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Subject: Review of Rejection of Petition to Designate the Streambeds of Anadromous Water bodies and Riparian Areas within the Chuitna River Watershed as Unsuitable for Surface Coal Mining Pursuant to A.S. 27.21.260.

Executive Summary:

None of the examples provided by the Alaska Department of Natural Resources (ADNR) or PacRim demonstrate that reclamation is technologically feasible for streams and riparian corridors in the Chuitna watershed. The proposed project would remove 300 feet of overburden, mine the coal, then replace the overburden, in an attempt to build an entirely new stream and create a functioning stream ecosystem that supports anadromous salmon productivity similar to that which existed pre-mining. As none of the examples provided by ADNR or PacRim involved complete removal of an entire drainage with its associated salmon spawning stream, aquifers, wetlands, vegetation, and the subsequent creation of a new functioning stream on top of the mine overburden, no support is provided for the feasibility of reclamation of a coal strip mine in streams of the Chuitna watershed.

Not a common denominator

With the exception of Moose Creek, Resurrection Creek and Clear Creek in California, all of the streams Commissioner Sullivan cited as examples of successful reclamation of a salmon producing drainage and stream never supported anadromous salmon and are generally unsuitable as salmon habitat. The resident fish inhabiting streams cited by Commissioner Sullivan such as grayling, burbot, and round white fish have very different life histories and habitat requirements than Pacific salmon and cannot be used as surrogates in evaluating impacts or in determining the feasibility of the creation of salmon habitat. For example Arctic Grayling (*Thymallus arcticus*) migrate to headwaters streams and small tributaries such as Nome Creek and Valdez Creek in the spring to feed and spawn. Salmon dig redds into the hyporheic zone but spawning grayling do not. Grayling broadcast their eggs which drift down to the stream bottom where they develop.   The eggs hatch within three weeks. It does not matter if these streams go anoxic, dry up or freeze to the bottom during the winter

because prior to freeze up both the adults and juveniles migrate out of these systems to deep rivers and lakes to overwinter (Alaska Department of Fish and Game [ADF&G], 2011). Furthermore grayling spawn annually so the loss of an entire year class does not have long-lasting consequences (U.S. Fish and Wildlife Service [USFWS], 1983).

In contrast, spawning Coho (*Oncoryhchus kisutch*), chum (*Oncoryhchus keta*), sockeye (*Oncoryhchus nerka*) and Chinook (*Oncoryhchus tshawytscha*) salmon (*Onchorynchus sp*.) select streams which flow year-round and have an adequate supply of ground water in the winter to support developing eggs and overwintering fry (USFWS, 2011). Pacific salmon select areas of ground water upwelling as redd sites (Geist, et al, 2001; USFWS 2011; and USFWS, 1983). Pacific salmon dig redds and deposit their eggs in the hyporheic zone of the stream bottom. The eggs develop over the winter months and the fry emerge the next spring. Depending on the species, fry may spend one or two years rearing in the same systems. If these streams dry up, freeze out, or go anoxic the eggs and fry will die. Pacific salmon die after spawning so the loss of a year class means that no salmon will return to that system in 2 to 4 years depending on the species

ADNR's examples - Consol Energy's Burning Star No. 4 and Amax's Pipestone Creek - were coal mines but are not relevant to proposed Chuitna mining and reclamation. There are no anadromous salmon (*Onchorynchus sp*.) in the warm water streams affected by these mines. The primary fish species within the reclaimed Burning Star No. 4 mine area are largemouth bass (*Micropterus salmoides*), bluegills (*Lepomis marochirus*), and catfish (*Ictalurus* sp.) all warm water species. These species have very different life history and habitat requirements than anadromous salmon and salmon could not survive in the warm water lakes and streams these species inhabit. After the coal was depleted the Burning Star No. 4 mine was restored to cropland and water fowl habitat, not fish habitat. Similarly Amax's Pipestone Creek restoration project only supports resident warm water fish.

The impacts of placer and gravel mining are very different than strip mining

ADNR's Valdez Creek, Nome Creek, and Resurrection Creek examples of stream and wetlands reclamation post-mining were placer mines. Placer mining by definition is very different than the deep strip mining proposed for the Chuitna River drainage. Placer mining is defined as mining valuable minerals from placers by washing or dredging. A placer is a waterborne or glacial deposit of sand or gravel containing heavy ore minerals such as gold or platinum that has eroded from their original bedrock and can be washed (Webster's New World Dictionary 1960). Placer mines do not mine through bedrock or continuous aquitards such as coal seams because the gold and platinum minerals are in the alluvium above the impervious layer. (See Diamond Shamrock 1990 FEIS at 4-25 to 4-27 (discussion of ground water hydrology impacted by proposed coal mining of coal seams located 300 feet below the surface). Because the placer minerals are found in stream channels or the alluvial flood plain, entire stream drainages and their watersheds are not usually mined as is currently proposed by PacRim in the Chuitna River drainage. Shallow aquifers outside of the placer mining area remain intact, although flow to stream channels may be detrimentally altered.

