effect in chronic toxicity tests. The draft permit recommends that the limit for this test is 1 TU_C (EPA 2007b).

Ammonia (as N) – Ammonia occurs naturally as a byproduct of metabolism, although high concentrations often occur as a result of anthropogenic inputs (e.g., sewage treatment plants, agricultural runoff, etc.) (Burkhalter and Kaya 1977). Ammonia is highly soluble, but not persistent in water with a half-life of less than two days (Vincoli 1997). Ammonia can be converted to nitrite (NO_2) and nitrate (NO_3) by bacteria, which are forms usable by plants.

Total ammonia includes the sum of both un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+). The toxicity of ammonia solutions is primarily due to NH_3 (Vincoli 1997). Ammonia toxicity is influenced by pH, water temperature, DO concentration, salinity, and the carbon dioxide-carbonic acid equilibrium (MacDonald et al. 1991; EPA 1999). Un-ionized ammonia, which is directly toxic to aquatic organisms, is a problem at higher pH values. At a given temperature, the higher the pH, the greater the amount of un-ionized ammonia will be present for a given amount of total ammonia (NMFS 1999). It's important to note that NPDES permit limits established by EPA for the ICP are set based on total ammonia.

Concentrations of ammonia acutely toxic to fish may cause loss of equilibrium, hyper-excitability, increased breathing, cardiac output, oxygen uptake, and, in extreme cases, convulsions, coma, and death. At lower concentrations ammonia has many effects on fishes, including a reduction in hatching success, reduction in growth rate and morphological development, and pathologic changes in tissue of gills, livers, and kidneys (EPA 1999, as cited in USDA Forest Service 2007).

When updating the ambient water quality criteria for ammonia, EPA (1999) calculated genus mean acute values (GMAV) and species mean acute values (SMAV) for various genus and species. Expressed in total ammonia nitrogen, EPA reported a GMAV of 21.95 mg/L for the genus *Oncorhynchus*, and SMAV's of 11.23 mg/L for rainbow trout and 17.34 mg/L for Chinook salmon (pH = 8). From the set of GMAVs, EPA calculated a final acute value (FAV) of 14.32 mg N/L for total ammonia. However, because the rainbow trout SMAV is lower at 11.23 mg N/L, the FAV was lowered to this level.

Noting that EPA standard toxicity protocols require testing be conducted on resting, unfed, and undistressed fish, Wicks et al. (2002) performed a series of acute toxicity tests on swimming and resting rainbow trout. Because ammonia tends to become internally elevated during periods of activity, the authors hypothesized that acute LC₅₀s might vary between resting and swimming fish. Swimming rainbow trout were exposed to ammonia levels ranging from 0 to 58 mg N/L, and resting rainbow trout were exposed to levels ranging from 0 to 378 mg N/L. Mortality of both the resting and swimming fish increased linearly with increasing concentrations of ammonia. However, mortality increased much more quickly with increasing ammonia concentrations for swimming fish. The 96-hour LC₅₀s varied significantly between the two groups, dropping from 207 mg N/L in resting trout to 32.4 mg N/L in swimming rainbow.

In Gila trout (*O. gilae*), Fuller et al. (2003) found that all fish survived exposures to ammonia up to concentrations of 4.5 mg/L total ammonia (0.36 mg/L un-ionized ammonia), and recorded a 96-hour median lethal concentration of 5.86 mg/L total ammonia (0.47 mg/L un-ionized ammonia) (pH 8.5, water temperature 59°F). Examining previous studies, the authors concluded that Gila trout appeared to have similar resistance to ammonia as rainbow trout.

Exposure to sublethal concentrations of ammonia may affect the swimming performance of salmonids (Shingles et al. 2001; Wicks et al. 2002). Muscle fatigue has been linked to ammonia accumulation and could lead to reduced swimming performance in trout (Shingles et al. 2001). Wicks et al. (2002) exposed coho salmon to sublethal levels of un-ionized ammonia (NH₃) to see if the ability to swim would be affected by low levels of ammonia. U_{crit} was recorded for coho salmon exposed to NH₃ levels of 0.02, 0.04, and 0.08 mg/L. Although not noting a significant difference between the U_{crit} of control fish versus those exposed to 0.02 mg/L, swimming performance was significantly reduced at 0.04 and 0.08 mg NH₃/L. The authors also found a correlation between the plasma and U_{crit} of individual fish, noting that plasma ammonia increases as the U_{crit} decreases. Studies by Shingles et al. (2001) documented similar results, noting increased ammonia plasma levels and a significant reduction in U_{crit} for trout exposed to increased concentrations of ammonia. At the pH range required by the NPDES permit (pH 6.5 – 9.0), and a wide range of water temperatures between 50 and 68°F, the 1.6 mg/L average monthly limit required in the NPDES permit correlates to NH₃ levels ranging from

approximately 0.0013 mg/L to 0.035 mg/L (EPA 1986). Therefore, because NH_3 levels are expected to remain below the 0.04 mg/L levels previously described as the lowest levels causing sublethal effects in coho salmon, NMFS expects that levels established for total ammonia in the NPDES permit should be adequate to avoid sublethal effects from effluent discharge.

Aquatic invertebrates are generally more resistant to acute ammonia toxicity than fish, with acute toxicity decreasing substantially with decreasing temperatures (EPA 1999). Ammonium is readily taken up by aquatic biota, so an increase in ammonium concentrations tends to diminish rapidly in the downstream direction (MacDonald et al. 1991). However, ammonia is not expected to bioaccumulate in fish (Vincoli 1997).

The EPA has identified acute water quality criteria for total ammonia at 5.6 mg/L, and chronic water quality criteria at 2.34 mg/L. The NPDES permit limits effluent total ammonia to 4.1 mg/L maximum daily load, and 1.6 mg/L average monthly load. The FCC estimates effluent concentrations of ammonia at 1 mg/L at the end-of-pipe. Both the effluent limits and estimated concentration at the outfall are below EPA's chronic water quality criteria. At the end-of-pipe, maximum concentrations allowed by the NPDES permit levels are below those reported for acute and chronic adverse effects to anadromous fish summarized in this analysis. Furthermore, considering dilution, mixing, and background concentrations of 0.022 mg ammonia/L in Big Deer Creek, ammonia concentrations instream are estimated to be approximately 0.1 mg/L downstream of the falls where anadromous fish reside (Table 11). Therefore, NMFS does not expect concentrations of ammonia contributed from the effluent to result in direct or indirect effects to Chinook salmon or steelhead in Big Deer Creek.

Nitrate plus Nitrite - Nitrate will be present in ICP mine drainage water as a residual from explosives used in underground blasting operations. EPA applies the permit limit to the combined form of nitrogen as "nitrate plus nitrite" because nitrite nitrogen is relatively unstable and is easily oxidized to the nitrate form. Nitrite is not expected to be present in ICP wastewaters (USDA Forest Service 2007).

Both oxidized forms of nitrogen, nitrate and nitrite, are known to be toxic to salmonids and other aquatic life as reviewed by Lewis and Morris (1986), Westin (1974), and Kroupova et al. (2005). Elevated ambient nitrite concentrations are also a potential problem for fish since nitrite is actively taken up across the gills in competition with chloride and disrupts multiple physiological functions (Kroupova et al. 2005, as cited in USDA Forest Service 2007). However, nitrite is not expected to be present in surface waters, as it's generally short-lived in natural environments, rarely existing in concentrations toxic to salmonids (Spence et al. 1996). Therefore, this effects analysis will focus on nitrates, the expected form in wastewater.

Idaho Water Quality Standards do not specify a numeric criterion for nutrients since stream and river productivity varies greatly due to natural water chemistry. Instead the Idaho Standards identify a narrative criterion to prevent eutrophication from human sources. The narrative standard states, "*surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.*" The draft permit refers to the narrative criteria in the Idaho Water Quality Standards, but does not recommend a numeric criterion for interpreting the narrative standard. Implementation of the

narrative standard in this fashion assumes that changes in eutrophication can be readily detected in a system that is already impaired by metals and that waste water treatment changes can rapidly be made to remedy the problem. This is not an adequately conservative approach to protect ESA-listed fish. A permit limit based on prevention of impairment needs to be developed for the ICP. The draft permit adopts a numeric criterion for nitrate plus nitrite (100 mg/L), based on protection of agricultural stock water, but this high concentration does not address the indirect effect of nutrient enrichment on aquatic life.

Nitrate toxicity in aquatic animals is caused by inhibition of the oxygen carrying ability of hemoglobin, and by disruption of osmoregulation at high concentrations (McGurk et al 2006). Toxicity to aquatic biota is directly related to increasing nitrate concentrations and exposure times (Camargo et al. 2005). Excessive nitrate concentrations are a concern from both the standpoint of toxicity, which may occur at very high concentrations, and from the standpoint of stimulating excessive algal growth and resulting negative effects on DO and pH regimes (USDA Forest Service 2007). Nitrates at high concentrations negatively impact domestic water supply, livestock drinking water, and are a direct toxicant to aquatic organisms. The maximum concentration of nitrates is 10 mg/L for human drinking water and 100 mg/L for livestock water (EPA 2003b).

Westin (1974) reported 96-hour median tolerance limits of 5,800 mg/L nitrate for Chinook salmon fingerlings, and 6,000 mg/L nitrate for rainbow trout fingerlings. Camargo et al. (2005) reviewed the laboratory studies of nitrate toxicity to fish, invertebrates, and amphibians. The primary source for salmonid toxicity values (rainbow trout, Chinook salmon, cutthroat trout, and coho salmon) cited by Camargo was a study by Kincheloe et al. (1979). The Kincheloe study reported toxicity values in the range of 1.1 to 7.6 mg/L nitrate (no observed and lowest observed effects). However, the validity of the Kincheloe et al. (1979) study was questioned by a recent study, where McGurk et al. (2006) reported toxicity values 2 to 3 orders of magnitude higher than reported by Kincheloe et al. (1979). For example, the most sensitive test reported by McGurk et al. (2006) noted sublethal effects for chronic exposures in the range of 6.25 to 25 mg/L for lake trout (*S. namaycush*) and lake whitefish embryos respectively; most other endpoints were reported at greater than 100 mg/L. McGurk et al. (2006) conclude that a low nitrate concentration that causes toxicity is valid only “for situations of long-term chronic exposure and only during the early life stages of fish. It does not support the use of the 2.9 mg/L nitrate value currently used as a risk benchmark in Canada for situations that involve short-term acute exposures or situations that involve exposures to adult salmonids, which are relatively insensitive to nitrate.”

Nitrates at high concentrations are a concern for toxic effects on aquatic biota, and at relatively low concentrations pose a concern for the deleterious effects associated with nitrogen enrichment. Camargo et al. (2005), in summarizing the literature up to that time, concluded that keeping nitrate levels below the drinking water standard of 10 mg/L would provide safe conditions for most sensitive freshwater species. McGurk et al. (2006) noted 96-hour LC₅₀s of 1,121 mg/L for lake trout swim-up fry, and 1,903 mg/L for lake whitefish swim-up fry. Chronic 130- to 150-day exposure LC₅₀s for embryo to swim-up fry were 190 to 64 mg/L respectively.

However, sublethal effects on developmental timing and fry body size were noted at nitrate concentrations of 6.25 and 25 mg/L. McGurk et al. (2006) further reported that adult salmonids are relatively insensitive to nitrate in comparison to early stages.

Aquatic invertebrates (particularly insects) have been identified as the most sensitive group to acute toxicity from nitrates, although little is known regarding chronic exposure (McGurk et al. 2006). Camargo et al. (2005) estimated short-term safe levels of nitrate of 6.7 – 9.6 mg/L and 4.5 – 6.5 mg/L for two net spinning caddisflies. Otherwise, the reported toxicity values for freshwater invertebrates, as summarized by Camargo, were an order of magnitude higher. In this paper, the authors recommended nitrate levels below 10 mg/L to protect sensitive freshwater biota. Concentrations of nitrate greater than 60 mg/L have been found to kill the tadpoles of many amphibians, although behavior and survivorship for some species has been affected by nitrate concentrations as low as 11 mg/L (Chambers et al. 2001).

An increase in fish production could occur from a small or moderate increase in primary production, potentially becoming beneficial to many forest streams. However, should excess plant growth occur increased plant respiration could deplete oxygen levels and result in adverse effects (MacDonald et al. 1991). Nutrient addition using fertilizers has been used to enhance productivity for aquatic communities expressly to increase salmonid populations; for example, with sockeye salmon in British Columbia (Stockner and Macisaac 1998) or as with the beneficial effect of salmon carcasses in the Pacific Northwest (Cederholm et al. 1999). However, nutrient enhancement efforts have all been accompanied by careful studies to determine the appropriate level of nutrient addition.

Although continuous discharge of nitrate in effluent for extended periods of months or years is generally not toxic, it can result in habitat alteration and changes in abundance and composition of riverine plants and animals depending upon the resulting nutrient concentrations (Chambers et al. 2001). Stimulation of excess algal productivity occurs at a much lower concentration than for potential toxicity. Ferreira et al. (2006) noted that microbial nitrogen demands can apparently be met at relatively low levels in streams, at levels one to two orders of magnitude lower than that found in polluted streams. They further suggested that even minor increases in dissolved nitrogen in streams can cause eutrophication which can lead to significant shifts in microbial dynamics and ecosystem function. Lacking a site-specific criterion, the literature provides some generic values that can be used for developing scenarios for this purpose. Golterman (1975) suggested a generic criterion of 0.3 mg/L for nitrate-nitrogen. Cline (1973), cited by MacDonald et al. 1991, suggested that <0.3 mg/L nitrate would *probably* (emphasis added) prevent eutrophication in forested systems.

The EPA published guidance in 2000 establishing nutrient criteria based on eco-regional specific nutrient conditions, but these recommendations have not been widely adopted by the states, and have not been adopted by the State of Idaho. The concentration for total nitrogen recommended by EPA for the Western Forested Mountains is 0.12 mg/L (EPA 2000), of which roughly 0.08 mg/L would be represented by nitrates (pers. comm. C. Mebane, USGS, March 2008). To get a better understanding of acceptable Idaho-specific levels of Nitrogen or Nitrates, NMFS conducted a review of Idaho watersheds where excess levels of nitrogen were a limiting factor and Total Maximum Daily Load (TMDL) targets had been developed. In the Teton TMDL the

target for Moody Creek was 0.3 mg/L (nitrite plus nitrate) to remove excess nutrients. In the American Falls Reservoir TMDL the total nitrogen target is set at 0.85 mg/L. In the Blackfoot River and Jim Ford Creek TMDLs, the nitrogen targets are not to exceed 0.3 mg/L and 0.23 mg/L as total inorganic nitrogen, respectively. NMFS believes that target levels in this range would also be appropriate for application to Big Deer Creek.

The highest nitrate concentrations will occur near the point of discharge, roughly 2.3 miles upstream from the upper distribution limit of ESA-listed anadromous fish. As described in the BA, dilution should be considered when evaluating the potential effects of nitrates since the effect occurs via growth of periphyton on stream substrate and not directly at the pipe outlet. However, because few contributing watersheds occur between the outfall and the falls downstream, nitrate concentrations will not be further diluted at the falls. At this point, the effluent should be well mixed with Big Deer Creek. A margin of safety is provided by the fact that nitrate is readily taken up by aquatic biota, so an increase in nitrate concentrations tends to diminish rapidly in the downstream direction (MacDonald et al. 1991).

Table 14 lists estimated nitrate concentrations in Big Deer Creek directly below the outfall, at Panther Creek below Big Deer Creek, and at Panther Creek at the mouth. Concentrations in this table factor in both the estimated effluent flow volume, and the estimated average and maximum flows.

In minimally disturbed watersheds, background nitrite + nitrate levels in the Salmon River basin range from undetectable levels to 0.225 mg/L (Ott and Maret 2003). Within the action area, DEQ has sampled nitrate + nitrite levels at least once in several locations, with the highest levels found at 0.12 mg/L in Panther Creek and 0.05 mg/L in Bucktail Creek. These levels were used to calculate the estimated total concentration in Table 14.

Table 14 Estimated nitrate concentrations downstream from Outfall at Draft NPDES permit limit of <100 mg/L (modified from BA Table 7-20, USDA Forest Service 2007).

	September Q-80 (cfs)	Dilution	Estimated Nitrate Concentration (mg/L)	Estimated Total Concentration (mg/L)
Outfall Average Flow	0.25	1.0	--	
Big Deer Ck. @ Outfall	6.9	27.6	3.6	3.65
Panther Ck. below Big Deer Ck.	51.1	204.4	0.5	0.62
Panther Ck. @ mouth	70.9	283.6	0.4	0.52
Outfall Maximum Flow	0.33	1.0	--	
Big Deer Ck. @ Outfall	6.9	20.9	4.8	4.85
Panther Ck. below Big Deer Ck.	51.1	154.8	0.6	0.72
Panther Ck. @ mouth	70.9	214.8	0.5	0.62

From a toxicity standpoint, resulting nitrate concentrations should be compared to the range of 6.25 mg/L to 10 mg/L, the lowest level where sublethal effects to fish embryos have been

observed (McGurk et al. 2006), and the 10 mg/L safe level recommended by Camargo et al. (2005). For eutrophication, the estimated instream nitrate concentration is compared to 0.3 mg/L, the target recommended by Cline (1973, as cited by MacDonald et al. 1991) to avoid eutrophication in forested streams. At the draft NPDES permit limit of <100 mg/L, nitrate concentration is estimated to be 3.65 to 4.85 mg/L in Big Deer Creek at the outfall, 0.62 to 0.72 mg/L at Panther Creek at the Big Deer Creek confluence, and 0.52 to 0.62 mg/L at the mouth of Panther Creek.

Therefore, predicted nitrate concentrations are not expected to be in the acute or chronically toxic range for anadromous fish in the action area. However, the NPDES permit level of <100 mg/L and concentrations in excess of 0.3 mg/L does not appear to be sufficient to prevent indirect effects related to nutrient enrichment. Although not likely to affect ESA-listed salmonids at the population-scale, anadromous fish could be affected indirectly in Big Deer Creek and Panther Creek as a result of habitat alteration and/or changes in abundance and composition of prey species and/or riverine plants.

Considering the information presented in Table 14 NMFS believes it is necessary to further reduce the maximum daily load to 10 mg/L to lower the risk of nutrient enrichment and prevent effects to sensitive aquatic biota (prey species for ESA-listed salmonids).