In-stream placer and gravel mining has been shown to be very destructive to fish habitat (including all of PacRim's examples (Reynolds et al, 2007; Madison, 1981; and Weber, 1986). However, the damage to salmon streams from alluvial placer mining is very different from the much greater damage caused by surface coal strip mining which may encompass entire drainages and alter both the surface topography, subsurface geology, and numerous aquifers down to several hundred feet, (Starnes, L., and D.Gasper, 2011; Environmental Protection Agency [EPA], 1990; and National Oceanic and Atmospheric Administration [NOAA], 2007). Strip mining disrupts and/or destroys aquifers that recharge or replenish surface water systems which support salmon. Surface mining will necessarily cut through any aquifer above the coal seam that is being mined. Portions of aquifers and surface water systems may be dewatered. Disposal of water from mine pits will disrupt flow patterns, water temperatures and water quality in receiving waters (Starnes, L., and D.Gasper, 2011, EPA, 1990 and NOAA, 2007). It has yet to be demonstrated that a ground water system that has been destroyed by strip mining can be permanently restructured. Although there are examples of attempts to rehabilitate small sections of placer mined streams in Alaska, no examples were found where entire salmon stream drainages have been strip mined or placer mined and subsequently restored to previous levels of wild fish productivity. As the proposed Chuitna Coal Project would mine directly through a stream including its headwaters, alter the surface topography, subsurface geology, and numerous aquifers down to several hundred feet and replace the substrate with unconsolidated overburden, the reclamation of placer mined streams cannot be used as a surrogate or example of how reclamation from coal strip mining is technologically feasible. Placer mine reclamation in no way demonstrates or supports how reclamation of a coal strip mine as that proposed by PacRim is technologically feasible.

Lack of data

None of the citations for ADNR's examples that I reviewed contained scientific studies that support ADNR's contention that restoration of strip mined salmon habitat within the Chuitna River drainage is feasible. There is anecdotal information that stream restoration/reclamation has improved fish habitat and fish numbers from the damage caused by placer and gravel mining but no hard scientific data to support the claim that habitat and fish numbers have been returned to pre-mining numbers. In fact, a critical evaluation of in-stream restoration projects is often lacking or inadequate (Illinois Department of Natural Resources, 2010,; Retzer, M.; and Carney, 2010). Nationwide less than 20% of all stream restoration projects are monitored after completion (Bernard et al, 2011). Even fewer stream reclamation projects are studied after completion to measure long term success or failure. For example, there is no scientific data to show that USFS reclamation projects on Resurrection Creek have restored salmon populations in the creek to pre-mining levels of productivity (Blanchet, 2011). In fact it is probable they have not (Blanchet, 2011). Similarly there are no pre-and post-project studies which show that the Cambior's (Valdez Creek Mine) reconstruction of a one mile section of Valdez Creek cited by ADNR as an example of successful restoration , restored grayling populations in that portion of Valdez Creek to pre-mining levels.

Other agencies opinions on the technological feasibility of Chuitna watershed and salmon stream restoration

NOAA's National Marine Fisheries Service (NMFS) is the nation's expert on fisheries. The NMFS works to promote sustainable fisheries and to prevent lost economic potential associated with overfishing, declining species, and degraded habitats (NOAA, 2011). In a 2007 letter to EPA on the "the effects of the proposed Chuitna Coal Project on fish populations, habitat and water quality in the Chuitna watershed" the NMFS concluded that the Project would cause permanent impacts to the Chuitna Watershed and associated salmon habitat (NMFS, 2007). NMFS states that: "the applicants proposed stream restoration plan and supporting presentation highlights examples of stream restoration techniques widely recognized as the best available methods. However, the examples presented by the applicant represent restoration projects of far smaller scale stream realignments. These examples do not illustrate or represent stream restoration efforts at the size and scale of this mining operation where hydrogeomorphic processes are disrupted to a depth of 300 feet over several thousand acres. Stream restoration efforts at this scale would face many complications and impediments. We are aware of no example of successful salmon stream restoration at this scale"(NMFS, 2007). In the Diamond Chuitna Coal Project Final Environmental Impact Statement, EPA concluded it is questionable whether mined through streams could be returned to pre-mining productivity: therefore, fish productivity loss could be a long term loss (EPA, 1990).

The ADF&G also contradicted Commissioner Sullivan's finding that creation of salmon producing drainages, watersheds, and associated aquifers is feasible in a May 26, 2011, letter to Russell Kirkham, ADNR Division of Mining and Water (ADF&G, 2011). This letter was in response to a letter from Russell Kirkham asking the ADF&G Habitat Division "does the information provided in the petition submitted by Trustees for Alaska, with additional information submitted by the interveners to the petition and the comments made by the general public or any other information known to the Department lead DF&G to believe that reclamation of anadromous waterbodies and riparian areas disturbed by surface coal mining operations is not technologically feasible under As 27.21 and 11 AAC90?" ADF&G provided the following response: "while we are aware of small scale successes in reclaiming certain stream functions we are not aware of any evidence documenting whether large-scale reclamation of ecosystem function can or cannot be accomplished."

In the process of reviewing the projects that Commissioner Sullivan and PacRim cited as examples of stream restoration post-mining, a number of fisheries biologists and hydrologists who have been involved in stream reclamation projects in Alaska were interviewed (see references). None of the individuals involved in the projects cited in Commissioner Sullivan's rejection of the Unsuitability Petition believed that these projects demonstrate that restoring thousands of acres of strip mined salmon streams, aquifers ,and drainages was feasible. They were also unaware of any example of where a salmon producing drainage has been destroyed by strip mining to depths of several hundred feet, and a new stream created on top of several hundred feet of mine overburden.

Scale

All of the Alaskan projects cited by Commissioner Sullivan and Pac Rim as examples of the feasibility of restoring the Chuitna River drainage after strip mining are small-scale compared with the proposed Chuitna Coal Project. Both NMFS and ADF&G have pointed out the problems with attempting to use small scale stream realignment and reclamation projects as the basis for a conclusion that over 11 miles of salmon producing stream's and drainage's can be restored to pre-mining productivity when hydrogeomorphic processes have been disrupted to a depth of 300 feet over several thousand acres. The initial 5,000 acre mining area indentified in the 1990 EIS contains portions of tributaries 2002, 2003 and 2004. It is the first of three mine areas which have been proposed within the 20,571 acre coal lease area (EPA, 1990)). In contrast with the proposed Chuitna coal mine the Valdez Creek mine, which was the largest placer mine in Alaska, encompassed less than 640 acres.

Introduction

I reviewed the examples used by the Commissioner of the Alaska Department of Natural Resources (ADNR) in his *Rejection of the Petition to Designate the Streambeds of Anadromous Water bodies and Riparian Areas within the Chuitna River Watershed as Unsuitable for Surface Coal Mining Pursuant to A.S. 27.21.260* (Petition Rejection) to support his claim that restoration activities at previously mined streams in Alaska and elsewhere demonstrate that it is technologically feasible to strip mine an entire drainage and its associated salmon streams to a depth of 300 feet for coal and then construct a fully functional watershed including salmon spawning and rearing streams on top of the formerly mined area (Sullivan 2011). I also reviewed examples relied upon by PacRim LC (PacRim), project proponent for the Chuitna Coal Project, to support their claims that past mining has been compatible with maintaining salmon production, and that restoration activities at previously mined streams in Alaska and elsewhere demonstrate that it is technologically feasible to strip mine an entire drainage and its associated salmon stream to a depth of 300 feet and then construct a fully functional watershed and salmon spawning and rearing stream on top of the overburden. To do this I perused the documentation in the citations provided by ADNR in its decision rejecting the petition, researched the available literature, and consulted biologists and hydrologists who were involved in these projects wherever possible. I also have first hand knowledge of many of the examples as a result of my experience during my 32 years as a fisheries research biologist and Habitat Division Regional Supervisor for the Alaska Department of Fish and Game (ADF&G).

I have previously described the likely impacts of the proposed Chuitna Coal Project on salmon habitat in the Chuitna River drainage based on the project analyzed in the 1987 Draft Environmental Impact Statement DEIS, the 1990 Environmental Impact Statement (EIS) for Diamond Alaska Coal Company's application for a National Pollutant Discharge Elimination System (NPDES) permit and more recent PacRim studies, documents and permit applications (EPA, 1990). Based on my studies of the available information on similar strip mines and watershed reclamation projects worldwide since production of the 1990 EIS, I could not find any examples of anadromous streams and their associated watersheds and aquifers that had been restored to a productive state after strip mining. My findings are consistent with EPA's conclusion that "it is questionable whether mined through streams could be returned to pre-mining productivity: therefore, fish productivity loss could be a long term loss, and NMFS's comment to EPA on the scoping document for the Chuitna Coal project, "We are aware of no example of successful salmon stream restoration at this scale."(EPA, 1990 and NMFS, 2007).