Sulfate/Sulfides – Sulfur is a critical element in living matter, it participates in several structural, metabolic and catalytic activities; and is a critical component of photosynthesis. Sulfur compounds are naturally occurring within the ore body at the ICP in the form of metallic sulfide minerals. In contact with aerated water the sulfides are oxidized to sulfate ions. Once liberated, both sulfates and sulfides would be present in wastewater from the mill and in the discharge at the outfall (USDA Forest Service 2007). Sulfate is usually found in low concentrations in most freshwater environments, although it can be found in high concentrations where sulfate-containing ores or anthropogenic activities exist (Davies 2007). Background concentrations of sulfate in Big Deer Creek are currently estimated at 7.3 mg/L (Table 11).

Sulfate toxicity testing generally indicates that invertebrates are more sensitive to sulfate than salmonids. As stated in the BA (USDA Forest Service 2007), BC Research (1998) evaluated toxicity to early life stages of rainbow trout, using 7-day salmonid embryo viability tests, and reported a NOEC of 1,060 mg/L SO₄ and a LOEC of 3,500 mg/L. An EC₅₀ (median effective concentration) calculated for embryo viability from this study was 1,477 mg SO₄/L. Other studies have reported 96-hour LC₅₀s for rainbow trout ranging from 5,000 mg/L in soft water (25 mg/L CaCO₃), to 9,900 mg SO₄/L in hard water (250 mg/L CaCO₃); and 96-hour LC₅₀s for coho salmon ranging from 5,742 mg/L in soft water (25 mg/L CaCO₃), to 9,875 mg SO₄/L in hard water (250 mg/L CaCO₃) (Singleton 2000).

Davies and Hall (2007) obtained recent LC₅₀ values for sulfate toxicity at low hardness (25 mg/L) for sensitive invertebrates which is similar to the hardness values in Big Deer Creek: *H. azteca*: 569 mg/L, *D. magna*: 1, 194 mg/L. Davies (2007) reevaluated previous studies by Frahm (1975) who reported toxic impacts at low concentrations of sulfate to the aquatic moss, *Fontinalis antipyretica*. Davies (2007) concluded that toxicity at the very low concentrations of sulfate reported earlier by Frahm (1975) were in error, and were actually due to the toxicity of

the potassium ion. Davies (2007) did not report LC₅₀s, but his results do not show toxicity effects at sulfate concentrations less than 600 mg/L at low hardness values similar to those found in Big Deer Creek.

Soucek (2005) reported acute toxicity values (48- or 96-hour LC₅₀s) for four invertebrates, which ranged from 512 mg/L sulfate for *H. azteca* to 14,134 mg/L for *C. tentans*, and found that hardness had a strong influence on sulfate toxicity for test crustaceans (Soucek 2005; Soucek 2007). There is growing evidence suggesting that some ions, particularly sulfate, are less toxic in harder waters (Davies and Hall 2007; Soucek 2007; Soucek and Kennedy 2005). Davies and Hall (2007) identified 48-hour LC₅₀s for *D. magna* and sodium sulfate increasing from 1,194 mg/L to 3,203 mg/L, with a change in water hardness from 25 to 100 mg/L CaCO₃. They also identified 96-hour LC₅₀s in *H. azteca* increasing from 569 mg/L to 5,259 mg/L, with a change in water hardness from 25 to 100 mg/L CaCO₃. Soucek (2007) documented *H. azteca* sulfate LC₅₀s increasing from less than 1,900 mg/L in 100 mg/L hardness, to over 4,000 mg/L at 500 mg/L hardness.

The degree of hazard from sulfide to aquatic life is dependent on the temperature, pH, and DO. At lower pH and in an anaerobic environment a greater proportion of sulfur occurs in the form of the toxic undissociated hydrogen sulfide (H₂S). The fact that H₂S is oxidized in well-aerated water by natural biological systems to sulfates or is biologically oxidized to elemental sulfur has caused investigators to minimize the toxic effects of H₂S on fish and other aquatic life (USDA Forest Service 2007).

The EPA has not established toxics criteria for sulfates or sulfides, and Idaho has not adopted any numeric criteria for these pollutants to protect aquatic life or human health in their Water Quality Standards. The EPA set the sulfate maximum daily limit in the draft NPDES permit at 250 mg/L based on the secondary drinking water standard, and not on toxicity to aquatic life. The maximum daily limit for sulfide was set at 2 µg/L (1:1 ratio), based on the chronic criteria for protection of freshwater aquatic life. A review of the literature indicates that the potential toxicity of sulfates to salmonids and invertebrates is 2 to 3 times higher (Davies and Hall 2007, Soucek and Kennedy 2005, Soucek 2007) than the draft permit limit of 250 mg/L. For impact evaluation purposes, the NOEC for an early life stage of a salmonid species of 1,060 mg/L is considered protective of listed species (BC Research 1998) and will be used to evaluate the potential effluent toxicity to fish that may occur in Big Deer Creek.

The FCC has formally requested a modification of the draft NPDES Permit to include a mixing zone for sulfate. Treated water discharged into Big Deer Creek is predicted to have sulfate concentrations ranging from approximately 400 to 840 mg/L at the end-of-pipe. Within the mixing zone, the ICP discharge would be diluted to meet the water quality standard of 250 mg/L established in the draft NPDES permit.

The actual length and width of the mixing zone would depend on the configuration of the effluent diffuser and on authorization of the mixing zone by IDEQ. According to IDEQ mixing zone policy⁵, in defining a mixing zone, several guidelines should be followed, including:

⁵ www.deq.idaho.gov/water/data_reports/surface_water/monitoring/mixing_zones.cfm

1. The mixing zone should not interfere with existing beneficial uses.
2. Water quality within a mixing zone may exceed chronic water quality criteria so long as chronic water quality criteria are met at the boundary of any approved mixing zone.
3. Acute water quality criteria may be exceeded within a zone of initial dilution inside the mixing zone.
4. The mixing zone may not be acutely toxic to biota significant to the receiving water's aquatic community.
5. The mixing zone should be limited to 25% of the width and volume of the stream to allow a zone of passage for aquatic life.

For the purposes of this analysis, the no observed effect value of 1,060 mg/L sulfate concentration is compared to the chronic value requirement in Item Number 2 above (Acute values would be much higher than chronic values and are therefore addressed by evaluating the chronic criteria). The mixing zone is evaluated assuming that it does not exceed 25% of the width or volume of flow. Based on the nature of flow in Big Deer Creek (turbulent), it's estimated that the mixing zone would extend several hundred feet in length.

Sulfate concentrations within the regulatory mixing zone were estimated based on ICP discharge and ambient Big Deer Creek water quality and flow estimates from the DSM modeling. A summary of the basis for the estimates and resultant instream sulfate concentrations are provided in Table 15. This table evaluates combinations of flow conditions, average flows (Scenario 1) and low flow conditions (Scenario 2) at both full mixing and only 25% of mixing with Big Deer Creek. Low flow conditions combined with a 25% mixing zone provides the worst-case scenario that fish may be exposed to. At the point of discharge, sulfate concentrations immediately adjacent to the diffuser ports would be similar to the discharge, 400 to 840 mg/L. At the edge of the assumed regulatory mixing zone (25% mixing), sulfate concentrations would range from approximately 34 to 166 mg/L during average conditions (Scenario 1) and low flow (7Q10) conditions (Scenario 2) respectively (Column 5 in the Table).

Outside of the regulatory mixing zone, after mixing with the entire volume of Big Deer Creek is achieved, sulfate concentrations in Big Deer Creek are predicted to increase from approximately 7.3 mg/L (baseline condition) to approximately 14 mg/L during average flow conditions and 53.6 mg/L during low flow (7Q10) conditions (Column 4 in the Table). The worst-case scenario of low stream flow and 25% mixing area results in a predicted sulfate concentration of 166.1 mg/L, much lower than the estimated protective value of 1,060 mg/L. Given these assumptions, NMFS concludes that levels of sulfates/sulfides from the effluent should not rise to levels that are likely to result in direct, indirect, or sublethal effects to ESA-listed salmonids. However, because NMFS' analysis relies on the mixing zone as described, any difference in the mixing zone from that specifically analyzed in this Opinion may require reinitiation of consultation.

Table 15. Sulfate concentrations within and outside of the mixing zone (USDA Forest Service 2007).

Scenario 1: Average Conditions				
Big Deer Creek Q50, Average Outfall Flow, Average Sulfate Discharge Concentration				
	Q50 (cfs) (1)	Sulfate Concentrations Before Mixing (mg/L) (2)	Sulfate Concentrations in Big Deer Creek After Full Mixing (mg/L)	Sulfate Concentrations in Big Deer Creek After Mixing with 25% of Big Deer Creek Flow (mg/L)
Outfall Average Discharge	0.25	581	---	---
Big Deer @ Outfall	20.72	7.3	14.1	33.7
Scenario 2: Low Flow Conditions				
Big Deer Creek 7Q10, Maximum Outfall Flow, 90th Percentile Sulfate Discharge Concentration				
Outfall Average Discharge	0.33	840	---	---
Big Deer @ Outfall	5.6	7.3	53.6	166.1

Notes:

- (1) **Flows:** Discharge flow estimate are from the ICP NPDES Permit application (FCC, 2006). Big Deer Creek average flow estimates from DSM results (see pg A-26, Appendix A, Water Resources Technical Report, Hydrometrics, 2006). Big Deer Creek 7Q10 estimated from duration curve developed from DSM daily flow results for the 100-year simulation period. For comparison to the 5.6 cfs value, USGS estimates 7Q10 to be 4.9 cfs from USGS StreamStats model (see Mebane, 2007). The DSM value was chosen for this analysis for consistency with other DSM predicted values that are based on the watershed model.
- (2) **Sulfate:** Big Deer Creek sulfate concentration during base flow condition as used in DSM model (see Table B-3b DEIS). ICP discharge concentrations from DSM results (see pg A-24, Appendix A, Water Resources Technical Report, Hydrometrics, 2006).

Total Suspended Solids – TSS include both organic and inorganic particulate matter in water and refer to the portion of total solids retained on a 2 µm (or smaller) filter. Total solids are the material left from a liquid mixture (e.g., effluent) after evaporation and drying at a defined temperature (EPA 2003a).

Factors affecting TSS concentrations and distributions in receiving waters, include: flow rate, temperature, soil erosion, urban runoff, wastewater and septic system effluent, decaying plants and animals, and bottom-feeding fish. The decrease in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. When suspended solids settle to the bottom of a waterbody, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae. Settling particulates can coat substrates and fill in spaces between rocks typically used by high value aquatic organisms eaten by salmonids (Wilber and Clarke 2001; Mitchell and Stapp 1992).

Four categories of effects resulting from exposure to TSS are recognized in fish: lethal, para-lethal, sublethal, and behavioral (Newcombe and Jensen 1996). These four effect categories are defined as follows: lethal effects are those that result in mortality; para-lethal effects are those that reduce the population in time such as reduced growth rate; sublethal effects are reduced feeding rate, or feeding success and physiological stress; and behavioral effects are avoidance,

alarm or movement from cover. Although concentration and duration of exposure are the primary drivers of TSS effects on fish, other factors influence the degree of the effects. Particle size affects the ability of fish to clear the gills of TSS (Servizi and Martens 1987). Environmental factors such as temperature and DO affect tolerance to TSS by further stressing the animal (Servizi and Martens 1991). Also, the availability of refugia will influence the ability to avoid exposure (Bisson and Bilby 1982).

Following discharge, the size of particles entrained in the receiving water varies with flow characteristics (e.g. velocity, gradient, turbulence, and temperature). Deposition of suspended sediment is related to particle size and diminished flow. Temperature stratification can prevent TSS from mixing with portions of water columns or extend its downstream attenuation. The very fine particle fraction (<0.06mm) tends to stay in suspension for the length of the fluvial system. These suspended solids can directly cause toxicity to aquatic biota or can settle to the bottom of the receiving waterbody and cause toxicity to the benthic community that serves as a prey base for other aquatic biota.

Large quantities of TSS in a waterbody often correlate to higher concentrations of bacteria, nutrients, pesticides, and metals in the water. These pollutants may attach to inorganic and organic particles on the land and be carried into waterbodies with stormwater or attach to particulates in effluent and be carried downstream. Pollutants bound to solids may settle to the bottom, or remain suspended through fluvial systems, and release into the water column at variable rates (Wilber and Clarke 2001; COE 1999).

Salmonid response to TSS is dependent on environmental factors including duration of exposure and temperature (Servizi and Martens 1992). In completing a thorough review of the literature, Newcombe and Jensen (1996) summarized data from a wide range of studies, noting various levels of effect to varying concentrations of suspended sediment. Although not likely lethal at low concentrations, 24-hour exposure to levels as low as 16.5 to 25 mg/L were reported to reduce feeding activity and behavior of salmon and trout. After 2-hour exposure to suspended sediment concentrations of only 35 mg/L, cutthroat trout ceased feeding and sought cover. Extended exposure resulted in more serious effects, even at lower concentrations. For example, after 720 hours of exposure to only 18 mg/L, rainbow trout abundance was reportedly reduced.

The FCC estimates their maximum daily TSS concentration at 30 mg/L, with an average daily value of 25 mg/L. The NPDES permit limits ICP effluent to a maximum daily value of 30 mg/L, with a 20 mg/L average monthly load. These TSS concentrations appear to exceed levels previously discussed that would result in paraethal and/or sublethal effects to salmon and steelhead. However, these concentrations are estimated at the end-of-pipe and will be diluted 20-fold by mixing in Big Deer Creek before reaching habitat occupied by ESA-listed fish species downstream of the falls. Therefore, NMFS concludes that levels of TSS from the effluent should not rise to levels that are likely to result in significant effects to ESA-listed salmonids.

pH– The pH is a measure of the concentration (activity) of hydrogen, or hydronium, ions in water. Specifically, pH is the negative log of the hydrogen ion concentration. The pH of natural waters reflects the acid-base equilibrium achieved by various dissolved solids and gases, and is an important factor in the chemical and biological interactions found in waterbodies. On the pH

scale of 0 to 14, waters of 0 to 7 are acidic, and waters from 7 to 14 are alkaline. Elevated hydrogen ion concentrations at low pH are directly toxic to fish, causing osmoregulatory problems (NMFS 1999).

Changes in pH also affect the solubility or toxicity of metals such as aluminum, manganese, zinc, copper, and cadmium in the water column and sediments, thereby affecting the exposure dose of metals to aquatic organisms (NMFS 1999). Metals exacerbate the physiological response to the increased hydrogen atom, increasing both their mobility and bioavailability to aquatic organisms (Spence et al. 1996). There are two types of metals: type I metals (e.g., cadmium, copper, and zinc), that are less toxic as the pH decreases; and type II metals (e.g., lead) that are more toxic at lower pH levels (USDA Forest Service 2007). Aluminum is the metal of greatest concern at low pH values, while un-ionized ammonia (directly toxic to aquatic organisms), is a problem at higher pH values. At a given temperature, the higher the pH, the greater the amount of un-ionized ammonia that will be present for a given amount of total ammonia (NMFS 1999).

Rainwater without anthropogenic acids has a pH generally between 5.0 and 5.6. The buffering capacity of a waterbody is related to alkalinity, a trait that is determined by soil type and parent geology. Waters with high alkalinity are able to neutralize or buffer a certain amount of acidic inputs. Alkalinities are lowest during periods of high surface runoff (winter and spring) and highest during periods when groundwater discharge dominates stream flow (summer and fall) (NMFS 1999).

There is little species-specific information for pH effects on anadromous fish. Highly acid-sensitive fish species (e.g. fathead minnow and striped bass) may suffer decreased reproductive success. Below pH 6.0, reproductive success of lake trout declines in some waters, and lake and rainbow trout do not survive in the wild in aquatic habitats at pH 5.5 to 5.0. Vulnerable life stages of Chinook salmon are sensitive to pH below 6.5 and possibly at pH greater than 9.0 (NMFS 1999). Winter et al. (2005) found water at pH 10 acutely toxic to juvenile rainbow trout.

Considering indirect effect to the salmonid food base, some insect larvae including those of the mayflies, stoneflies, and caddisflies are sensitive to low pH in the range of 5.5 to 6.0 (NMFS 1999). In the pH range of 6.5 to 6.0, anticipated effects are a small decrease in species richness of phytoplankton, zooplankton, and benthic invertebrate communities resulting from the loss of a few highly acid-sensitive species (NMFS 1999).

The FCC has estimated the maximum daily pH of the effluent to be 9.0, with an average daily pH of 7.5. The NPDES permit requires that water in Big Deer Creek be in the range of 6.5 to 9.0 at all times. Based on the tolerances previously described for fish and their prey base, pH values in this range are not expected to result in adverse effects to ESA-listed fish species as a result of the effluent discharge.

Temperature – Temperature controls many physical and chemical processes in water, affecting concentrations of numerous constituents, such as: dissolved oxygen, pH, hardness and alkalinity, and the toxicity of some constituents such as, ammonia, organics, metals, and nitrogen. Temperature affects a number of biological interactions, which may affect or alter ecological

regimes, including, competition, predation, metabolic function, disease, and prey forage. The National Academy of Sciences (NAS 1972, in McCullough et al. 2001) recommendations for water temperature exposure for protection of aquatic life specify maximum acceptable temperatures for prolonged exposures (greater than one week), winter maximum temperatures, short-term exposure to extreme temperature, and suitable reproduction and development temperatures. Comprehensive literature reviews, issue papers, and guidance have recently been completed and most of the following information is from these sources (McCullough et al. 1999, 2001; EPA 2003a).

Temperature is important in controlling many physiological and behavioral processes in salmon and steelhead (McCullough et al. 2001). Data from many experiments provide evidence that temperatures tolerated by salmonids (and other species of fish as well) are a function of at least three factors: (1) the acclimation temperature; (2) the magnitude of the difference between the acclimation temperature and the elevated temperature; and (3) the duration of exposure to the elevated temperature (Tang et al. 1987, in McCullough 1999). The acclimation temperature is the temperature of the water the fish are living in before being exposed to the elevated temperature. The elevated temperature that a salmonid can tolerate increases with increasing acclimation temperature.