I explained why it was unlikely that stream affected by the proposed mine and the Chuitna watershed could be restored to their former level of productivity after strip mining in a report on *PacRim's Chuitna Coal Project Aquatic Studies and Fish and Wildlife Protection Plan (Trasky, 2010).* I summarized these conclusions in a January 17, 2011, letter to Mr. Daniel S. Sullivan, Commissioner Alaska Department of Natural Resources, in support of the Petition to Designate the Streambeds of Anadromous Water Bodies and Riparian Areas within the Chuitna River Watershed, Alaska as Unsuitable for Surface Coal Mining Pursuant to AS. 27.21.260 (Trasky, 2011).

Review criteria:
I used two sets of related criteria to determine if the examples that Commissioner Sullivan used to support his rejection of the Unsuitability Petition provide scientific confirmation that restoration of Chuitna salmon streams is feasible after strip mining claims. The first is an evaluation of Commissioner Sullivan's examples of mining and subsequent reclamation projects in compliance with the criteria in the Alaska Surface Coal Mine Control and Reclamation Act (ASCMCRA) regulations below:

1. Restore a strip mined watershed and associated anadromous stream to the uses which they were capable of supporting before any mining;

2. Avoid long-term adverse changes in the hydrological balance in the permit area and adjacent areas;

3. Minimize changes in water quality and quantity, in the depth and flow pattern of ground water, and in the location of surface and subsurface water drainages so salmon spawning and rearing are not adversely impacted;

4. Conducting strip mining for coal so as to restore the capacity of the area as a whole to transmit water to the ground water system supporting salmon spawning and rearing; or

5. Minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and enhanced these values where practical; and,

6. Restore the recharge capacity to a condition that supports salmon spawning and rearing in reconstructed streams.

The second set of criteria used to evaluate if ADNR's examples demonstrate the technological feasibility of reconstructing a fully functioning watershed, aquifers and salmon spawning and rearing stream on top of approximately 300 feet of replaced overburden are:

1. Was the stream salmon spawning and rearing habitat?
2. Were the entire stream, riparian area, and watershed mined?
3. Did mining penetrate bedrock or other impermeable layers and alter the shallow and deep aquifers that provide year round flow to the stream?
4. Were Pacific salmon, their habitat and the essential shallow aquifers supporting their freshwater lifecycle in the mined area restored or rehabilitated to their previous level of productivity after mining?
5. Were there any scientific studies of the mine or project to provide quantifiable data on the success of restoration?
6. What is the status of Pacific salmon populations after mining?

7. Was the project located in a cold climate where the input of ground water into the hypoheric zone and upwelling ground water into salmon spawning areas is essential to successful salmon spawning and rearing?
8. Were a fully functioning 11 mile long salmon spawning and rearing stream, and its associated watershed, aquifers, wetlands, and vegetation created on top of several hundred feet of replaced overburden in a former strip mine?

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Analysis of ADNR Examples Used To Justify Rejection of the Unsuitability Petition

Following is an analysis of each example that Commissioner Sullivan cites to determine if they demonstrate the technological feasibility of reconstructing a fully functioning watershed, aquifers and salmon spawning and rearing stream on top of approximately 300 feet of replaced overburden and if they comply with the ASCMCRA regulations**:**

ADNR Decision 138 Exhibit 2 Practical Examples of Fish and Wildlife Habitat Construction Reclamation and Restoration, PacRim Coal LP

Weaver Creek Spawning Channel

The Weaver Creek Spawning Channel was constructed because flooding associated with extensive logging in the Weaver Creek drainage destroyed salmon spawning grounds in Weaver Creek (Fisheries and Oceans Canada, 2011). Sockeye escapement declined from an average of 20,000 sockeye salmon to 12,000 annually. To save this valuable run of salmon an artificial spawning channel was built beside Weaver Creek in 1965. This channel is a shallow stream with a gravel bottom and sloping sides built up with rocks, sockeye and a smaller numbers of chum and pink salmon deposit their eggs in this 2,932 meter (1.82 mile) long channel annually (Fisheries and Oceans Canada, 2011). An underground pipeline provides a dependable supply of water to the channel when eggs or fish are present. Water from Weaver Creek, Sakwi Creek, and Weaver Lake is piped to a large settling basin where it is treated to remove sediment. A second pipeline delivers clean water to the head of the spawning channel (Fisheries and Oceans Canada 2011). The run of sockeye produced by the Weaver Creek spawning channel is more than 200 times the size of the natural run produced from Weaver Creek prior to 1965. Because of construction and controlled water supply this spawning channel is really an outdoor salmon hatchery and is called that in some of the sources I reviewed. No mention of the rearing habitat for fry produced by this facility.

Englishman River Spawning Channels

The Englishman River originates on the slopes of Mt. Arrowsmith and flows 40 km before entering the Straits of Georgia near Parksville B.C. The river supports all five species of trout and salmon and is considered one of the most valuable but also endangered rivers in the province (Vancouver Island University, 2011). The Englishman River has experienced extensive channel widening and chronic sedimentation related to logging, reduced rearing habitat, and increasing sedimentation from increasing urbanization (B.C. Steelhead Recovery Plan, 2011). Sedimentation has reduced egg survival and ultimately salmon returns. Two semi-natural side channels (Weyerhaeuser channel and the Clay Young channel) have been constructed by the Division of Fisheries and Oceans (DFO) in an attempt to bolster declining runs of salmon and steelhead in the Englishman River. These channels accommodate a number of uses. Hatchery reared pink and Chinook salmon are stocked in the Clay Young channel. Pink salmon eggs are also placed in incubators in the Clay Young channel (Davies, 2011). Wild Coho, steelhead and other species of salmon also spawn in these channels. The two side channels produce between 15-25% of the Coho smolt produced in the drainage (Davies, 2011). The spawning channels do not seem to be too successful in reversing declining escapements.

Coho escapement into the Englishman River reached a high of 8,000 in 2001 but declined to 2,500 in 2009. Steelhead are present but apparently have declined to very low numbers. No information is available on the amount of available rearing habitat for Coho, Chinook, steel head and sockeye in this system.

The spawning channels on Weaver Creek and the Englishman River do not support the conclusion that reconstruction of a fully functioning watershed, aquifers and salmon spawning and rearing stream on top of approximately 300 feet of replaced overburden after strip mining in the Chuitna River drainage is technologically feasible. The Weaver Creek and the Englishman River drainages were damaged and their capacity to produce salmon greatly reduced by logging and other watershed developments. However, the impacts from these activities are relatively minor when compared to the disruption of surface and subsurface hydro geomorphic processes that would result from strip mining. The substitution of artificial spawning channels for natural habitat and wild stocks does appear to comply with the ASCMCRA regulations.

Although PacRim's intent is not clear, it may be that they will propose to mitigate the loss of natural spawning and rearing habitat in the Chuitna River drainage by construction of artificial spawning channels. This solution is flawed for the following reasons:

1. Any Chinook, Coho, or sockeye salmon fry produced in a spawning channel would need rearing habitat. To replace natural stream habitat destroyed by strip mining up to 30 acres of high value rearing habitat would have to be replaced. Because of the presence of invasive northern pike in the Chuitna River drainage it could not be shallow ponds which have been shown to be good northern pike habitat (Rutz, 2011, Bosch, 2011, and USFWS, 1982). It would have to be relatively high gradient stream habitat similar to what which would be lost; otherwise the pike would simply eat all of the fry as they have in Red Shirt Lake, Cheney Lake, and many other systems in the Cook Inlet region. If the spawning channel were relatively low gradient such as the Weaver Creek spawning channel, it might also become prime northern pike feeding habitat.
2. A number of spawning channels have been constructed previously in Cook Inlet and all have failed over time because of flooding and other factors (Fandrei, 2011). The Weaver Creek spawning channel has likely succeeded because it is a very large, actively maintained facility, with a treated water source.
3. A number of spawning channels have been constructed in British Colombia to bolster declining fish runs related to habitat loss and degradation. According to the University of Washington, Weaver Creek is "one of the more successful ones" (Quinn, 2011). Some of these channels have failed and some have had limited success (Hartman and Miles, 1997). However, information is limited because agencies do not like to advertise their failures. Even if the problem of lack of Cohof, Chinook, and sockeye rearing habitat and the presence of northern pike in the Chuitna River drainage are ignored, a spawning channel still may not be successful.

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ADNR Decision 163 and 164 Formerly Permitted Chuitna Project

In Decision 163, Commissioner Sullivan argues that the Unsuitability Petition fails to account for mitigation required by ADNR's 1987 Permitting Decision, i.e. the creation of at least 4 one-half acre Coho salmon rearing ponds to be located adjacent to Coho salmon spawning habitat in tributary 2003. In Decision 164, he states that information regarding anadromous fish streams has advanced since the 1990 FEIS, as has the understanding of the technology used to restore fish productivity in disturbed areas. He points to the gravel pits at the Granite Creek material site as an example of the creation off channel rearing habitat.