The upper incipient lethal temperature (UILT) is an exposure temperature, given a previous acclimation to a constant acclimation temperature, in which 50% of the fish will die within 7 days (McCullough et al. 2001). The duration for which a salmonid can tolerate an elevated temperature decreases with increasing temperature. As acclimation temperatures rise above 68°F, the UILT essentially estimates the ultimate upper incipient lethal temperature (UUILT). The UUILT for salmonids is quite consistent, ranging from about 73.4-78.8 °F among species (McCullough et al. 2001). Sockeye salmon are more sensitive than Chinook with a 0.9-1.8 °F lower UUILT. Rainbow trout have a higher UUILT (about 1.8 °F) than Chinook salmon. However, steelhead smolts appear to be much more sensitive than Chinook smolts. Although UUILT values for salmonids reported in the literature are up to 78.8 °F, fish in the field will not necessarily be acclimated to warm temperatures as they are in laboratory tests of UUILT. Given that wild fish are often more sensitive than domesticated laboratory stocks and are often acclimated to temperatures lower than laboratory fish, mortality in the field could be induced at in the field may be 1.8 - 3.6 °F lower than the UUILT values derived in the laboratory. Field data suggest maximum distribution of salmonids is limited to waters that have a temperature of about 3.6 – 5.4 °F less than the UUILT derived from laboratory experiments (McCullough et al. 2001).

The incipient lethal temperature (ILT) for a given fish species is determined by acclimating the fish to one temperature and then subjecting them instantaneously to another temperature. Acute thermal shock leading to death can be induced by rapid shifts in temperature (McCullough 1999). When salmonids are acclimated below 53.6 °F, substantial (50%) lethality (LT50) can be expected to occur almost instantly (1-60 seconds) at temperatures above 86-93.2 °F. For spring Chinook salmon acclimated at 59 °F and subjected to water at 85.5 °F, survival time can be calculated to be 3.2 minutes (McCullough 1999).

Thermal shock can also cause sublethal effects and indirect mortality even with short duration exposures. Juvenile Chinook salmon and rainbow trout acclimated to 59-60.8 °F and transferred to temperature baths in the range of 78.8 to 86 °F suffered significantly greater predation than controls (Coutant 1973). Coho salmon and steelhead trout acclimated to 50 °F and transferred to 68 °F water suffered physiological changes including hyperglycemia, hypocholesterolemia, increased blood hemoglobin, and decreased blood sugar regulatory precision (Wedemeyer 1973). Predation of sockeye salmon fry by juvenile coho salmon increased with an 18 °F increase in temperature (Sylvester 1972). Rainbow trout acclimated at 46.4 °F and transferred to 75.2 °F water remained at the surface for 1 to 2 minutes, expended large amounts of energy swimming haphazardly, then became lethargic at the surface. After about 1 hour, the fish could be handled with very little evasive response (Smith and Hubert 2003). In a fluctuating environment, multiple-day exposure to near lethal or lethal temperatures may create cumulative effects (McCullough et al. 2001). Multiple stresses can load or limit physiological systems, reduce growth rates, initiate disease, reduce osmoregulatory ability, and result in death when the physiological tolerance is overwhelmed (Budy et al. 2002; McCormick et al. 1998; Wedemeyer et al. 1990).

The smoltification process is tightly linked to temperature. At the time of smoltification, anadromous salmonids experience reduced ATPase levels at constant or acclimation temperatures greater than 51.8-55.4 °F that may result in delay or residualization (McCullough et al. 2001). It appears that temperatures between 59 and 68 °F can block smoltification during migration of smolts to the ocean (McCullough et al. 2001). Temperatures above 64.4 °F may inhibit feeding in smolts. At elevated temperatures (i.e., temperatures that cause changes in the smoltification process), several outcomes are possible. First, if smoltification cannot be completed then residualization occurs. Juvenile salmon usually wait for another year before out-migrating to the ocean. Remaining in freshwater for a second year subjects these juveniles to increased predation and sublethal effects associated with rearing in an area that reaches critical temperatures. Second, survival of smolts that reach the ocean depends heavily upon the degree of smoltification and general health to volitionally enter saltwater. If elevated temperatures have inhibited smoltification, reduced growth, or increased stress, then ocean survival can be decreased.

Adult salmonids are very sensitive to temperature and appear to have lethal tolerances 3.6-5.4 °F lower than the juvenile fish typically used in lethality testing (McCullough et al. 2001). The National Academy of Sciences (1972, in McCullough 1999) recommended that a safety factor of -3.6 °F be added to the UILT. This safety factor was meant to minimize mortality but did not consider disease incidence or other sublethal effects, which were poorly understood at that time (McCullough 1999). The UILT also does not consider other stressors that may be present, such as high turbidity, low dissolved oxygen, or chemical toxicants, that may cause fish to die at temperatures lower than the UILT (McCullough 1999).

Loss of equilibrium occurs at lower temperatures than lethality. In addition, as temperatures increase, incidence of disease increases. Holding adult Chinook at 57.2 °F for 1.5 months resulted in no mortality, but holding for a similar amount of time at 66.2 °F resulted in nearly total mortality from disease (McCullough 1999). Columbia River steelhead, acclimated at

66.2 °F, had a lethal threshold of 69.8 °F and have also been shown not to migrate until river temperatures fall below 69.8 °F (McCullough et al. 2001). Of note, is that as temperature increases and causes adult salmon to hold in thermal refugia, the additional expenditure of energy while holding and not migrating may cause pre-spawning mortality through expenditure of limited energy reserves (McCullough et al. 2001). MacDonald (2000) noted that in a tributary to the Frazier River, 25% mortality of Chinook salmon spawning runs occurred when mean summer temperatures were frequently above 68 °F and reached a high of 73.4 °F.

Migration behavior of adult Chinook salmon can be changed by water temperature. Chinook and other salmon are assumed to delay migration until water temperature is conducive. Extensive delays can prevent adult salmon from reaching spawning grounds in time to spawn successfully. Generally, spring and fall Chinook salmon migrate upstream when temperatures are between 51.8 and 68 °F (McCullough et al. 2001). A migration threshold at a temperature of 69.8 to 71.6 °F is documented by numerous studies across major migratory salmonid species in the Columbia River (McCullough et al. 2001; McCullough 1999). On the Tucannon River in Washington, spring Chinook salmon stopped migrating when water temperature reached 69.8 °F. Similarly, adult sockeye salmon migrations were also blocked at 69.8 °F according to one study. Another study reports that some passage occurred even when temperatures exceeded 72 °F. In the Okanogan River steelhead migration did not begin until temperatures fell below 73 °F, though optimal migration temperature was about 57.9 °F (McCullough 1999). Snake River sockeye salmon are reported to delay migration at temperatures greater than 69.8 °F (Quinn et al. 1997). At temperatures above 68-69.8 °F, less than 50% of fall Chinook entering the Snake River successfully passed Lower Granite Dam (Karr et al. 1998). Migrations during temperatures a few degrees lower resulted in almost twice as many fish reaching Lower Granite Dam.

Spawning success can change as a result of the temperature experienced by adult salmon before spawning. Pre-hatch mortality and developmental abnormalities were higher and alevin size was smaller in Chinook salmon held at 63.5-66.2 °F for 2 weeks before spawning compared to Chinook salmon held at 57.2-59.9 °F for the same period of time (McCullough 1999). As a result of these and similar observations, temperatures of 42.8-57.2 °F have been recommended for holding of Chinook salmon broodstock (McCullough 1999). Pre-spawning mortality caused by elevated temperature and extended holding times are similar for sockeye salmon survival; 51% of adults survived in a diel temperature regime of 48.9-73.9 °F while 96% survived in a diel regime of 52-60 °F (McCullough 1999). Elevated holding temperature has also been shown to result in lower health and reproductive indices (McCullough et al. 2001).

Under stressful conditions mortality rates of gravid, and therefore sensitive, adult migrants are likely to increase at the population or run level. Furthermore, gametes inside body cavities of exposed adults are highly susceptible to thermal damage. Delayed pre-spawning mortality due to disease, stress, and exhaustion will increase in upstream areas (Wilkie et al. 1997). Also spawning vigor (penetration into low order streams, mate selection, redd construction, and other such essential behaviors) may be severely impaired and result in lower rates of survival of progeny. Pre-spawning mortality rates of salmon often exceed 20-40% after passage through the lower Snake River (Wilkie et al. 1997).

The NPDES permit sets a maximum daily limit of 66 °F for the ICP effluent. FCC estimates that the effluent will have a maximum daily value of 55 °F in the summer and 35 °F in the winter. Average daily temperatures of the effluent are estimated to range from 55 °F in the summer, to 40 °F in the winter. Effluent temperatures ranging from 35 to 55 °F should not affect background temperature levels in Big Deer Creek. These temperatures are also not in a range where adverse effects to steelhead or Chinook salmon are likely to occur as a result of effluent discharge.

Dissolved Oxygen – Low levels of DO in water can cause direct and indirect effects to fish, as well as create additional stress by causing an increase in toxicity of metals such as zinc. Sublethal effects of reducing DO below saturation can include metabolic, feeding, growth, behavioral, and productivity effects. Behavioral responses include avoidance of low DO sites or patches and curtailment of migration if DO levels drop too low across the entire stream corridor. Physiological changes to low DO, include elevation in both rate and amplitude of breathing, decreased heart rate, increased stroke volume of the heart, and altered metabolic rate (Ruggerone 2000). In situations where demand of DO exceeds input, fish kills may occur.

Productive streams exhibit diurnal cycles in water-column DO concentrations due to photosynthesis and respiration. Although fish can detect and will attempt to avoid reduced concentrations of DO, average measurements of DO do not reflect the damage that can occur during diurnal minima. Other important factors include the length and frequency of fish exposure to the low DO level. In several species studied, fish growth appeared to be determined by the daily minimum of DO, not the average or maximum. Studies reviewed in NMFS (1999) indicate possible 5-20% reductions in growth of juvenile coho salmon between 6.5-8 mg/L DO.

Reductions in DO can decrease swimming performance in both adult and juvenile fish, affecting the ability to migrate, forage and avoid predators (NMFS 1999; Spence et al. 1996). Any reduction in DO below saturation at high water temperatures increases the risk of adverse effects to salmonids. Subyearling and smolt life stages are very sensitive to low DO. Dahlberg et al. (1968) found that a reduction in DO to 7.5 mg/L resulted in a 5% reduction in swimming speed. Dahlberg noted that swimming speed declined markedly below 7-8 mg/L DO. As cited in Spence et al. (1996), Bjornn and Reiser (1991) concluded that although thresholds for survival were generally low (3.3 mg/L), growth and food conversion efficiency are affected at DO levels of 5 mg/L, and DO levels of 8 to 9 mg/L are needed to ensure unimpaired normal physiological functions of salmonids. The ecological significance of increased stress and reduced swimming ability has only recently been increasingly verified and associated with latent declines in production and survival (Servizi and Martens 1991; Wilkie et al. 1997; Wedemeyer et al. 1990; Budy et al. 2002).

Sublethal effects that occur below 8 mg/L may control survival and success of juvenile salmonids in nature through reduced growth and size observed in juvenile salmonids at DO concentrations below saturation. Swimming speed in juvenile salmon declines markedly at DO concentrations below 7-8 mg/L (NMFS 1999). Results of several growth experiments summarized for coho salmon (Warren et al. 1973, as cited in ODEQ 1995) show that growth rate appears closely related to DO concentrations below 6.0-6.5 mg/L. The Oregon Department of Environmental Quality (ODEQ's) issue paper reports that concentrations around 8 to 6.5 mg/L

resulted in measurable reductions in swim speed and maximum attainable growth. The paper also cites laboratory studies that note changes in oxygen transfer efficiency occurring and blood not fully saturated with oxygen at levels near 6.5 mg/L.

Warm water levels and water temperatures work in synergy with DO concentrations to cause a range of adverse effects to salmonids. This range includes acute lethal toxicity, inability to complete essential foraging and predator avoidance behaviors, area avoidance, migration delays, increased stress, reductions in growth, and slower swimming speed. Low DO concentrations increase the acute toxicity of various toxicants such as metals (e.g., zinc) and ammonia (Rand and Petrocelli 1985; NMFS 1999). Also, TSS and toxicants may increase sensitivity to low concentrations of DO. For example, any toxicant which damages the gill epithelium can decrease the efficiency of oxygen uptake.

Three components of effluent can affect receiving water DO levels: (1) the actual concentration of DO by volume discharged into the waterbody; (2) the load of chemical oxygen demand (COD) material; and (3) the load of biological oxygen demand (BOD) material. These components cumulatively affect different areas within receiving waters based upon rate of assimilation and degradation, fate and transport. The EPA has identified a DO concentration limit of >6 mg/L at all times to meet the Idaho State water quality criteria for aquatic life. A 20-fold mixing of the effluent will occur in Big Deer Creek at low streamflow and full discharge. When considered in addition to the predicted low BOD and COD levels (1 mg/L maximum daily) in the effluent, the ICP is not expected to exceed the 6 mg/L limit identified for DO in the NPDES permit. Based on DO effect levels described above, DO levels >6 should be adequate to avoid the effects of low DO on ESA-listed salmonids downstream from the discharge pipe.

Iron – Iron is pivotal to metabolism in almost all living organisms (Andersen 1997). Iron is an abundant, naturally occurring metal that can be found in a variety of forms. Oxidation of ferrous minerals in iron-containing ores is a primary source of environmental acids (Nelson et al. 1991). Acid mine drainage often contains elevated levels of dissolved ferrous iron (Fe^{2+}) which converts to insoluble ferric (Fe^{3+}) species, including particulate ferric hydroxide ($\text{Fe}(\text{OH})_3$), as pH is elevated and oxygenation takes place (Smith and Sykora 1976). Iron and most of its compounds are insoluble and highly persistent in water, with a half-life >200 days (Vincoli 1997).

Iron can be mobilized in acid mine drainages, precipitating out of solution in the form of ferric oxide. These oxide and hydroxide precipitates are the more toxic forms of iron, and have been shown to suffocate trout eggs and to coat gills suffocating other aquatic biota. The toxicity of iron to fish increases with decreasing pH. For example, brook trout 96-hour LC_{50} s shifted from 1,750 μg iron/L at pH 7.0, to 480 μg iron/L at pH 6.0 (Nelson et al. 1991). Anderson (1997) exposed brown trout fertilized eggs, yolk-sac larvae, and start-fed fry to various concentrations of iron (0 to 35 mg/L), finding only the start-fed fry were highly susceptible to waterborne iron. Iron accumulation affecting the fry was thought to increase with the development of the gills. Smith and Sykora (1976) noted sharp declines in coho salmon alevin survival when exposed to iron concentrations of 6,000 to 12,000 μg /L.

The EPA has not identified water quality criteria for iron, nor have they identified any NPDES permit limits for the ICP. Although there are no toxic criteria established for iron in section 210 of the Idaho Water Quality Standards, a value of 5,000 µg/L is recommended in the EPA Blue Book for irrigation water supply. In their NPDES application, FCC estimates maximum daily effluent concentrations of iron at 300 µg/L, and average daily concentrations of 30 µg/L at the end-of-pipe. At these concentrations, EPA determined that the discharge shows no reasonable potential of violating water quality standards, and an iron effluent limit was not developed for the ICP. Although no limit has been developed, iron will be monitored on a monthly basis with the other pollutants to ensure that limits do not exceed those anticipated by FCC. Based on review of the data cited above, NMFS concludes that levels of iron predicted for the effluent are not likely to rise to concentrations that will result in direct, indirect, or sublethal effects to ESA-listed salmonids.

Aluminum – Elemental aluminum is one of the most abundant metals in the earth's crust, and because of its frequent use it enters the environment from both point and non-point sources (Vincoli 1997). It has been identified as one of the most important toxicants of aquatic systems acidified by anthropogenic introduction of acids (Dussault et al. 2004; Exley 2000) and is highly persistent in water with a half-life >200 days (Vincoli 1997). Solubility is dependent upon pH, increasing as pH increases or decreases from near neutrality. Solubility also increases at lower temperatures or with the addition of complexing ligands. It is lowest between pH 6 and 8 (Winter et al. 2005). As previously stated, changes in pH affects the solubility or toxicity of metals, thereby affecting the exposure dose of metals to aquatic organisms. Aluminum is the metal of greatest concern at low pH values (NMFS 1999).

Aluminum has moderate acute and high chronic toxicity to aquatic biota (Vincoli 1997). Natural water chemistry appears to be more effective at protecting fish from acute toxicity than chronic toxicity (Exely 2000). Inorganic monomeric aluminum species are generally considered the most toxic, including Al^{3+} , AlOH^{2+} , $\text{Al}(\text{OH})_2^+$, $\text{Al}(\text{OH})_3$, and $\text{Al}(\text{OH})_4^-$ (Winter et al. 2005). Exely (2000) showed that rainbow trout fry avoided elevated concentrations of waterborne aluminum, although the response varied depending upon both concentration and pH. When exposed to aluminum concentrations ranging from 17 to 540 µg/L, fry avoided concentrations as low as 34 µg/L at pH levels of 5.0. However, avoidance noted at pH levels between 5 and 5.75 did not occur at a pH of 6.0, where fish did not avoid concentrations as high as 540 µg/L. No mortality or signs of acute toxicity were noted for rainbow trout at these concentrations or pH levels.

Waterborne aluminum is the main toxicant affecting fish in acidic waters, acting as a gill toxicant by causing ionoregulatory and respiratory effects (Winters et al. 2005; Dussault et al. 2004; Allin and Wilson 1999; McDonald et al. 1991; Mueller et al. 1991). If pH in acidic waters is increased quickly, aluminum solubility decreases which increases toxicity as aluminum polymerizes and precipitates in fish gills. Mortality in brook trout exposed to 200 µg/L aluminum for 56 days was significantly higher at pH 5.3 than either pH 6.1 or 7.2 (Cleveland et al. 1991). Although Winters et al. (2005) found that aluminum readily accumulated on rainbow trout gills at pH levels ranging between 6 and 8, accumulation was eliminated at all pH levels by the presence of natural organic matter (aluminum bonded to the organic matter versus fish gills).

Following 53 to 69 days of exposure of juvenile rainbow trout to aluminum concentrations ranging from 0 to 80 µg/L, Dussault et al. (2004) noted aluminum accumulation in both the gills and liver increased with increasing waterborne concentrations of aluminum. The study documented issues with trout swimming speed and cardiac output, describing a significant relationship between aluminum accumulation at the gill and both decreased swimming speed and increased heart rate. Prior to this study Allin and Wilson (1999) had shown similar results in fish behavior, noting dramatic changes in swimming behavior of juvenile rainbow trout exposed for 34 days to aluminum concentrations of 30 µg/L (pH 5.2). Trout were more sluggish after only 1 day of exposure; spending considerably less time swimming, more time holding position, and demonstrating dramatically fewer burst-swimming episodes. At the conclusion of their study, the authors theorized that if fish experienced similar changes to routine swimming behavior in the wild as observed in the laboratory, chronic exposure to aluminum would likely affect a fish's ability to forage, avoid predation, migrate, or reproduce.