It is true that the information on anadromous stream structure, function, and the relationship with surface and ground water flow and its watershed has advanced greatly since the 1990's. The information on fish populations, genetics, and fish habitat in the Chuitna River drainage has also advanced. First, based on new information, 4 one half acre ponds are inadequate mitigation for the loss of approximately 30 acres of spawning and rearing habitat in the Stream 2003 watershed. It also would not compensate for the loss of spawning and rearing habitat for the other four species of salmon that are now known to use stream 2002, 2003 and 2004. Second, Granite Creek has not been disturbed by mining or any other activity. The 3 material sites which were used for local construction projects intercepted a shallow aquifer feeding Granite Creek and were flooded. The material sites were subsequently connected to the Granite Creek (Cross 2011 and Blanchet, 2011). It is correct that salmonids have been observed in these flooded material sites, but there is no information on numbers or if the material sites have increased the rearing capacity of Granite Creek (Cross, 2011). Unfortunately, similar attempts to increase spawning and rearing habitat by connecting flooded material sites to salmon streams have failed and some have become fish traps (Hughes, 2011; Ruffner, 2011; and Litchfield, 2011). The ADOT gravel pit on Quartz Creek and the gravel pits on the north fork of the Anchor River are examples (Hughes, 2011; Ruffner, 2011; and Litchfield, 2011).

Unfortunately, new information also shows that gravel pits and ponds also make good spawning and rearing habitat for northern pike (Rutz, 2011 and Bosh, 2011). Northern pike are not native to south central Alaska and threaten both wild and stocked fisheries (ADF&G, 2011). It is now known that northern pike have recently invaded the Chuitna River drainage (Rutz, 2011). No ponds, flooded gravel pits, or similar shallow low flow water bodies should be constructed in the Chuitna drainage because any juvenile salmonids utilizing them would be rapidly eaten by pike.

Commissioner Sullivan's other mitigation examples such as artificial propagation (e.g., ARED) to enhance production without corresponding rearing habitat, and fertilizing with bone meal, transported salmon carcasses etc., do not appear to be consistent with the following ASCM regulations:.

1. Restoring a strip mined watershed and associated anadromous stream to the uses which they were capable of supporting before any mining.

2. Avoiding long-term adverse changes in the hydrological balance in the permit area and adjacent areas.

3. Minimizing changes in water quality and quantity, in the depth and flow pattern of ground water, and in the location of surface and subsurface water drainage can so that salmon spawning and rearing are not adversely impacted.

4. Conducting strip mining for coal so as to restore the capacity of the area as a whole to transmit water to the ground water system supporting salmon spawning and rearing.

5. Minimizing disturbances and adverse impacts on fish, wildlife, and related environmental values and enhanced these values where practical.

6. Restoring the recharge capacity to a condition that supports salmon spawning and rearing in reconstructed streams.

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ADNR Decision 176: Moose Creek:

The Moose Creek rehabilitation project does not demonstrate the technical feasibility of creating a new watershed, wetlands, shallow and deep aquifers, and a fully functioning salmon spawning and rearing stream on top of approximately 300 feet of coal mine overburden at the proposed Chuitna Coal Mine or anywhere else in the Chuitna watershed where a stream is removed entirely and coal is mined 300 feet below that stream. Moose Creek was rerouted at several locations in the early 1900's to facilitate the construction of a rail line to transport coal. Channel realignment resulted in significant loss of in stream aquatic habitat and floodplain connectivity as well as the formation of a ten foot high waterfall at mile 3 that blocked upstream salmon migration. Salmon populations that were once abundant enough to feed both miners and local people rapidly declined. However, remnant populations of Chinook, Coho and chum salmon continued to spawn and rear in the lower 3 miles of Moose Creek (Dryden et al, 2006; USFWS, 2011; Chickaloon Traditional Village Council 2011; and Winnestaffer, 2011).

Restoration of Moose Creek fish passage was championed by the Village of Chickaloon who traditionally harvested salmon from Moose Creek for subsistence. Restoration of salmon runs to upper Moose Creek was accomplished by:

1. Reconstructing two stream reaches to bypass several waterfall barriers.

2. Restoring channel connection to the adjacent floodplain-a connection which was lost when Moose Creek was straightened.