The EPA has not identified water quality criteria for aluminum, nor have they identified any NPDES permit limits for the ICP. However, in their NPDES application, FCC estimates maximum daily effluent concentrations of aluminum at 200 µg/L, and average daily concentrations of 20 µg/L at the end-of-pipe. At these concentrations, EPA determined that the discharge shows no reasonable potential of violating water quality standards, and an aluminum effluent limit was not developed for the ICP. Although no limit has been developed, aluminum will be monitored on a monthly basis with the other pollutants to ensure that limits do not exceed acute and chronic toxicity values described above. Provided pH levels are maintained between 6.5 and 9.0, as required in EPA's effluent limits, NMFS concludes that levels of aluminum in the effluent are not likely to rise to concentrations that will result in direct, indirect, or sublethal effects to ESA-listed salmonids.

Magnesium – Magnesium is a naturally occurring mineral, found in both terrestrial soils and aquatic sediment, posing very little threat to the environment (Vincoli 1997). As described by El-Mowafi and Maage (1998), magnesium is an essential element for fish, where deficiency has been found to result in retarded growth, anorexia, sluggishness, high mortality, reduced ash content, and reduced concentrations of magnesium and calcium in the whole body and vertebrae. Magnesium is nearly insoluble (0.01%) and highly persistent in water, with a half-life >200 days. Anthropogenic sources of magnesium include discharges and spills from industrial and municipal waste treatment plants (Vincoli 1997).

Magnesium and its salts have slight acute toxicity to aquatic life, and little information exists regarding its short-term toxicity to plants, birds, or terrestrial animals. The EPA does not currently consider magnesium a hazardous substance (Vincoli 1997). Mount et al. (1997) reported 24-, 48-, and 96-hour LC₅₀s of 3,520, 2,840, and 2,120 mg/L MgCl₂ for fathead minnows, and 24-, and 48-hour LC₅₀s of 1,560 and 3,330 mg/L MgCl₂ for *D. magna*. For rainbow trout eggs exposed to MgCl₂, the Pesticide Action Network's PAN Pesticides Database (2008) reported a mean 28-day LC₅₀ of 1,355 mg/L, ranging from a low of 119.9 mg/L to a maximum of 1,507 mg/L. After 14 days, Shearer and Åsgård (1992) noted elevated whole body concentrations of magnesium in fish exposed to 150 mg/L and 1,000 mg/L, further noting that fish exposed to the higher concentration were significantly smaller than fish exposed to lesser concentrations. Mortalities began to occur in rainbow trout after 2 days of exposure to the

1,000 µg/L concentration, increasing to 48% total mortality at the end of the experiment (14 days). In the absence of dietary magnesium, the authors concluded that rainbow trout are able to meet their magnesium requirement at waterborne concentrations of 46 mg/L.

EPA has not identified water quality criteria for magnesium, nor have they identified any NPDES permit limits for the ICP. However, in their NPDES application, FCC estimates maximum daily effluent concentrations of magnesium at 100 mg/L, and average daily concentrations of 10 mg/L at the end-of-pipe. At these concentrations, EPA determined that the discharge shows no reasonable potential of violating water quality standards, and a magnesium effluent limit was not developed for the ICP. Although no limit has been developed, magnesium will be monitored on a monthly basis with the other pollutants to ensure that limits do not exceed acute and chronic toxicity values described above. Based on review of the data cited above, NMFS concludes that levels of magnesium in the effluent are not likely to rise to concentrations that will result in direct, indirect, or sublethal effects to ESA-listed salmonids.

Manganese – Manganese is a naturally occurring metallic element weathered from rock, broadly distributed throughout surface waters, soil, aquatic sediments, and groundwater (Reimer 1999; Stubblefield et al. 1997). Manganese is an essential trace element for both plant and animal life (Reimer 1999; Vincoli 1997). It and its compounds vary in their solubility in water from very soluble to nearly insoluble, and are highly persistent in water with a half-life >200 days (Vincoli 1997). Manganese solubility increases at low pH, while the presence of high concentrations of chlorides, nitrates, and sulfates may also increase solubility and increase aqueous mobility and plant uptake. Undisturbed freshwater concentrations of manganese vary widely, seldom exceeding 100 µg/L, but infrequently ranging to 10,000 µg/L. Highest concentrations of manganese are typically observed during spring runoff (Reimer 1999). Manganese is a common constituent of point and nonpoint discharges from mining and smelting operations, and is often present in elevated concentrations in proximity to these activities (Stubblefield 1997).

Manganese and its compounds reportedly have moderate acute toxicity to aquatic life (Vincoli 1997). Previously, several states have employed a water quality standard of 1,000 µg/L for manganese. However, this standard was apparently based on limited toxicological data and did not take water hardness into consideration. The toxicity of manganese is inversely correlated to water hardness, becoming less toxic with increasing water hardness (Reimer 1999; Stubblefield et al. 1997). Reimer (1999) appears to have completed the most thorough review of manganese acute and chronic toxicities to date, an effort completed in support of establishing ambient water quality criteria for the Province of British Columbia. Reimer's results take hardness into consideration. This analysis will focus primarily on results of testing in soft or moderately soft waters, since this information is most applicable to conditions within the action area.

Exposure of juvenile longfin dace (*Agosia chrysogaster*) to manganese resulted in a 96-hour LC₅₀ of 13,000 µg/L at 224 mg/L CaCO₃ (Lewis 1978). For salmonids, Reimer (1999) identified 96-hour LC₅₀s ranging from a low of 2,400 µg/L (hardness 25 mg CaCO₃) in coho salmon to a high of 4,830 µg/L in rainbow trout (hardness 38 mg CaCO₃). Results for brown trout were intermediate with a 96-hour LC₅₀ of 3,770 µg/L (hardness 34 mg CaCO₃). Aquatic invertebrates appeared to be more sensitive to manganese concentrations, exhibiting 96-hour LC₅₀s of 3,600 and 5,800 µg/L for *H. azteca* and *C. tentans* respectively (hardness 25 mg/L CaCO₃). Although

finding a 48-hour LC₅₀ of 800 µg/L for *D. magna* at 25 mg/L CaCO₃ hardness, Reimer used results from his chronic toxicity studies (summarized below) to theorize that *D. magna* sensitivity to water hardness may have artificially influenced the test result. Reiser calculated an IC₂₅ concentration of 5,300 µg/L that he considered to be a more effective measure of toxicity than either the LOEC or NOEC concentrations.

Chronic toxicity tests on rainbow trout revealed a seven-day early life stage EC₅₀ concentration of 14,600 µg/L (hardness 25mg/L). Because the chronic value actually came out higher than the acute values previously reported, Reimer (1999) suggested that a less sensitive life stage may have been used in the chronic study than the acute study. Because of excessive deaths of *D. magna* at hardness levels of 25mg/L, the author was not able to determine chronic toxicity values in soft water. However, he did calculate IC₂₅ concentrations of 5,400 and 9,400 µg/L at water hardnesses of 100 and 250 mg/L CaCO₃.

According to Vincoli (1997), the concentration of manganese found in fish tissues is expected to be about the same as the average concentration of manganese in the water from which the fish was taken. Although not specifically stating that bioaccumulation of manganese does occur, Reimer (1999) reported higher concentrations of manganese in liver and gill tissue than in muscle tissue.

The EPA has not identified water quality criteria for manganese, nor have they identified any NPDES permit limits for the ICP. However, in their NPDES application, FCC estimates maximum daily effluent concentrations of manganese at 50 µg/L, and average daily concentrations of 0.005 µg/L at the end-of-pipe. At these concentrations, EPA determined that the discharge shows no reasonable potential of violating water quality standards, and a manganese effluent limit was not developed for the ICP. Although no limit has been developed, manganese will be monitored on a monthly basis with the other pollutants to ensure that limits do not exceed acute and chronic toxicity values described above. Both of these concentrations fall well below acute and chronic toxicities reported in this analysis, even before dilution. Therefore, NMFS concludes that levels of manganese from the effluent should not rise to concentrations that will result in direct, indirect, or sublethal effects to ESA-listed salmonids.

Water Quantity/Groundwater: The FCC has applied for water rights to the groundwater from the mines and from two wells. Water would be used initially for drilling and other start-up water needs until the mine pumping and precipitation capture from the TWSF is adequate to supply operating water needs. A groundwater capture system will be set up downgradient from the mines to capture and test groundwater for compliance with surface water quality standards. As proposed, the USFS estimates that the ICP will result in a baseflow reduction in Big Deer Creek of 1%, which will be completely restored post operation (USDA Forest Service 2007).

For salmon and other aquatic organisms, flows determine the amount of available water and space, the types of micro- and macro-habitats, and the seasonal patterns of disturbance to aquatic communities. High flows redistribute sediments in streams, flushing fine sediments from spawning gravels and allow recruitment of gravels to downstream reaches. Extreme high flows are essential for developing and maintaining healthy floodplains, moving and depositing sediment, recharging groundwater aquifers, dispersing vegetation propagules, and recruiting and

transporting LWD (Spence et al. 1996). Low flow conditions can affect rearing juveniles by reducing the amount of refugia available for protection from predators, by elevating water temperatures, reducing the availability of food, and increasing competition for space and food sources (Gregory and Bisson 1997).

Streamflow is also important in facilitating downstream movement of salmonid smolts. Dorn (1989) found that streamflow increases triggered downstream movement of coho salmon in a western Washington stream. Similarly, Spence (1995) also found short-term flow increases are an important stimulus for smolt migration in four populations of coho salmon. Chinook salmon can gradually move downstream over several weeks or months. Thus the normal range of streamflows might be required to maintain normal temporal patterns of migration in a particular basin. Streamflow is also important in determining the rate at which smolts move downstream, although factors influencing the speed of migration remain poorly understood (Spence et al. 1996).

Where water is withdrawn from smaller rivers and streams, seasonal or daily flow fluctuations can adversely affect fish, macroinvertebrates in littoral areas, aquatic macrophytes, and periphyton (Ploskey 1983). Fluctuating water levels can delay spawning migrations, impact breeding condition, reduce salmon spawning area (Beiningen 1976), dewater redds and expose developing embryos, strand fry (CRFC 1979), and delay downstream migration of smolts. The literature suggests that diversions can contribute to low flows and are likely to inhibit or delay salmonid smolt migration. This delay could limit fish survival and reduce potential numbers of returning adults (NPPC 1986).

Surface water quality impacts from the ICP were evaluated through multiple methods and tools, including the DSM, baseline surface water hydrology and chemistry characterization, and a watershed hydrology model (Hydrometrics 2006). The mine dewatering process would alter groundwater flow and is expected to reduce the groundwater inputs into Big Flat and Bucktail Creeks, thereby causing reduction of flow into the South Fork Big Deer and Big Deer Creeks. The changes were modeled using DSM Version 4.0 (Hydrometrics 2006).

The predicted changes from the ICP would be expected to occur only for the duration of the mining operation when active dewatering is taking place (10 to 14 years). The largest alterations of stream flow would occur in Bucktail, South Fork Big Deer, and Big Flat Creeks. Bucktail Creek and Big Flat Creeks are small streams that have probably never provided fish habitat. The South Fork Big Deer Creek is a small stream with steep gradient, likely providing limited resident fish habitat only in the lowest reach. Salmon and steelhead do not occur in any of these streams. The predicted downstream change in Big Deer Creek would be a baseflow reduction of approximately 1% (Table 16).

Table 16. Predicted changes in stream baseflow due to ICP operations (USDA Forest Service 2007).

Stream	% Flow Reduction During Operations
Big Flat Creek	3%
Bucktail Creek	44%
South Fork Big Deer Creek	11%
Big Deer Creek	1%
Panther Creek	0

Mine dewatering would create small decreases in flow in the fish-bearing Big Deer Creek. However, NMFS does not expect a small baseflow reduction of 1% to alter the wetted width or instream habitat characteristics of Big Deer Creek. Therefore, a baseflow reduction of only 1% should not appreciably affect available habitat for anadromous fish in Big Deer Creek.

Effects to water quality could occur as a result of groundwater contamination. In an effort to ensure this does not occur, FCC has installed a network of 29 groundwater monitoring wells around the project site. Fourteen new wells and three replacements will be installed to complete the groundwater monitoring effort. The ICP has outlined a water monitoring plan to address operational and closure assessment of water resources (Telesto 2007). The monitoring plan includes a performance-based approach to compliance assessment. For example, groundwater quality data from select operational monitoring wells to be located downgradient of the mines would be evaluated for compliance. If performance criteria exceed pre-established targets (e.g. if the calculated groundwater load were to result in exceedance of a surface water compliance target), a response action would be required by the mine to reduce the groundwater load to acceptable levels. Post closure groundwater capture wells installed and tested during the initial construction phase will confirm that the system would capture a sufficient amount of groundwater to protect downstream water quality. If testing indicates that bedrock wells could not capture enough of the groundwater metals load, an additional groundwater/surface water capture system consisting of an interception trench or series of wells across Bucktail Creek alluvium would be installed downgradient of the Ram mine. The Bucktail capture system would collect alluvial groundwater and surface water, if necessary. The Bucktail capture system would allow collection of additional groundwater and COCs from the Ram and Sunshine mines, and would allow capture and treatment of additional metal load to ensure that the ICP does not contribute to a net increase in metal loading to the South Fork Big Deer, Big Deer, Panther Creek system. With this groundwater monitoring and response system in place, NMFS does not expect adverse effects to water quality from groundwater contamination to occur.

Riparian Vegetation: Disturbance of riparian vegetation has the potential to result in decreased shade and increased solar radiation, which potentially could further increase water temperatures in the action area. Riparian vegetation will be disturbed in the vicinity of the outfall and cable car crossings alongside Big Deer and Panther Creeks. Elevated water temperatures may adversely affect salmonid physiology, growth, development, alter life history patterns, induce disease, and may exacerbate competitive predator-prey interactions (Spence et al. 1996).

However, the small amount of vegetation disturbed as a result of this project is negligible when considered in context of the stream reach scale, particularly with RHCAs currently classified as “Functioning Appropriately” for both Big Deer Creek and Panther Creek.

2.1.3.2. Effects on Critical Habitat

Critical habitat within the action area has an associated combination of physical and biological features essential for supporting freshwater spawning, rearing, and migration of the ESA-listed salmon and steelhead. The critical habitat elements most likely to be affected by the proposed action include water quantity, water quality (sediment and chemical contamination), riparian vegetation, substrate/spawning gravel, forage/food, and safe fish passage. Impacts to these critical habitat elements are likely to impact the action area’s ability to provide for successful spawning, rearing, and/or migration. The effects of the proposed action on these features are summarized as a subset of the habitat-related effects that were discussed above.

Water quantity – Withdrawal of water from the Big Deer Creek watershed will potentially affect the water quantity PCE for rearing juvenile steelhead and Chinook salmon. However, as previously stated, baseflow reductions of only 1% are expected to occur Big Deer Creek, an amount not likely to appreciably diminish the conservation value of affected critical habitats downstream.

Water quality – Chemical contamination and turbidity have the potential to affect the water quality PCE for freshwater migration, spawning, and/or rearing habitat. Effects to water quality could occur: (1) when construction equipment is working within or adjacent to the stream channel; (2) should a spill occur in the transportation corridor; (3) as a result of effluent discharge; or (4) through groundwater contamination.

As previously discussed, construction equipment operating in the vicinity of action area streams will result in a temporary minor degradation of water quality through the introduction of fine sediment and associated increased turbidity. Increased turbidity generated as a result of the cable car installation is expected to be short-lived and highly localized due to the short work window, construction occurring outside the active channel, and low flow conditions during the construction period. Sediment control measures proposed are expected to effectively minimize sediment delivery from these activities. However, BMPs are not well described for the installation of the pipeline on Big Deer Creek or the removal of the two culverts on North Fork Williams Creek. The proposed action does not describe dewatering the work areas when removing the culverts or trenching within the active channel. Although sediment suspended as a result of these activities is expected to settle out long before reaching critical habitat downstream, additional BMPs are necessary to ensure that critical habitat is not further degraded by the pipeline installation. Although degradation will occur in the reach immediately downstream of the proposed action, this amount is not likely to appreciably diminish the conservation value of designated critical habitat at the 5th field HUC.

There is also a potential for temporary toxic chemical contamination, primarily from petroleum based fuels and lubricants. As previously stated species effects section, it's unclear in the proposed action if equipment used on this project will be clean and free of fuel and lubricant leaks, or whether the equipment will be inspected prior to beginning and during this work. It's also unclear what provisions will be in place regarding the fueling and maintenance of equipment in RHCAs. Additional fuel spill and equipment leak contingencies and preventions will be necessary to effectively minimize the risk of negative impacts to fish habitat from toxic contamination. Any degradation would occur in the immediate vicinity of the proposed action, and not in amounts likely to appreciably diminish the conservation value of designated critical habitat at the 5th field HUC.

Road construction, reconstruction, use, road maintenance will all generate sediment and increase the potential for surface runoff and turbidity. Turbidity levels may periodically spike in the project area during and immediately following rain events. However, the majority of these roads are already in existence and actively contributing sediment to action area waterbodies. Efforts to resurface the road, improve drainage, obliterate existing roads, and elevate the road above the floodplain should work to reduce effects from the haul road over its existing condition (based on modeling effort previously described). NMFS believes that the road upgrades proposed and the conservation measures described should be adequate to keep turbidity and erosion to levels to a minimum. However, to best minimize sediment delivery to action area streams, completion of all road upgrades in environmentally sensitive areas, in road segments bordering streams, and along road segments draining directly to streams should be completed in the first phase of project implementation. Although degradation will occur in reaches bordering roadwork, the amount is not likely to appreciably diminish the conservation value of designated critical habitat at the 5th field HUC.

Water quality could also be affected by an accidental spill of toxic materials as they're being transported to the site, or through an on-site spill and subsequent discharge into nearby waterbodies. Depending upon the location, an accidental spill of fuels or toxic materials could adversely affect the water quality in salmon and steelhead spawning, rearing, or migratory habitat. Many materials hauled to the site will result in acutely toxic concentrations of chemicals, with the magnitude, duration, and extent of exposure varying with the chemical spilled, whether it's a bulk or liquid, if it's delivered to a stream, the size of the receiving waterbody, etc. The speed of the response and effectiveness of the clean-up activities will also determine the duration of effect to water quality. Considering proper application of the proposed spill avoidance measures and spill control plan, NMFS does not expect an accidental spill to occur as a result of the project.

Water quality in Big Deer Creek and possibly lower Panther Creek could also be affected by chemical contamination from the effluent outfall. Each potential pollutant and their potential effect to fish and fish habitat were described in detail in the previous section. Except for excess levels of nitrate, effluent meeting levels established in the NPDES permit should ensure that water quality is protected in Big Deer and Panther Creeks. Degradation will occur in lower Big Deer Creek, but these amounts are not likely to appreciably diminish the conservation value of designated critical habitat at the 5th field HUC.

Substrate/Spawning Gravel – As previously discussed, construction equipment and roadwork is expected to result in increased sediment delivery to action area streams. Suspended sediments generated by the project are expected to settle out and be deposited within 300 feet of the point of introduction. Sediment related effects are most likely to be realized to steelhead along Williams Creek, or Chinook salmon and/or steelhead from roadwork along Deep Creek, Panther Creek, or Blackbird Creek. The amount of suspended sediment is not expected to be substantial, and the proposed roadwork could actually result in an improvement over existing condition. Sediment control measures are expected to effectively limit the amount of sediment delivered from project-related activities.

However, as previously described, BMPs are not well described for the installation of the pipeline on Big Deer Creek. The proposed action does not describe dewatering the work area when trenching within the active channel. Sediment suspended as a result of this activity is expected to settle out long before reaching critical habitat downstream. However, this stream segment is already on the 303(d) list for sediment, with additional sediment potentially further degrading this PCE. Additional BMPs will be necessary to ensure that no long-term effects to substrate or spawning gravel quality occur.

Riparian Vegetation (spring/summer Chinook salmon) – A small-scale alteration of streamside vegetation will occur along Panther Creek from installation of the cable car crossing. Riparian vegetation will also be altered along Big Deer Creek from the installation of the outfall, but will not be considered further in this analysis due to the very small amount of vegetation disturbed and that it occurs upstream from the impassable waterfall, approximately 2.3 miles upstream from the nearest Chinook salmon rearing habitat. Although not specified in the BA, review of the plans, the small size of the structures, and the description of this particular action suggest that the disturbance of riparian vegetation for installation of the cable car will not likely exceed 25- to 30-feet in length on either side of Panther Creek. The localized removal of this small amount of riparian vegetation should not alter riparian functions and processes in this segment of Panther Creek. Consequently, the effects of riparian vegetation alteration should be negligible when considered in the context of the stream reach and/or watershed.

Forage/Food – Chemical contamination resulting from an accidental spill or through effluent discharge has the potential to affect the forage/food PCE for juvenile salmon or steelhead. Mortality of aquatic invertebrates from a spill of toxic materials would be dependent upon the type and amount of material spilled. Since toxicity is expected to attenuate in a downstream direction, mortality from a spill is not likely to extend more than a mile or two downstream. As discussed in the previous section, concentrations of pollutants from the effluent are not expected to rise to a level acutely toxic to aquatic invertebrates in Big Deer Creek. However, as discussed above, it's less certain that pollutants will not reach levels chronically toxic to aquatic invertebrates. It's also not certain to what extent various pollutants might affect community assemblage or bioaccumulate in the prey base, indirectly affecting fish survival and growth downstream.

Safe Passage – Although no physical barriers will be constructed as a result of the project, migratory fish passage could be affected through chemical contamination resulting from an

accidental spill or effluent discharge. Because spills are not expected to occur, and effluent discharged into Big Deer Creek is expected to be within the limits established in the NPDES permit, fish passage is not expected to be affected by the project.

2.1.3.3. Cumulative Effects

‘Cumulative effects’ are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Cumulative effects that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

Between April 1, 2000, and July 1, 2006, the population of Lemhi County increased by 1.6%⁶. Thus, NMFS assumes that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. However, because the SCNF administers approximately 93% of the area in the Panther Creek watershed, the effects of new development caused by that demand are not likely to reduce the conservation value of the habitat within the action area. Any actions taking place on the SCNF would correspondingly be subject to section 7 consultation and would not be considered cumulative effects.

The SCNF identified no specific private or state actions that are reasonably certain to occur in the future that would affect anadromous fish or their habitat within the action area. Similarly, NMFS is not aware of any specific future non-Federal activities within the action area that would cause greater effects to a listed species or a designated critical habitat than presently occurs. Therefore, for purposes of this analysis, NMFS assumes that private and state actions will continue to have impacts on habitat at the same level as that reflected in the environmental baseline.

2.1.4. Conclusion

After reviewing the status of Snake River spring/summer Chinook salmon, Snake River Basin steelhead, their designated critical habitats, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the affected species and is not likely to destroy or adversely modify designated critical habitats for those species. These conclusions are based on the following considerations.

⁶ U.S. Census Bureau, State and County Quickfacts, Lemhi County.
Available at <http://quickfacts.census.gov/qfd/states/16/16059.html>

In spite of some uncertainties, the likelihood of jeopardizing listed salmon or steelhead through harm from sublethal effects or outright mortality is highly improbable due to the following circumstances:

1. Transportation spills of toxic substances have a low likelihood of occurring along the transportation corridor. Conservation measures designed to avoid the risk of accident and spill, combined with the application of the proposed SPCC plan should effectively avoid or minimize the risk of spill.
2. NPDES permit levels identified for the effluent of this project generally protect aquatic biota from acute toxicities. The WET testing required as a condition of the NPDES permit should ensure that chronic toxicity levels do not occur to aquatic biota.⁷
3. With the majority of work occurring outside the active channel, and only two crossings of Panther Creek proposed, it's not expected that any fish will be killed by crushing during project implementation,
4. Turbidity and sediment deposition are expected to be temporary and effectively minimized. Turbidity generated is expected to be in the form of temporary pulses, settling out within 300 feet of the disturbance, and not expected to extend across entire channels. In addition, road obliteration, surfacing, and drainage improvements are expected to reduce sediment delivery over baseline conditions.
5. Some fish could potentially be exposed to stress from temporary water quality degradation and fish displacement due to noise and construction activity. Any stress experienced by those fish is likely to be brief. Additionally, most juveniles will be large enough to move to less turbid adjacent habitats and avoid possible negative effects.
6. In spite of the specific uncertainties mentioned above, the proposed action contains measures sufficient to avoid appreciably diminish VSP parameters, especially abundance/productivity. This is true at the population level, and should therefore not diminish the likelihood of the survival and recovery of the species at the MPG or ESU-scales.

The destruction or adverse modification of critical habitat is unlikely due to the following circumstances:

1. Construction related BMPs should effectively minimize the disturbance of instream habitat and riparian vegetation. Turbidity and sediment deposition are expected to be temporary and effectively minimized. Reseeding areas disturbed by ground disturbing activities with native species should ensure that long-term effects are avoided.

⁷ The conclusions for toxics included in this biologic opinion are based on site-specific conditions including, among other things, the lack of mixing zones (except for sulfate), dilution factors, and the distance between the outfall and the nearest ESA listed fish. Because this analysis is specific to the ICP, it cannot be relied upon to determine the effects of toxics in other areas or circumstances.

2. Any significant chemical contamination is likely to be quickly discovered and addressed through proposed water quality monitoring efforts.
3. Chemical contamination is not expected to occur. Concentrations are not likely to reach acutely toxic levels, nor are they likely to reach chronically toxic levels that could alter the biological community in a manner that would appreciably alter PCEs of proposed or designated critical habitat at spatial and temporal scales relevant to conservation of the species.

2.1.5. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The following recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the action agencies:

1. The SCNF should accelerate the environmentally sound replacement of the Shoup Bridge spanning the Salmon River and enlarge it from single lane to double lane to reduce the risk of collisions and accidental spills of heavy metals, acids, or other toxic materials into the Salmon River.
2. EPA should complete the Blackbird Mine cleanup remedial actions.
3. The EPA should work to establish a water quality criterion for protection of cold-water biota for nitrates.

Please notify NMFS if the action agencies carry out any of these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit listed species or their designated critical habitats.

2.1.6. Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the Opinion; or (d) if a new species is listed or critical habitat is designated that may be affected by the identified action (50 CFR 402.16).

In the proposed action it was noted that the production life of the ICP may be extended beyond the currently proposed mine and mill life schedule. However, this effects analysis cannot consider an unspecified expansion of the project footprint or extension of the life span of the operation. Any expansion of the mine or extension of its lifespan could result in effects not considered in this Opinion. Therefore, NMFS must be contacted prior to any expansion or extension in order to evaluate whether reinitiation is warranted.

To reinitiate consultation, contact the Idaho State Habitat Office of NMFS and refer to NMFS Number assigned to this consultation.

2.2. Incidental Take Statement

Section 9(a)(1) of the ESA prohibits the taking of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend the prohibition to threatened species. Among other things, an action that harasses, wounds, or kills an individual of a listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o)(2) exempts any taking that meets the terms and conditions of a written incidental take statement from the taking prohibition.

2.2.1. Amount or Extent of Take

Adult and juvenile Snake River spring/summer Chinook salmon and steelhead are likely to be present in the action area during implementation/operation of the Project and thus exposed to adverse effects. Because these effects may injure or kill individuals of these ESA-listed species, or may increase the likelihood that exposed individuals will be injured or killed, take is reasonably certain to occur.

Construction activity will occur alongside and in streams occupied by ESA-listed species. These actions will cause increases in turbidity and sediment in areas with high conservation value for the affected species. As previously described, elevated levels of turbidity or sediment deposition may cause take by affecting fish behavior or through degradation of spawning/rearing habitat. Generally speaking, the amount of take would increase with an increase in turbidity and sediment deposition. Take caused by temporary reduced habitat conditions cannot be accurately quantified as a number of fish. This is because the relationship between habitat-related effects and the distribution and abundance of fish in the action area is not precisely known, and no specific number of individuals can be predicted. In such circumstances, NMFS uses the causal link established between the activity and a change in habitat conditions affecting the species to describe the extent of take as a quantified indicator of habitat perturbation. The consequence of these effects will be temporary, minor reductions in water quality that will cause most fish to avoid the treatment area, as measured by turbidity plumes extending from 50 feet upstream to 300 feet downstream of each disturbance. Based on the project description and the known

distributions of ESA-listed anadromous fish, NMFS anticipates sediment-related take to occur only in lower Williams Creek, lower Deep Creek, Blackbird Creek, and Panther Creek, from Blackbird Creek downstream to Deep Creek.

Similarly, the total number of fish likely to be harmed or killed by pollutant spill or discharge cannot be quantified. Take could occur in the unlikely event of a transportation-related spill of chemicals or fuel along the transportation route. However, mortality associated with a toxic spill will be highly dependent upon the toxicity of the pollutant spilled, the stability of the container it's enclosed in, whether it's liquid or dry, whether it makes it into a waterbody, and what fish and life stages are present should a spill occur. This uncertainty is confounded by the fact that the number of fish in the action area, and the location of those individual fish when effects occur will vary throughout the duration of the project. Because pollutant spills are not expected to occur, NMFS does not anticipate take from a pollutant spill, and therefore does not authorize take for any spill of a pollutant in this Opinion.

NMFS also does not expect any lethal take of ESA-listed salmonids as a result of effluent discharge provided limits established by the NPDES permit are met. Therefore, NMFS does not authorize lethal take associated with pollutant levels exceeding NPDES maximum daily or average monthly limits, or from exceeding EPA's acute or chronic water quality criteria. However, based on the effects analysis above, it is likely that harm could occur to ESA-listed fish or their prey base from effluent discharges. This harm could occur in the form of bioaccumulation in fish tissues. Because neither steelhead or Chinook salmon are believed to spawn in Big Deer Creek, harm would only be expected to occur to juvenile salmonids. However, because EPA's chronic water quality criteria are set at levels intended to avoid chronic effects, harm from bioaccumulation of metals and other pollutants should not occur. Therefore, any measureable bioaccumulation of metals or other pollutants in fish tissues will indicate the amount of take authorized has been exceeded.

The extent of affected habitat exceeding that described for the Projects' activities, a pollutant spill, and/or any bioaccumulation of metals/pollutants from the effluent are the thresholds for reinitiating consultation. Should any of these limits be exceeded during Project activities, the reinitiation provisions of this Opinion will apply.

2.2.2. Reasonable and Prudent Measures

The RPMs are nondiscretionary measures to avoid or minimize take that must be carried out by cooperators for the exemption in section 7(o)(2) to apply. The USFS and EPA have the continuing duty to regulate the activities covered in this incidental take statement where discretionary Federal involvement or control over the action has been retained or is authorized by law. The protective coverage of section 7(o)(2) will lapse if the USFS or EPA fails to exercise their discretion to require adherence to terms and conditions of the incidental take statement, or to exercise that discretion as necessary to retain the oversight to ensure compliance with these terms and conditions. Similarly, if any applicant fails to act in accordance with the terms and conditions of the incidental take statement, protective coverage will lapse.

NMFS believes that full application of conservation measures included as part of the proposed action, together with use of the RPMs and terms and conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of listed species due to completion of the proposed action.

The SCNF and EPA shall:

1. Minimize incidental take from construction related activities (SCNF).
2. Minimize incidental take from water quality related effects (SCNF and EPA).
3. Ensure completion of a monitoring and reporting program to confirm that the Terms and Conditions in this Incidental Take Statement are effective in avoiding and minimizing incidental take from permitted activities. Ensure completion of monitoring and reporting sufficient to determine the amount and/or extent of take described in this Opinion is not exceeded (SCNF and EPA).

2.2.3. Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the SCNF, EPA, and their cooperators, including the applicant, if any, must fully comply with conservation measures described as part of the proposed action and the following terms and conditions that implement the RPMs described above. Partial compliance with these terms and conditions may invalidate this take exemption, result in more take than anticipated, and lead NMFS to a different conclusion regarding whether the proposed action will result in jeopardy or the destruction or adverse modification of designated critical habitats.

1. To implement RPM #1, minimizing incidental take from construction related activities, the SCNF shall ensure that:
 - a. Prior to beginning work, all contractors working on-site shall be provided with a complete list of proposed BMPs, RPMs, and terms and conditions intended to minimize the amount and extent of take resulting from riparian disturbance and general construction activities.
 - b. Confine construction impacts to the minimum area necessary to complete the Project, particularly where project activities affect riparian vegetation.
 - c. Activity in the stream shall be kept to the minimum necessary. Equipment shall be moved to an upland location at least 150 feet from the water prior to refueling, repair, or maintenance.

- d. Equipment will work from the streambank during installation of the effluent pipeline. Use work area isolation methods (complete or partial) and sediment containment measures (i.e. SedimatTM, straw bales, silt fence) to reduce the amount of sediment transported downstream during construction.
- e. Project design criteria and BMPs associated with the culvert removal on North Fork Williams Creek will be submitted to NMFS for review and approval prior to beginning road reconstruction efforts on the Williams Creek Road.
- f. At a minimum, culvert removal shall be conducted in accordance with project design criteria and BMPs established in NMFS R1/R4 Stream Crossing Structure Replacement and Removal Programmatic Biological Opinion (NMFS No. P/NWR/2005/06396). http://bluefin2.nmfs.noaa.gov/pls/pcts-pub/sxn7.pcts_upload.download?p_file=F18879/200506396_culvert_programmatic_08-08-2006.pdf
- g. Ensure an adequate supply of sediment control materials (e.g., SedimatTM, silt fence, straw bales, etc.) is available on-site to address emergency situations should they arise.
- h. Visual turbidity monitoring will be completed during construction of the effluent pipeline, construction of the cable car, and during road construction activities by observing any sediment plumes that might be caused by project activities. If the sediment plumes are visible more than 300 feet downstream, the USFS shall immediately notify NMFS to determine if reinitiation of consultation is necessary.
- i. Specific to the culvert removal action on North Fork Williams Creek, a Fisheries Biologist or Hydrologist will monitor turbidity levels downstream from construction activities to ensure that levels do not exceed State standards of 50 nephelometric turbidity units (NTUs) above baseline (instantaneous), or > 25 NTUs above baseline (chronic). If available, a NMFS representative shall be present on-site during dewatering and re-watering of the North Fork.
- j. Toxic materials do not enter live water during construction activities. Equipment used in construction of the cable car crossing on Panther Creek and the construction of the NPDES outfall on Big Deer Creek shall be clean and free of fuel and lubricant leaks prior to beginning work, and shall be inspected daily once beginning work.
- k. Prior to and during the equipment crossing of Panther Creek for the cable car installation, a fish biologist shall be present on-site. The fish biologist shall walk alongside the stream and look for adult steelhead and/or steelhead redds within 350 feet of the construction site. If either adult or redd are observed, activity will cease until the fish biologist has coordinated with NMFS to determine the best approach to proceed while avoiding effects to adult steelhead and/or their redds.

- I. As outlined in Section 1.2.15 of this Opinion, NMFS shall participate on the Interagency Oversight Task Force to assist with oversight of the ICP. NMFS shall review and provide input where appropriate to all project design reports, documents, and annual reports. At a minimum, as an active member of this group, NMFS expects to be able to review and provide input to the following elements described in the proposed action:
 - i. The engineering design for the water treatment system;
 - ii. Final design of the TWSE;
 - iii. Final road construction/reconstruction plan;
 - iv. Final stormwater pollution prevention plan;
 - v. Final geochemical amendment plan;
 - vi. Final design for the outfall diffuser;
 - vii. Post-mining groundwater/surface water capture plan;
 - viii. Weed control plan;
 - ix. Wetland monitoring plan;
 - x. Copper loading demonstration plan;
 - xi. Methylmercury study plan and report; and,
 - xii. Final reclamation and closure plan.
2. To implement RPM #2, minimizing incidental take from effects to water quality:
 - a. The EPA shall modify the draft NPDES permit to limit the effluents maximum daily concentration for levels of nitrate + nitrite to <10 mg/L at the end-of-pipe to prevent nutrient enrichment of habitat in Big Deer and Panther Creeks.
 - b. The SCNF shall work with the applicant to prioritize, schedule, and complete road reconstruction/improvements to ensure that all road segments with environmental or safety concerns are addressed in Phase I. This includes all road segments in RHCAs or draining directly into perennial or intermittent streams. The SCNF will work with the Interagency Oversight Task Force to identify and prioritize the road segments of concern.