3. Revegetating the riparian habitat along the reconstructed reaches.

The project was completed in two phases: Phase 1 was completed in the summer of 2005. It involved restoring Moose Creek to a stable dimension, pattern, and profile adjacent to the upper waterfall at reach 3. After completion, both Chinook and Coho salmon were observed passing above the previously impassible barrier. Phase 2 was completed in the summer of 2006. It involved restoring Moose Creek to a stable dimension, pattern, and profile adjacent to the lower waterfalls at reach 5. In both reaches the channel realignment ***largely followed relic channel locations***, although both the channel and floodplain were reconstructed throughout the new alignment (USFWS 2011).

Although several descriptions of the Moose Creek Fish Passage Restoration Project indicate that early underground mining, followed by adjoining strip mining operations severely altered more than seven miles of Moose Creek, it appears that most of the damage to Moose Creek addressed by this project actually occurred not from mining but from the rail line upgrade. When the rail line was upgraded to a standard gauge rail Moose Creek was rerouted, straightened, and channelized separating it from its flood plain, creating artificial waterfalls and ***impacting more than 7 miles of Creek*** (Sullivan, D. 2011; Winnestaffer, 2011; and USFWS, 2011). Although, underground coal mining along Moose Creek occurred and likely impacted the Creek in a number of ways, there is nothing in the record or literature which indicates that the bed and flood plain of Moose Creek were strip mined to any great depth, that the present stream substrate is old coal mine overburden, or that the aquifers providing the base flow to the creek were altered (Dryden, 2003). The fact that the channel realignment largely follows relic channel locations indicates that the stream and riparian area were not altered by mining but by dykes and levees built to confine Moose Creek to a single channel (USFWS, 2011). This project corrected a fish passage obstruction by returning a relatively short section (1850 feet) of the 7 miles of Moose Creek, which had been altered by the railroad, to its original channel in its original flood plain on top of an intact shallow aquifer. This project is completely different from reclamation necessary to create new salmon streams, aquifers, and drainages that would be destroyed by thousands of acres of coal strip mining in the Chuitna watershed. The Moose Creek restoration project fails to support in any way or demonstrate how reclamation and creation of entire salmon spawning and rearing stream's with associated riparian areas, wetlands, and confined and unconfined aquifers on top of 300 feet of porous mine overburden is feasible.

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ADNR Decision Nome Creek

Nome Creek is a grayling stream and portions of the creek and its riparian area were extensively ***placer mined*** for gold from the turn of the century to recent times (Kostohrys, J. 2007). Miners disturbed over 7 miles of the 22 mile long stream, often by diverting it into bypass channels or through old settling ponds. By the 1980's the floodplain was largely obliterated in many areas (Kostohrys, J. 2007). The Bureau of Land Management's (BLM) reclamation objectives for Nome Creek were:

1. Keep Nome Creek within a single channel.

2. Eliminate unstable debris piles and settling ponds that have contributed to excessive sediment runoff.

3. Stabilize and revegetate the flood plain. BLM plans to apply the techniques that were successful at Nome Creek to other ***placer mining reclamation*** (Kostohrys, J. 2007).

Commissioner Sullivan cites BLM's efforts to stabilize and revegetate heavily placer mined sections of the Nome Creek channel and adjacent riparian area and reestablish Nome Creek in a single channel as an example of the technical feasibility of restoring salmon streams in the Chuitna River drainage after strip mining for coal. Nome Creek may be a good example of the techniques used to reclaim a placer mined grayling stream, but it does not demonstrate the technical feasibility of:

1. Creating a entirely new watershed where the Middle Creek watershed currently exists after the majority of the watershed is strip mined to a depth of 300 feet (NMFS,2007)

2. Maintaining slope stability and water quality while the watershed is being revegetated over many years

3. Successfully revegetating the watershed and riparian areas with plant species that provide organic material and nitrogen that have been shown to be essential to productive salmon rearing streams (Wipfli, M., J. Richardson, and R. Naiman. 2007, and King et al .in review)

4. Reconstructing shallow and deep aquifers to provide phreatic and hyporheic ground water flow to a newly created stream to replace Middle Creek and other streams which may be obliterated by strip mining (Winter et al, 1998; Stanford, J., .and J. Ward, 1993; and Reidy and Clinton, 2004)

5. Constructing a stable and fully functioning salmon spawning and rearing stream with the same water quality and chemical homing signature as the mined stream on top of 300 feet of coal mine overburden.

6. Maintaining the genetically unique stocks of 6 species Pacific salmon currently inhabiting Middle Creek and other similarly affected stream for 25 years before a new stream is created.