- c. The SCNF shall ensure that an appropriate native seed mix is used to mulch and seed all cuts and fills of roads, and disturbed areas from road maintenance. As described in the Mitigations section of the ICP DEIS (page 2-55), Item 3/c), disturbed areas will be treated during the same years as the construction/ disturbance activity. If vegetation is not adequately established for erosion control the mulch and seed will be applied in subsequent years until natural vegetation is established.
- d. The SCNF shall require the FCC implement the following process (Table 17) to screen new reagents/formulas before changing the manufacturer, the formula, or adding a chemical not considered in the BA.
 - i. **Toxicity** - If the new material is considered highly or very highly toxic with a 96 hr $LC_{50} < 1,000 \mu\text{g/L}$ for fish species or aquatic invertebrates the material needs to be carefully reviewed regardless of accident probability or spill risk. If the toxicity of the proposed new material is below this threshold then the spill risk and accident probability need to be considered and evaluated in coordination with NMFS.
 - ii. **Screen for Probability of Accident** – If the accident probability as described in the BA indicates that accidents near a stream are not likely to occur in more than 100 years (equates to < 59 trips/year), and toxicity is rated Moderate or lower, then no additional analysis will be required regardless of spill risk. However, if the accident rate predicts that accidents near a stream would occur in less than 100 years (>59 trips/year), toxicity is rated Moderate or High, and spill risk is rated High, additional analysis will need to be completed in coordination with NMFS.

Table 17. Screen to identify when additional toxic effects analysis is needed.

# of Trips/ year (accident probability near streams)	Spill Risk	Toxicity	Coordination Needed?
Any	Any	very highly toxic or highly toxic (Fish 96 hr $LC_{50} < 1,000 \mu\text{g/L}$)	Additional Analysis and Coordination with NMFS Necessary.
>59 (less than 100 yrs between accidents)	High or Moderate	moderately toxic (Fish 96 hr $LC_{50} < 10,000 \mu\text{g/L}$)	Additional Analysis and Coordination with NMFS Necessary.
<59 (more than 100 yrs between accidents)	Low, Moderate, or High	moderately toxic, slightly toxic, not acutely toxic	No Coordination with NMFS Necessary.

The risk of a material spill happening in case of an accident is determined based on the material packaging. Containerized solid = **Low Risk**, Containerized liquids in small containers (<100 gallons) = **Moderate Risk**, Bulk liquids = **High Risk**.

3. To implement RPM #3, monitoring and reporting:
- a. The SCNF shall monitor and report compliance with the project's proposed effects minimization measures. Ensure completion of a monitoring and reporting program to confirm that the amount and/or extent of take anticipated in this Opinion is not exceeded and that the project is implemented as proposed.
 - i. Annually report on the compliance with and implementation of the RPMs and Terms and Conditions.
 - ii. Adhere to the proposed monitoring as described in the ICP BA, ROD, and Supplemental Reports.
 - b. The EPA shall work with FCC to develop a tissue sampling protocol and sampling scheme for salmonids in Big Deer Creek. The protocol and sampling scheme must be approved by NMFS prior to first effluent discharge. A baseline study shall be conducted prior to first effluent discharge, and annually for 3 years following, conduct tissue sampling of non-ESA listed resident salmonids in Big Deer Creek collected downstream from effluent and upstream from the falls for:
 - i. Bioaccumulation of aluminum, arsenic, cadmium, cobalt, lead, manganese, mercury, nickel, selenium, thallium, and zinc;

Measureable bioaccumulation of these metals and pollutants will indicate the amount of take authorized has been exceeded. If resident fish are not collected in numbers suitable for tissue sampling purposes, coordinate with NMFS to develop an alternative sampling protocol.
 - c. The EPA shall work with FCC to develop an aquatic invertebrate sampling scheme and protocol in Big Deer Creek. The protocol and sampling scheme must be approved by NMFS prior to first effluent discharge. Prior to first effluent discharge, and annually for 3 years following, conduct sampling of aquatic invertebrates in Big Deer Creek to assess the potential for bioaccumulation of pollutants and/or changes in community structure. Measureable bioaccumulation of metals/pollutants identified in Term and Condition 3.b.i. and/or changes in community structure will indicate the amount of take authorized has been exceeded.
 - d. The SCNF and EPA will annually report monitoring results as described in the ICP BA, ROD, Supplemental Reports, and this Opinion. The report shall identify in separate sections: (1) any results indicating adverse habitat modification or other adverse effects of the action on spring/summer Chinook salmon, steelhead, or sockeye salmon; (2) persistence of adverse conditions that could be improved through modification of the proposed action, or through additional actions; and

(3) recommended remedies to address the problems identified in items 1 and 2. NMFS shall work with the SCNF and EPA to determine any corrective actions, which the applicant must implement.

- e. The SCNF and EPA shall submit reports and annual monitoring results noted in the BA, ROD, Supplemental Reports, and this Opinion to: NMFS, Attn: David Mabe, 10095 W Emerald, Boise, Idaho 83704.
- f. NOTICE: If a sick, injured or dead specimen of a threatened or endangered species is found in the project area, the finder must notify NMFS through the contact person identified in the transmittal letter for this Opinion, or through Idaho State Habitat Office of NMFS Law Enforcement at (208) 321-2956, and follow any instructions. If the proposed action may worsen the fish's condition before NMFS can be contacted, the finder should attempt to move the fish to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead, or dies while being captured or moved, report the following information: (1) NMFS consultation number; (2) the date, time, and location of discovery; (3) a brief description of circumstances and any information that may show the cause of death; and (4) photographs of the fish and where it was found. NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

3. MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook salmon.

Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for Snake River spring/summer Chinook salmon:

1. Localized effects to instream habitat – increased turbidity, sediment deposition, and/or riparian disturbance/streambank alteration, as described in Sections 2.1.3.1 and 2.1.3.2 of this Opinion;
2. Localized effects to water quality – increased chemical contamination, as described in Sections 2.1.3.1 and 2.1.3.2 of this Opinion.

3.1. EFH Conservation Recommendations

NMFS believes that the following two conservation measures are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. NMFS believes that RPMs 1 and 2 of this Opinion and their implementing terms and conditions are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. These conservation recommendations are a non-identical subset of the ESA RPMs and Terms and Conditions.

3.2. Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations [50 CFR 600.920(j)(1)]. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse effects of the activity on EFH. If the response is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations. The reasons must include the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

3.3. Supplemental Consultation

The USFS and EPA must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(k)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act [DQA]) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

This ESA consultation concludes that the proposed approval of FCC's POO for the ICP and the EPA's issuance of an NPDES permit for discharging treated mine wastewater into Big Deer Creek will not jeopardize the affected listed species. Therefore, the SCNF can authorize this action in accordance with its authority under the General Mining Law of 1872 and FLPMA. The EPA can authorize the wastewater discharge in accordance with its authority under the Clean Water Act. The intended users are the SCNF, EPA, and FCC.

Individual copies were provided to the above-listed entities. This consultation will be posted on NMFS Northwest Region website (<http://www.nwr.noaa.gov>). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq.*, and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

5. LITERATURE CITED

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Appendix A

(Appendix to Appendix F - FEIS)

Figures and Tables

Figure 1: Transportation access route proposed mitigation.

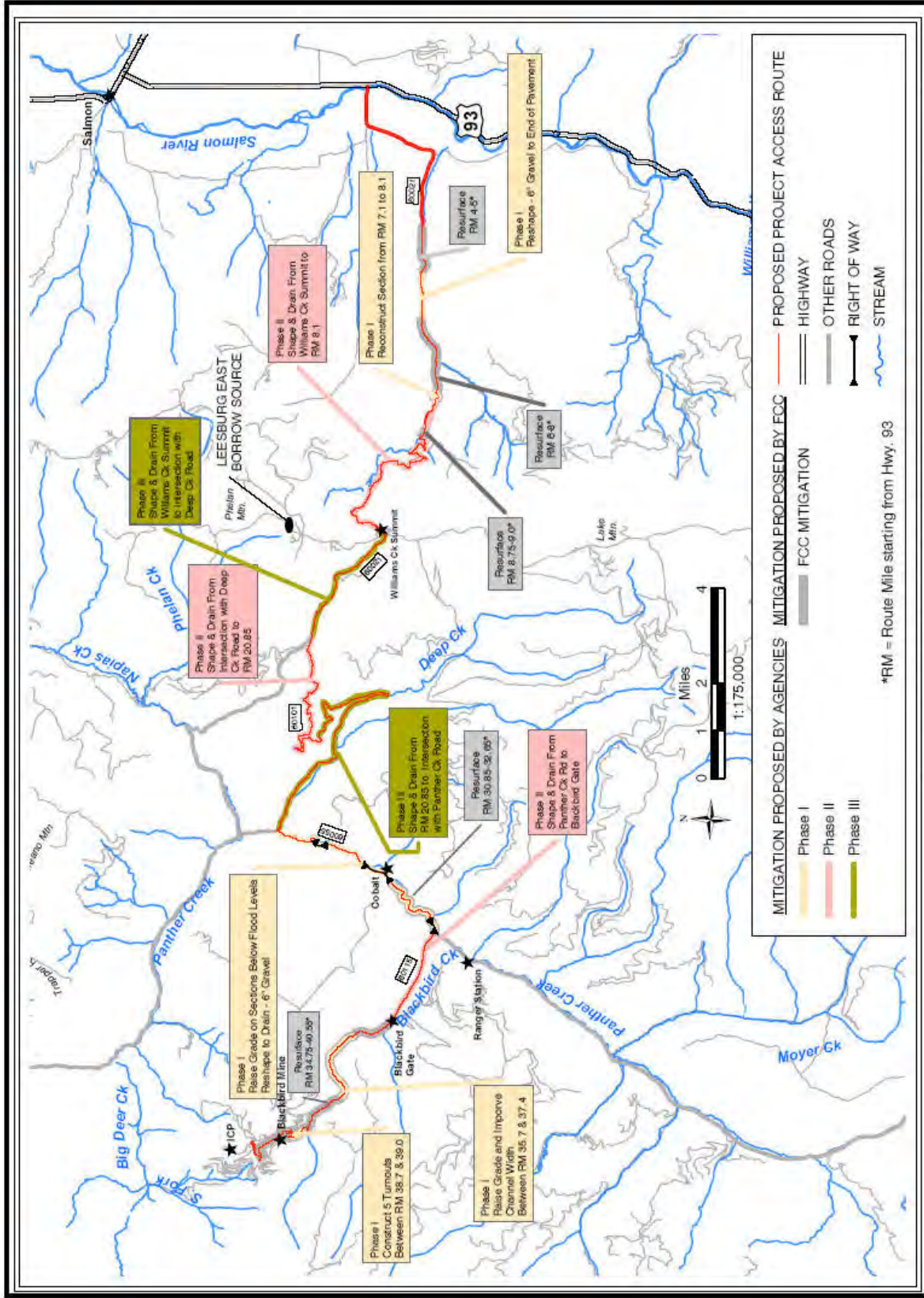
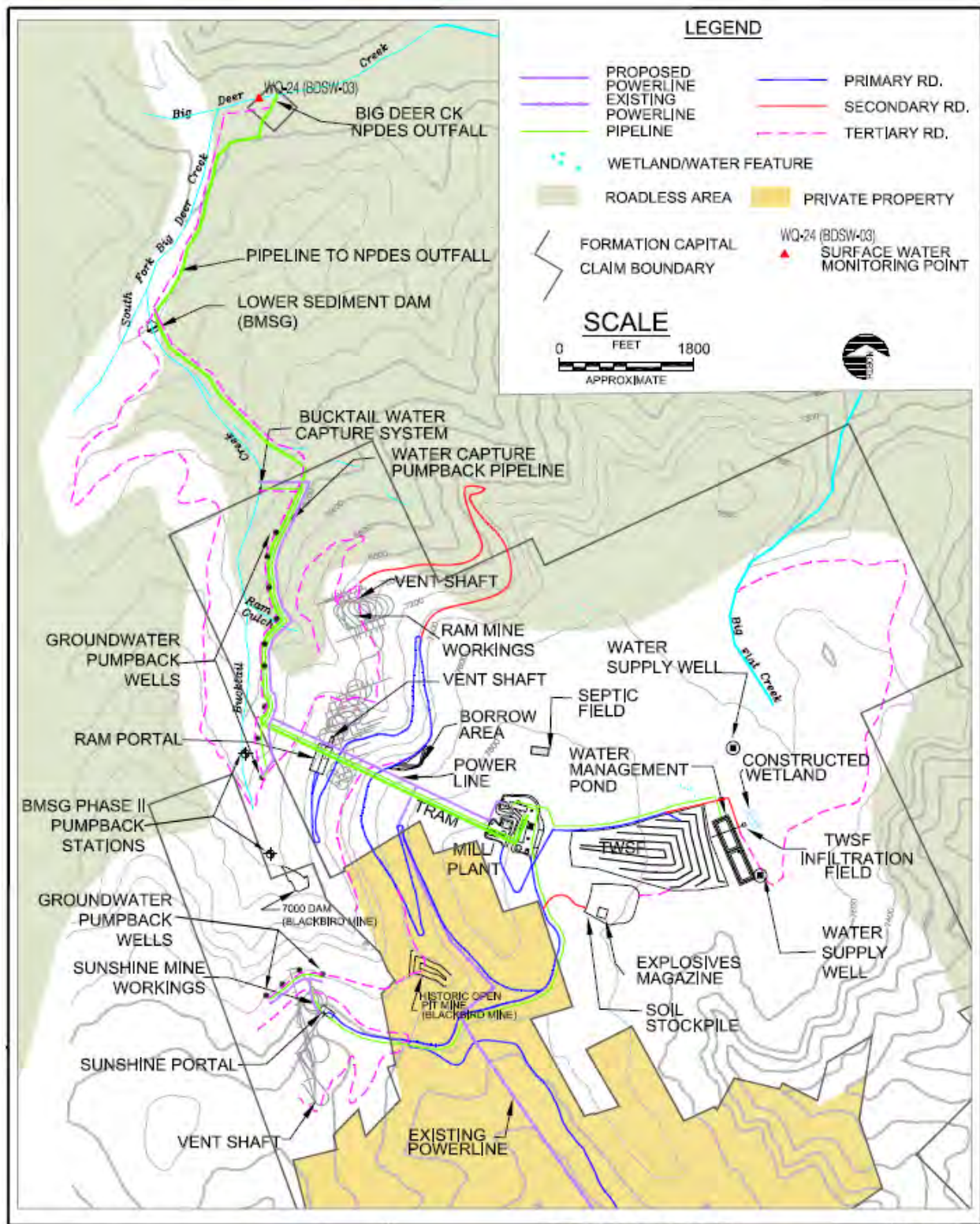


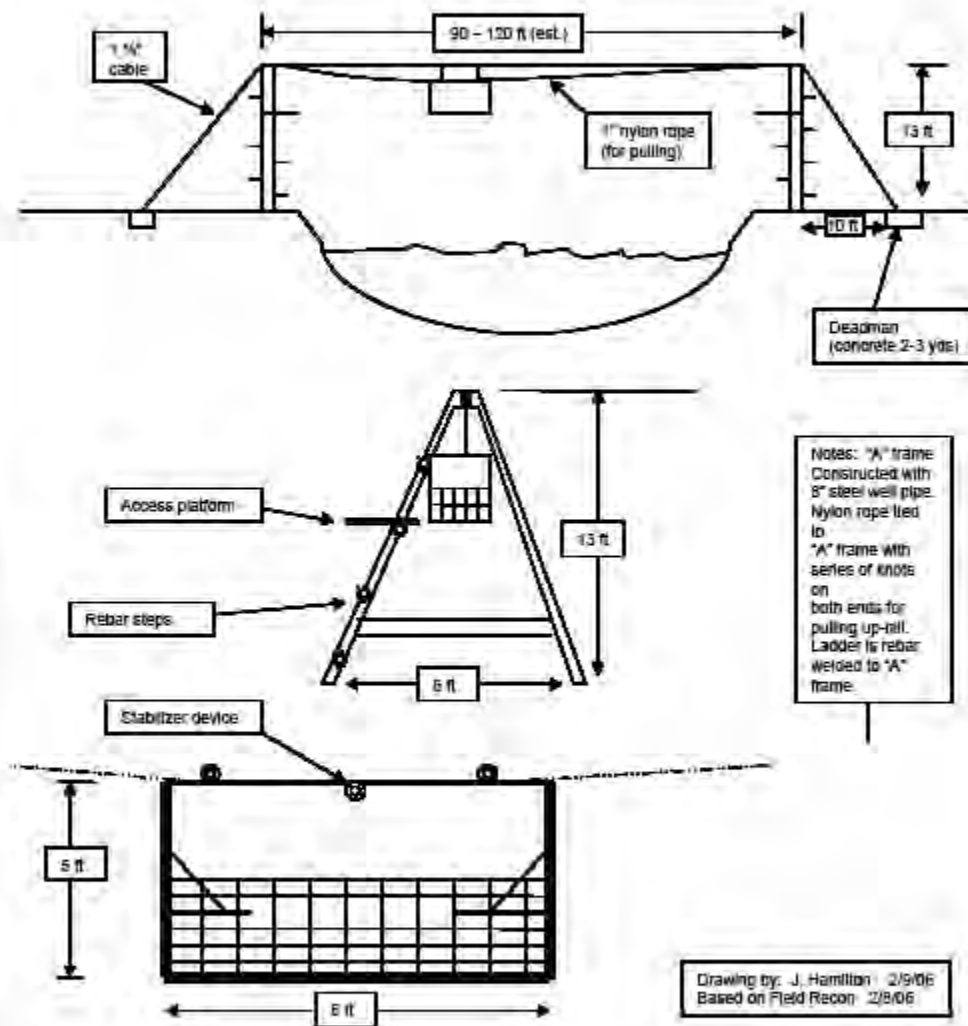
Table 1. Summary of Proposed Route Mitigation by Milepost and Phase.

Phase	Road Segment (Mileposts)		Proposed Mitigation
I	5	6	Reshape - Gravel
	7.1	8.1	Realignment
	27.9	32.6	Reconstruct sections FR 60055 to raise road grade through sections w/in the floodplain. Construct retaining structure on the section at MP 30.6 to protect the fill slope. Shape and drain the subgrade. Place 6-inches gravel between Deep Ck. Road and Blackbird Creek Road (details follow).
	29.07	29.42	Raise grade above floodplain, drain
	29.51	29.63	Raise grade above floodplain, drain
	29.97	30.02	Raise grade above floodplain, drain
	30.02	30.49	Raise grade above floodplain, drain
	30.5	30.5	Improve ditch
	30.6	30.6	Construct retaining structure to protect fill slope
	30.63	30.66	Raise grade to drain
II	35.7	37.4	Raise grade and improve channel width of Blackbird Creek
	38.7	39	Construct five turnouts
	7.1	13.5	Reshape and drain
	11.64	12.45	Reinforce subgrade (geotextile)
III	16.5	20.9	Reshape and drain
	32.6	34.8	Reshape and drain
Additional Proposed Mitigation			
	4	5	Resurface
	6	8	
	8.75	9	
	30.9	32.6	
	34.8	40.6	

Figure 2: Idaho Cobalt Project proposed facility and site road layout.



Project: 222-100, Prepared by: TELESTO, Drawing: 222-100-01, Title: PROPOSED CABLE CROSSING DESIGN NEAR WQ-2, Date: 2/9/06, Scale: 1/8" = 1'-0"



Based on Noranda Cable Crossing on Panther Creek Near Big Deer

PROJECT: 222-100
TAGE: 22
PREPARED BY: TELESTO

FIGURE 3
PROPOSED CABLE CROSSING DESIGN NEAR WQ-2

PREPARED FOR:
Formation

Appendix B

(Appendix to Appendix F - FEIS)

An evaluation of the protectiveness of a site-specific criteria for cobalt in the Panther Creek watershed, Idaho for Chinook Salmon and Steelhead

March 1, 2007

An evaluation of the protectiveness of a site-specific criteria for cobalt in the Panther Creek watershed, Idaho for Chinook Salmon and Steelhead

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Prepared for: National Marine Fisheries Service, Idaho State Habitat Office

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ACRONYMS

ACR	Acute-to-Chronic Ratio
BMSG	Blackbird Mine Site Group
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCV	Fish Chronic Value
HUC	Hydrologic Unit Code
ICV	Invertebrate Chronic Value
IDEQ	Idaho Department of Environmental Quality
LOEC	Lowest-Observed-adverse Effect Concentrations
MATC	Maximum Acceptable Toxicant Concentration
NMFS	National Marine Fisheries Service
NOEC	No-Observed-Effect Concentration
PER	Pacific EcoRisk
USGS	U.S. Geological Survey

Background and Summary

Panther Creek, Idaho (U.S. Geological Survey [USGS] hydrologic unit code [HUC] 17060203) provides habitat for Snake River Basin steelhead and Snake River spring/summer Chinook salmon, “species” listed as threatened under the Endangered Species Act (ESA). Panther Creek receives mine drainage from the Blackbird Mine. The drainage contains elevated concentrations of copper and cobalt, and has been the focus of scientific studies since the early 1990s. Substantive cleanup activities began around 1996, under supervision by the U.S. Environmental Protection Agency (EPA). Because no Idaho water quality standard or Federal recommended criteria existed for cobalt, EPA (2003c) derived a risk based cleanup level for cobalt. Using an ad hoc combination of site-specific and literature data on cobalt toxicity together with an uncertainty factor, a cleanup target of 38 µg/L for cobalt was selected for Panther Creek and portions of a tributary, Big Deer Creek¹. The terms “criteria” or “target” are used here synonyms for benchmark or threshold of safe or low-effect concentrations, and do not attempt to match definitions used in various regulatory or environmental management schemes.

The EPA’s record of decision included the sentence that *“EPA may consider a staged implementation which would allow for further cobalt toxicity analysis and biological testing, to determine if another cleanup level for cobalt is protective”* before requiring costly treatment of cobalt contaminated groundwater (EPA 2003c, at p. 12-7). On October 23, 2003, EPA completed a biological assessment of the effects of the remedial actions at the Blackbird Mine and concluded that their activities “may affect, but are not likely to adversely affect” Snake River Basin steelhead and Snake River spring/summer Chinook salmon. On November 24, 2003, the National Marine Fisheries Service (NMFS) wrote EPA concurring with assessment.

In 2004, further studies were done on the toxicity of cobalt to fish and invertebrate species that were considered representative of the Panther Creek aquatic community under representative test conditions. Rainbow trout, mottled sculpin, two mayflies, a caddisfly, and a midge were tested. The rainbow trout was considered a surrogate for the ESA-listed salmonid species. Based upon the results of the studies, EPA determined that the data supported approximately doubling the cobalt cleanup target from 38 µg/L to 86 µg/L. On November 6, 2006, EPA wrote to NMFS and the U.S. Fish and Wildlife Service, and requested concurrence with their determination that, as modified by the higher cobalt cleanup target, the remedial actions still “may affect, but are not likely to adversely affect” listed salmonids.

I have participated in and reviewed (1) earlier cobalt toxicity studies, (2) the evaluation used to develop the original 38 µg/L cobalt cleanup target, (3) the study plan and interpretation criteria for the 2004 testing, and (4) the results and interpretations of the 2004 testing. From these experiences, my view is that the 2004 test results represent the best available science on the effects of cobalt on species that are representative of the Panther Creek aquatic community. The EPA’s interpretation of the test results was reasonable and conservative. I recommend concurring that the new cobalt target of 86 µg/L does not change the determination that the

¹ 38 micrograms per liter (µg/L), or parts-per-billion is equivalent to 0.038 milligrams-per-liter (mg/L) or parts per million.

remedial activities “may affect, but are not likely to adversely affect” listed Snake River Basin steelhead and Chinook salmon. Further, EPA intends to effectively use the 86°µg/L cobalt target as a water quality criteria in a new National Pollution Discharge Elimination System permit for discharges from the proposed Idaho Cobalt Project mine, located near the Blackbird Mine and discharging into Big Deer Creek. Such further application of the cleanup target would be equally supported by the data and would adequately protect listed salmonids.

Important elements of the 2004 cobalt testing program are described in more detail as follows.

Review of Methods and Decision Criteria

Little research into the toxicity of cobalt has been reported, relative to other metals such as copper, zinc, or cadmium. The few data available were difficult to interpret and apply to a watershed such as Panther Creek because of large disparities in the toxicity of cobalt reported with different species or conditions. With some freshwater crustaceans such as amphipods and daphnids, cobalt has been reported to be highly toxic with adverse effects observed at concentrations as low as 5 µg/L (Borgmann et al. 2005; Mebane 1994). In contrast, in 14-day duration tests with rainbow trout in soft-water, cobalt concentrations up to 125 µg/L caused no mortality, although sublethal effects such as reduced growth were not tested (Marr et al. 1998). Fathead minnows could tolerate up to about 290 µg/L before adverse reproductive effects were expected (Mebane 1994, citing Kimball 1978). However, with the exception of one study reporting severe impairment of mayfly development at 32 µg/L cobalt (Sodergren 1976), the tests with effect concentrations below 100 µg/L were otherwise from lentic (lake) species. The EPA (2003b) did not consider lentic species such as *Daphnia* sp. relevant to flowing water ecosystems such as Panther Creek. Instead, they focused on studies conducted on rainbow trout, a species that was likely to occur in Panther Creek and was related to other salmonid species of concern. The EPA’s (2003b) interpretation of available literature on the effects of cobalt on rainbow trout included safety factors or extrapolation factors to attempt to account for shortcomings in existing data, such as extrapolating from a chronic test that apparently used a metals-resistant strain of fish and to extrapolate acute effects to possible chronic effects. This resulted in the initial cleanup target of 38 µg/L.

The EPA’s (2003b) interpretation of a cobalt cleanup target was reasoned, addressed uncertainty conservatively, and considered the best science available to them at the time. However, because of the anticipated costs to meet the 38 µg/L cobalt target and because of the scientific uncertainty in the target, the Blackbird Mine Site Group (BMSG, the responsible parties conducting the cleanup) decided to undertake a series of aquatic toxicity tests on cobalt in Panther Creek water to make a more rigorous assessment of site-specific toxicity to resident fish, anadromous salmonids, and their prey.

Discussions among the BMSG, EPA, Idaho Department of Environmental Quality, and NMFS on study design began in fall 2003, study plans were agreed to in spring 2004 (Stantec 2004), and testing was conducted in summer and fall 2004. The study design had similarities to EPA’s resident species approach to developing site-specific criteria (Carlson et al. 1984; EPA 1994), but was modified to address concerns for ESA-listed salmonids (Table 1).

The cobalt toxicity testing workplan was the result of a cooperative effort to objectively define how test data would be used in advance of the testing. Considerable effort was made by the workgroup participants to both define in advance which tests were to be conducted and how the data would be interpreted. At the time, it was anticipated that these efforts would reduce later disagreements or misunderstandings on data interpretation. The workplan covered all major questions that the authors and reviewers could anticipate in advance of the testing. However, it did not cover every situation, question, or extenuating circumstance that resulted, and best professional judgment was still needed in some points in the project. This was particularly the case in the interpretation of a single, highly influential acute toxicity test with a mayfly.

By law, EPA has primary responsibility for administering the Blackbird Mine remediation. Therefore, the final responsibility and authority for determining cobalt cleanup values in Panther Creek rested with EPA.

Rationale for evaluating direct effects on listed species

Rainbow trout (*Oncorhynchus mykiss*) were selected as the best available single surrogate test species for ESA-listed Snake River Chinook salmon (*O. tshawytscha*), steelhead and bull trout (*Salvelinus confluentus*)². Rainbow trout are the same species as listed Snake River Basin steelhead and are in the same genus as Chinook salmon and family as bull trout. In comparative toxicity testing with cadmium, copper and zinc, rainbow trout have been about as sensitive or were more sensitive than Chinook salmon or bull trout (Chapman 1978; Hansen et al. 2002a; Hansen et al. 2002b). However, inbred strains of cultured test animals or even wild strains may have wide differences in sensitivities to metals. For example, even after normalization to reduce the influence of water quality differences on metals sensitivities, rainbow trout differed in sensitivity by a factor of 6 with cobalt (EPA 2003c), a factor of 20 with copper (EPA 2003a), and a factor of 10 with cadmium (Mebane 2006). As a precaution against the risk conducting an expensive chronic rainbow trout toxicity test with an unrepresentative strain of hatchery rainbow trout, rainbow trout from the same hatchery stock were first tested for resistance to copper, a well tested metal. The assumption was that if the responses of the test trout to copper were intermediate or sensitive in comparison to previous reports, the fish would be similarly responsive to cobalt.

One feature of the data interpretation that was specific to addressing ESA concerns was the use of the no-observed-effect concentration (NOEC) statistic in the decision criteria for the rainbow trout test, rather than less protective conventional endpoints. Typically in EPA's criteria derivation process, the statistical value used to summarize chronic toxicity data and set criteria is the geometric mean of the statistical NOEC and lowest-adverse-effect-concentration (LOEC). In toxicological textbooks and literature (Rand et al. 1995) this value is often referred to as a hypothetical "maximum acceptable toxicant concentration" (MATC). Despite this reassuring

² While this memo focuses on listed anadromous fish, ESA listed bull trout occur in Panther Creek and affected tributaries. Along with the listed anadromous fish, the intent of the work group was for the study design to sufficiently protect bull trout, and the entire aquatic community.

sounding term, when applied to ESA listed or other vulnerable species, this test statistic may not reflect a “maximum acceptable” concentration, since the magnitude of adverse effect may be quite high. Suter et al. (1987) determined that levels of effect associated with the MATC were 20% to 40% reductions in survival or fecundity, and questioned whether these could be considered “acceptable.” Instead, for the present project, the NOEC was used. NOECs are not a perfect statistic either because of the problem that effects that may be biologically important may not be statistically significant if the test design is not robust or if the responses have high variability. For example, Suter et al. (1987) found that the average effect of a NOEC for fecundity in fish corresponded to about a 14% reduction. Conversely, biologically trivial effects could be statistically significant if tests have low variability and lots of replicates. Still, the NOEC is a much more protective statistic than is the MATC and seemed the most suitable test statistic for analyzing rainbow trout responses to cobalt, since rainbow trout were considered the direct surrogate for listed salmonids. The use of the NOEC to estimate a chronic effects value for a listed species is consistent with the national methods manual for conducting biological evaluations under section 7 of the Endangered Species Act, *“For this chronic analysis, each test should be represented by a value that estimates a very low effect level. For most tests, the NOEC will be used as this value that estimates a very low effect level. While the NOEC is not a true “effects” concentration, the NOEC may be the best parameter, for purposes of an ESA Section 7 biological evaluation”* (EPA 2003d).

Rationale for evaluating indirect effects on listed species

“Indirect effects” of an action on listed species include effects on species that interact with listed species, such as prey, predators, or competitors for food or space. Protection against indirect effects is intended to protect the conservation value of the ecosystem, avoid adverse modifications of habitat, and avoid impeding recovery.

The cobalt toxicity study plan was probably sufficient to protect against appreciable adverse indirect effects on aquatic species. In the higher elevation parts of the Panther Creek drainage, the fish assemblage consists almost entirely of salmonids and sculpin. Thus by testing rainbow trout and sculpin, test species representative of the entire fish assemblage were being tested. As Panther Creek drops in elevation and warms, minnow and sucker species become better represented in the assemblage. Previous information on the relative sensitivities of salmonids, sculpin, minnows, and suckers to cobalt and other metals suggested that either sculpins or salmonids were generally most sensitive to metals, and most data for minnows and suckers indicated they were less sensitive (Dillon and Mebane 2002; EPA 2003a; EPA 2003c; Mebane 1994). Thus, minnows and suckers would probably be sufficiently protected if sculpin and salmonids were protected.

The invertebrate testing targeted species that were usually abundant in upper sections of Panther Creek and tributaries that were unaffected by mine effluents and were representative of groups that are important in stream food webs (mayflies, caddisflies, and midges). Caddisflies and midges were well known to be resistant to acute metals toxicity. However, an implicit assumption of this approach is that it is not necessary (or feasible) to test the most sensitive resident invertebrate species, rather what is important is to test representatives from major taxonomic groups.

Extrapolating acute to chronic effects data: the acute-to-chronic ratio (ACR) issue

A conundrum for this project, other consultations and assessments of criteria, and most projects involving ecotoxicology, is that exposures in the stream are likely indefinite and long-term whereas the toxicity tests for most species are mostly conducted for 48 or 96 hours. Acute-to-chronic ratios (ACR) are a simple mathematical approach for extrapolating chronic toxicity test values to untested taxa from tested taxa. As a practical matter, the ACR approach is a necessary tool for estimating standards that are protective of chronic endpoints of untested species. The ACR approach is widely used for several reasons despite its reliance of several implicit, fundamental, and untested assumptions. Reasons for its longstanding use include:

- Conducting direct chronic toxicity tests (e.g. long-term laboratory exposures that are designed to assess endpoints important to the protection of populations and communities) on all species of concern is an impossibility, even at a discrete location. Thus some other estimation techniques are needed;
- Life history and culture requirements of many important species are poorly understood, and techniques for culturing and testing some species in laboratories may be uncertain;
- Present understanding of chronic toxicity mechanisms in response to long-term exposures to metals is inadequate to predict responses of untested (or untestable) species based upon on theoretical relationship.

Thus, the simple, empirical approach of using ACRs is considered a necessary, interim approach for protecting aquatic ecosystems from chronic toxicity until chronic toxicity mechanisms are better understood.

While seldom explicitly described in criteria documents, the rationale for the ACR rests upon several fundamental, implicit assumptions. These include:

1. Mechanisms of acute and chronic metals toxicity are related so that predictions of one as a constant proportion of the other are warranted;
2. Even if mechanisms for acute and chronic toxicity vary, the factors that make metals more or less toxic affect chronic responses in the same manner and at a constant proportion as acute toxicity. In other words, even if acute metals toxicity is due to accumulation on the gill surfaces and chronic toxicity is due to kidney failure, the influences of hardness, pH, and organic carbon may be assumed to act equally in mitigating toxicity.
3. In cases where ACRs are not constant between species, the rank order of acutely sensitive species and chronically sensitive species will generally hold.
4. The ACRs vary mostly as a function of acute sensitivity. Assuming that acute responses to a given metal are more variable than chronic responses, it follows that ACRs vary in a

predictable manner such that tests that provide lower acute LC50s will not yield proportionally lower chronic values.

5. If assumptions numbers 3 and 4 are accepted, it follows that if the acute sensitivities have been tested for a wide variety of species, and if an ACR is derived for the most acutely sensitive (or nearly so) species, then it is unlikely that a acutely less-sensitive species will be chronically more-sensitive than the most acutely-sensitive species.

These implicit assumptions may be internally conflicting, in conflict with current aquatic toxicology theory, and at the least, under tested. In practical applications such as the EPA criteria documents, these assumptions may hold in some cases but not in others. While the assumptions follow patterns sometimes seen in testing, there is little theoretical support for these assumptions, and in some cases these assumptions are known to be false. The questionable scientific bases of ACRs notwithstanding (and because of the limited, practical alternative approaches), ACRs remain a useful way to extrapolate the chronic toxicity to untested species.

Important Statistical Issues

In contrast to the direct surrogate for listed salmonids (rainbow trout), other chronic effect estimates for sculpin and invertebrates were defined less conservatively with the EC20 statistic (Table 1). The EC20 statistic is the concentration causing a 20% reduction in some important biological endpoint, such as survival, growth, emergence, or fecundity. The EC20 value was accepted by a consensus among the cobalt technical advisory group of consulting and agency scientists. No analysis was attempted of why a 20% effect was expected to be acceptable to sculpin populations or sensitive invertebrates. The EC20s have been used in risk assessments and in recent EPA criteria documents as a regression-based substitute that reflects similar magnitudes of adverse effects for the MATC (EPA 1999; EPA 2003a). No biological analyses of the assumed acceptability of 20% adverse effects to stream communities is known of and none was attempted here.

To ensure that the results of the toxicity testing would be representative of Panther Creek waters during the seasons when cobalt is of greatest risk, a large volume of water was pumped from Panther Creek, upstream of mining effluents, and shipped in refrigerated trucks to the Pacific EcoRisk (PER) test facility in Martinez, California (Figure 1). Water was collected during the summer at base flow; unlike copper which is highest in the early spring snowmelt, cobalt concentrations tend to be higher and thus of most concern at base flows. Native invertebrates were collected from Panther Creek, identified and sorted on site (Figure 2), and shipped by air to the PER facility for testing. Because little information on the acute toxicity of stream insects to cobalt was available, the tests with resident invertebrates were first conducted as rangefinding tests. As the name suggests, “rangefinding” tests are relatively low precision tests that encompass a wide range of concentrations in order to hone in on a narrower range of concentrations for follow-on “definitive” testing. Definitive tests are expected to give more precise results.

No attempts were made to collect or breed resident sculpin so that the sensitive early life stages could be tested. Instead testing was conducted with a broodstock of mottled sculpin (*Cottus*

bairdi) maintained by the USGS Columbia Ecological Research Center, Columbia, Missouri . The USGS Columbia center had recently conducted an extensive series of acute and chronic tests with mottled sculpin and cadmium, copper, and zinc (Besser et al. 2006). The Missouri mottled sculpin were considered a surrogate species for Panther Creek mottled and shorthead sculpin populations. Because of uncertainty whether the Missouri mottled sculpin stock were more or less resistant to cobalt than Panther Creek sculpin, they were tested in conjunction with hatchery rainbow trout as a “common denominator” (Appendix 1).

Chronic tests with rainbow trout and the midge *Chironomus tentans* were done using animals purchased from commercial suppliers. The chronic tests were conducted aquaria or beakers with automated refreshing of the exposure solutions (flow through tests) (Figure 3). Water chemistry was measured frequently during the chronic tests both to measure the cobalt exposures and to document and interpret water quality conditions that may affect the toxicity of the metal or the animals’ responses (e.g. organic carbon, hardness, pH, alkalinity, temperature, dissolved oxygen).

Table 1. General approach for developing a site-specific chronic criterion for cobalt in Panther Creek, using resident species

Fish Chronic Value		Invertebrate Chronic Value	
Lower of either:	Remarks	Lower of either	Remarks
1. Rainbow trout no-observed-effect concentration (NOEC), or	Rainbow trout were considered a surrogate for ESA listed steelhead and Chinook salmon. NOEC was chosen as a low-effect measure appropriate for evaluating direct effects to a listed species. NOEC is defined as the highest tested concentration that wasn't statistically different from the control with 95% confidence.	1. The lowest chronic EC20 obtained with the midge <i>Chironomus tentans</i> (non-resident laboratory cultured population); or	The midge was selected because it was an invertebrate species for which full life cycle test methods had been developed, and midges are important stream resident insects. Midges are often metals-resistant, so the data were intended to be used in a relative sense to relate acute responses to chronic responses (acute to chronic ratios, ACRs)
2. The estimated sculpin chronic concentration adversely affecting 20% of the test population (EC20) <u>if</u> sculpin more acutely sensitive than trout	Sculpin were included because they have been shown to be sensitive to other metals. An EC20 was selected as an endpoint because of the assumption that adverse effects to 20% of the sculpin populations are sustainable.	2. The lowest estimated chronic EC20 obtained from resident invertebrate species collected from Panther Creek.	7 species were targeted for collection based on their abundance in surveys. 4 species were successfully tested.
		Chronic EC20 values for resident invertebrates were estimated as the acute values, divided by an acute-to-chronic ratio (ACR). The ACR was defined as the geometric mean of the ACRs obtained from the rainbow trout tests and from the midge tests.	

Table 2. Summary of results of toxicity tests using species resident to Panther Creek (in milligrams per liter, mg/L, parts per million).

Fish Acute tests		Invertebrate Acute Tests	
Species	LC50 (mg/L)	Species	LC50 (mg/L)
Rainbow trout (acute test #1 in Panther Creek water)	0.86	Midge <i>Chironomus tentans</i>	157
Rainbow trout (acute test #2 in Panther Creek water)	0.80	Caddisfly <i>Brachycentrus americanas</i>	7,219
Rainbow trout (USGS acute test conducted in laboratory water)	1.36	Ephemerellid mayfly (<i>Serratella</i> sp.)	79
Mottled sculpin (USGS acute test conducted in laboratory water)	2.11	Baetid mayfly (<i>Centroptilum</i> sp.), rangefinding test #1	≈ 2
		Baetid mayfly (<i>Centroptilum</i> sp.), rangefinding test #2	9.4
		Baetid mayfly (<i>Centroptilum</i> sp.), definitive test	2.0
Fish chronic test	Effect (mg/L)	Invertebrate chronic test	Lowest EC20 (mg/L)
Rainbow trout (NOEC-no reduction in growth or survival)	0.101	Midge <i>Chironomus tentans</i> (reduced survival at 20 days)	0.237
Rainbow trout (LOEC- 5% reduction in growth, as total growth of individuals)	0.242		
Rainbow trout (20% reduction in growth or survival)	>0.971		

Table 3. Determination of an instream cobalt cleanup criteria (the lower of the fish chronic value (FCV) or the invertebrate chronic value (ICV))

Fish Chronic Value (FCV)		Invertebrate Chronic Value (ICV)	
Lower of either:	Remarks	Lower of either	Remarks
1. Rainbow trout no-observed-effect concentration (NOEC), <u>or</u>	0.101 mg/L	3. The lowest chronic EC20 obtained with the midge <i>Chironomus tentans</i> (non-resident laboratory cultured population); <u>or</u>	0.237 mg/L
2. The estimated sculpin chronic concentration adversely affecting 20% of the test population (EC20) <u>if</u> sculpin more acutely sensitive than trout	Sculpin were less acutely sensitive than rainbow trout.	4. The lowest estimated chronic EC20 obtained from resident invertebrate species collected from Panther Creek. This was estimated as the lowest acute invertebrate value, divided by an acute-to-chronic ratio (ACR). The ACR was defined as the geometric mean of the ACRs obtained from the rainbow trout tests and from the midge tests. ACR calculations for rainbow trout: ACR = Mean acute LC50/Chronic EC20 = (0.83 mg/L)/ (>0.971 mg/L) = < 0.82 (unitless) [Note: Because the >0.971 value was unquantifiable, the value was treated as 0.971 for ACR calculations] ACR calculations for midge <i>Chironomus</i> : ACR = (157 mg/L)/ (.237 mg/L) = 662 Site ACR = geometric mean of <0.82 and 662 = <23.3 4b. Lowest resident invertebrate LC50: mayfly <i>Centroptilum</i> .	
		5. <u>ICV</u> = Lowest invertebrate LC50/Site ACR = (2.0 mg/L)/(<23.3)	>86 mg/L
		6. <u>Overall site cleanup value</u> , also called cobalt toxicity reference value is the lower of the fish or invertebrate chronic value. (FCV = 0.101 mg/L; ICV >=0.086 mg/L, ICV considered lower	0.086 mg/L (ppm) = 86 µg/L (ppb)



Figure 1. About 113, 000 L (30,000 gallons) of Panther Creek water were collected upstream of mining influences and shipped in 6 refrigerated trucks to the Pacific EcoRisk Laboratories, Martinez, California (PER). Photos from McKee and Hansen (McKee and Hansen 2005).



Figure 2. Native macroinvertebrates were collected from Panther Creek with kick-nets, were sorted and identified on site, and selectees were shipped by air to PER for testing. Photos from McKee and Hansen (2005).



Figure 3. Chronic trout test setup (top) and chronic midge test setup (bottom). Photos from McKee and Hansen (2005).

Test results and data interpretation

Rainbow trout were consistently the most acutely sensitive fish and thus results with rainbow trout could safely be assumed to be protective of sculpin (Table 2). However, interpretation of the most acutely sensitive native invertebrates were much more complicated and controversial. Of the invertebrate tests conducted, it was clear that the Baetid mayfly was most sensitive. However, in the data report for these tests, the reported LC50 (concentration lethal to 50% of the test population) was mistakenly reported as 3.9 mg/L. Upon review and recalculation, it was found that depending upon the statistical model used, adjustments for deaths that occurred in the control treatment, adjustments for larvae that emerged from the treatments prior to the end of the test and other assumptions or decisions, possible LC50 estimates for this test could be calculated ranging from about 1.6 to 4.6 mg/L. The estimates straddled a concentration that when divided by an acute-to-chronic toxicity extrapolation factor, would either influence the final cobalt cleanup criteria or would drop out of the decision criteria (Tables 1 and 3). This triggered extensive debates, statistical analyses, written exchanges and a meeting³ between the workgroup members on how best to calculate an LC50 for this single test. In my view, valid arguments could be made supporting LC50 calculations for this test ranging from about 1.8 to 2.4 mg/L and within this narrow range, these estimates probably would not have changed the conclusion reached here that the site-specific cobalt target avoids appreciable adverse effects to listed species. The final LC50 value of 2.0 mg/L selected by EPA fit the data well, the statistical and biological assumptions seem fully appropriate, and thus it probably reflects the best interpretation of the available science for this test and species (Figure 4).

Convergence of lines of evidence – In sum, there were three independent lines of evidence completed to support an instream cobalt criteria for aquatic life in Panther Creek: (1) the highest cobalt concentration that did not result in direct adverse effects to rainbow trout, the surrogate species for listed salmonids; (2) the lowest chronic EC20 for the midge *Chironomus tentans*; and (3) an estimated chronic value for a sensitive, native invertebrate (the lowest definitive native invertebrate acute LC50 divided by the mean site acute-chronic ratio).

Despite the wide range of results obtained from disparate taxa, these three lines of evidence converged within a factor of 3 (86 to 237 µg/L). Since literature values for cobalt targets or safe endpoints for different species range over a factor of at least 60 (<5 to >300 µg/L), the range of the Panther Creek final endpoints is fairly narrow. Whether this convergence indicates corroboration or mere coincidence, it does offer some reassurance that the approach and results were reasonable.

³ Including exchanges of letters by (1) Michael Ives, Humboldt State University, March 31, 2005; (2) Russell Erickson, EPA National Health and Environmental Effects Laboratory, Duluth, of April 6, 2005; (3) Russell Erickson of April 18, 2005; (4) Frank Dillon and Shaun Roark, CH2M Hill, Seattle of April 18, 2005; (5) Steven Hansen and Paul McKee of May 6, 2005; (6) Fran Allans, EPA, Boise of May 23, 2005, (7) a meeting in Boise on August 25, 2005, and (8) a letter with further analysis from Russell Erickson on about September 5, 2005.

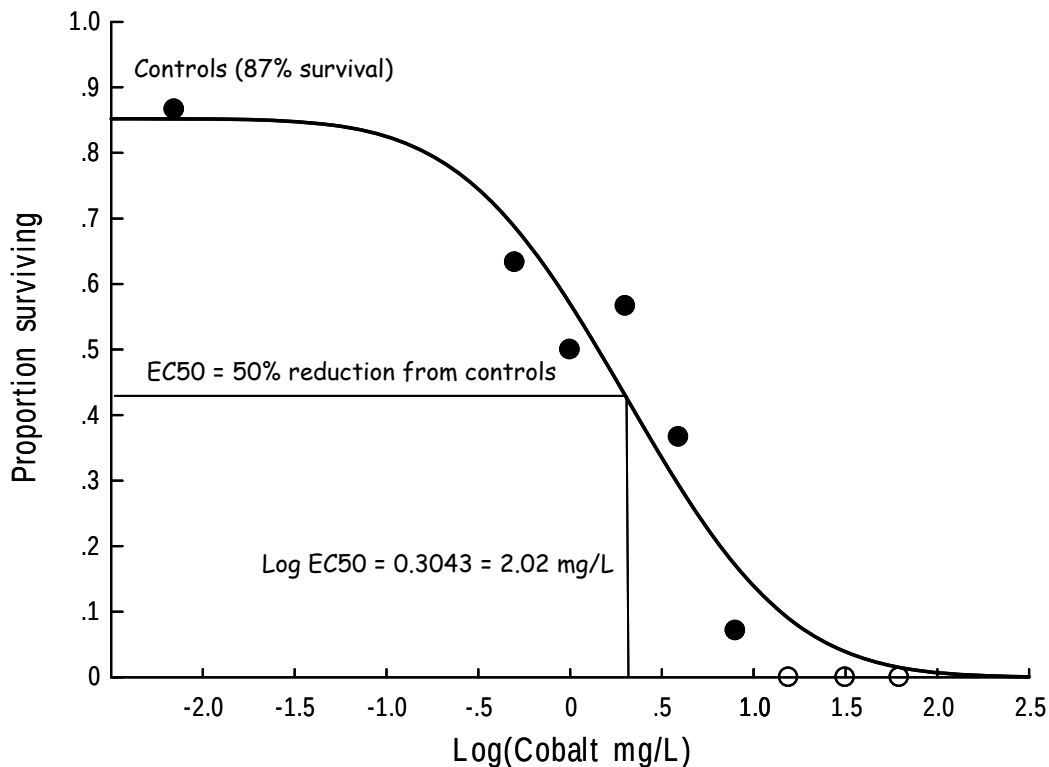


Figure 4. Illustration of best EC50 estimate from the definitive mayfly *Centropilum* test (most sensitive invertebrate). Open circles indicate data points with complete mortality that were censored from the analysis to avoid right skewing the EC50 estimate.

Uncertainties in the protectiveness of the site-specific cobalt criteria for listed salmonids

Ecotoxicology and ecological risk assessment are not certain sciences, and pronounced uncertainties are unavoidable in most projects. The cobalt site-specific criteria project reviewed here was an ambitious effort to reduce one major aspect of uncertainty - the extrapolation of toxicity testing results using standard laboratory cultured test organisms in laboratory water supplies. By using site water, site organisms, and at least laboratory or hatchery stocks of the same or similar species that occur in the study area, the uncertainty associated with that extrapolation was reduced. Several other areas of scientific uncertainty were considered (Table 4). Overall, the uncertainties remaining probably represent acceptable risks. Some of the remaining uncertainties were interpreted conservatively to give the benefit of doubt to the listed species and environment. Those uncertainties that were not treated conservatively did not seem to be of such magnitude that they compromised the protectiveness of the overall target.

Table 4. Some uncertainties and their implications to the protectiveness of the Panther Creek watershed cobalt site-specific criteria.

Uncertainties	Considerations	Direction of Potential Bias (C–conservative, NC– non-conservative)
Fish value based on rainbow trout NOEC	A statistical NOEC (no-observed-effect-concentration) is not a “true” effect, but is a statistical absence of effects.	Conservative
Rainbow trout threshold of effects was subtle	The statistical LOEC (lowest-observed-effect-concentration) resulted from only a 5% reduction in total weight of individual fish in the treatment. This low level of effect suggests that there is some safety margin in the cobalt target against severe, direct adverse effects to salmonids	Conservative
ACR of <23 is highly uncertain	Ratio is the geometric mean of two numbers differing by ~700X. Viewed in isolation, averaging numbers as disparate as <1 and 662 may be biologically meaningless. But when viewed in the context of other data, the resulting ACR of <23 is not out of the range of ACRs seen with other metals for similar taxa; When applied in the decision criteria, the result was similar to the trout NOEC. While this convergence was probably serendipitous, it indicates the ACR value is biologically plausible. (Continued from right column) The use of a geometric rather than arithmetic mean lessens the conservatism (Arithmetic mean of 1 and 662 is 331, but the geometric mean is 23). Still the ACR is probably somewhat conservative.	Probably conservative, since (1) the number is calculated as “less than,” and (2) acute-to-chronic ratios tend to be lower for more acutely sensitive species. The estimated sensitivity of the <i>Centroptilum</i> mayfly (LC50 2.0 mg/L) was closer to that of the rainbow trout (LC50 0.83 mg/L) than to the midge (LC50 157 mg/L). <i>Continued</i>
Most sensitive early instar life-stage of stream invertebrates doubtfully tested	But, mayflies seem to be recovering in Panther Creek under ambient Co concentrations of about 40-60 µg/L, suggesting earliest instars aren’t orders of magnitude more sensitive than the target	Non-conservative. Difficult or infeasible to test earliest instars of field collected insects.
Most sensitive resident invertebrate species were doubtfully tested	But, among the invertebrates found in fast moving, mountain streams, mayflies are often more sensitive to metals than other major groups such as common caddisflies, stoneflies, and true flies. Among the mayflies, the Heptageniid and Ephemerellid groups may be generally more sensitive than Baetid mayflies. Efforts to collect and test Heptageniid mayflies failed; an	Non-conservative. This is an inherent limitation of testing resident species; difficult or infeasible to collect and test large numbers of rare taxa

Uncertainties	Considerations	Direction of Potential Bias (C–conservative, NC– non-conservative)
LC50 value from most sensitive resident invertebrate, the mayfly <i>Centroptilum</i>	Ephemereid was tested but was less sensitive than the Baetid <i>Centroptilum</i>. The species tested include those that are abundant in site-waters and are likely important salmonid prey items. This assumes that the more important prey species are those that are relatively abundant and thus available in fish diets, not necessarily those that are most sensitive EPA's best estimate of the LC50 for this test was 2.0 mg/L; other estimates ranged from 1.6 to 4.6 mg/L.	Conservative. Although the 2.0 mg/L estimate was neither conservative or non-conservative for the definitive test, the two lower precision rangefinding test LC50s conducted earlier in the summer were about 2 mg/L and 9.4 mg/L. Together the three tests suggest that under some circumstances, the <i>Centroptilum</i> mayfly species could be less sensitive.

Uncertainties	Considerations	Direction of Potential Bias (C–conservative, NC– non-conservative)
Cobalt tested singly but always occurs with copper. Metals mixtures may be more toxic than either singly.	Previous literature reports that the toxicity of copper and cobalt mixtures is greater than the toxicity of either alone. The joint toxicity of copper -cobalt mixtures was about additive with an invertebrate (<i>Daphnia</i>) and slightly less than additive with a fathead minnow (Mebane 1994). With rainbow trout tested at mixture ratios more relevant to Panther Creek, the presence of low copper levels would increase cobalt toxicity by about 10% (Marr et al. 1998)	Non-conservative, perhaps by about a factor of 1.1 (Marr et al. 1998) or of up to 2 (Mebane 1994). The lower factor of 1.1 seems more likely, since the ratios tested were more relevant to Panther Creek conditions. <u>(continued in middle column below)</u>
	<u>(Continued from above right)</u> Recent field surveys of macroinvertebrates show about a 20% decline in taxa richness in Panther Creek sites located downstream from Blackbird Mine drainages, compared to upstream reference sites. However, overall invertebrate abundances including abundances of salmonid food items were similar between upstream and mine influenced sites. Changes in macroinvertebrate metrics associated with mine effluents were not correlated with cobalt concentrations, but were correlated with copper concentrations and with temperature. No adverse effects to Panther Creek fish communities were obvious in recent survey results (EcoMetrix 2006). Therefore, the magnitude of increased toxicity from copper-cobalt mixtures under site-specific conditions is probably not so large as to overwhelm the conservatism of other factors, nor large enough to compromise the validity of the site-specific criteria analysis or to change conclusions of the overall protectiveness of the target.	

Conclusion

Based upon (1) the review of and in some instances participation in previous studies relating the effects of cobalt on Panther Creek stream ecosystems, and (2) review of the methods and results of the most recent studies, I think the current data described here likely represents the best available science for evaluating direct and indirect effects to Snake River Basin steelhead and Snake River Chinook salmon. The EPA's interpretation of the testing design and test results was well reasoned and most major uncertainties were interpreted sufficiently conservatively as to give the benefit of doubt to the listed species. The majority of the information reviewed indicates that appreciable adverse effects to Snake River steelhead or Snake River Chinook salmon populations or their ecosystem associated with sustained cobalt concentrations up to 86 µg/L (the cleanup target) are unlikely.

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Appendix: Summary of acute toxicity testing of mottled sculpin and rainbow trout with cobalt by the U.S. Geological Survey, Columbia, Missouri

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