Nome Creek reclamation does not support Commissioner Sullivan's finding that it would be technically feasible to restore streams destroyed by coal strip mining, such as that proposed by PacRim to their previous levels of productivity, for the following reasons:

1. Nome Creek was not strip mined, it was placer mined down to bedrock (17-20 feet).

2. The watershed was not mined, only 7 miles of the 22 mile long stream channel and adjacent riparian area.

3. The aquifers providing base flow to Nome Creek were not altered (Kennedy, 2011 and Kostohrys, J., 2007).

4. Nome Creek is a grayling stream and no Pacific salmon are present. Sections of Nome Creek freeze to the bottom which would eliminate salmon spawning or overwintering. Grayling survive in Nome Creek because they leave Nome Creek when it begins to freeze up in the fall and overwinter in lakes and large rivers (Fleming and McSweeny, 2001; Kennedy, B., 2011; and Kostohrys, J. 2007).

5. Reclamation at Nome Creek consists of grading placer mined gravels to create a stable channel and fertilizing the riparian area to encourage growth of pioneering plant species.

In contrast, reclamation at the proposed Chuitna coal mine would require creation of an entire watershed, with associated aquifers, wetlands, and a fully functioning salmon stream on top of 300 feet of mine overburden (Kennedy, B., 2011; Kostohrys, J., 2007; and Kostohrys and Koss, 2011). Nome Creek is likely better habitat for grayling as a result of the BLM reclamation efforts. However, as with most reclamation projects in Alaska, no pre- and post-project scientific studies with data confirming that grayling densities have improved as a result of the reclamation efforts could be found (AECOM Environment, 2009). Even if grayling numbers improved, it does not establish the feasibility of reclamation following strip coal mining to 300 feet in the portions of the Chuitna watershed covered by the unsuitable lands petition.

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ADNR Decision 174. Valdez Creek

Cambior's (Valdez Creek Mining Company) reclamation of the 600 acre Valdez Mine and the construction of a one mile section of new stream channel at the Valdez Creek Placer mine are cited by Commissioner Sullivan an examples of mining-related successful stream reclamation. Cambior reclaimed the placer mine site by infilling, landscaping, and reseeding the waste dump, flooding the open mine pit to create a lake more than a half mile wide, and by recontouring and rebuilding the creek bed to follow its original course (King, 1997). The restoration plan also called for the rehabilitated channel of Valdez Creek to conform as closely as possible to the grade and curve of its original course. The newly reconstructed stream bed was lined with rocks and boulders, liberally placed to moderate the flow velocities and provide a habitat for migrating fish species such as grayling and whitefish. In total, more than 5,200 feet of Valdez Creek was rebuilt (King, 1997). Most of the roads used during the mining project have been re-seeded. However, an unpaved access road from the Denali Highway provides access to the site and several mining claims further upstream.

As stated previously, because of the type of mining at this site (placer) and the absence of any of the five species of Pacific salmon in Valdez Creek, reclamation at this site does not demonstrate that successful reclamation of thousands of acres of watershed and more than 11 miles of salmon spawning and rearing streams in the Chulitna River drainage after strip mining is feasible. The scale of mining at Valdez Creek was small (600 acres) compared with proposals to strip mine over 5,000 acres containing three salmon streams within the 20,571 acre coal lease area in the Chuitna River drainage. Mining was also limited to Valdez Creek, its riparian area, and old channels and not the entire watershed.

Because there were no scientific studies of fish populations, fish habitat, and hydrology in Valdez Creek before mining and apparently no post project studies in the reconstructed portion of Valdez Creek, there is no data to support ADNR's claim that stream reconstruction was successful in providing productive habitat and access to upstream habitat (BLM, 1986; Sundlove 2011; and Whitlock, 2011). The lack of long term monitoring and critical evaluation of stream restoration projects is a common problem nationwide (Nawrot et al, 1999 and Bernhardt et al, 2011). One cause for skepticism about the long term success of this reclamation project is that ADF&G biologists recently studied the fish passage structures at Valdez Creek road crossings and found that all the culverts were crushed and blocked with debris. None of the culverts met USFS fish passage criteria (O'Doherty, 2011). This means that passage from overwintering areas into the Valdez Creek mining area may be blocked, particularly for juvenile fish. It also illustrates that reclamation projects may appear to be successful initially, but fail over time if there is no maintenance after completion. It is important to note that BLM monitoring of stream reclamation and stream stabilization projects in Nome Creek reported that high waters damaged reconstructed channels and riparian areas (Kostohrys, 2007). Similar high water events in Valdez Creek may have caused changes in the Valdez Creek channel, but since there have been no post project studies there is no way to tell if the reclaimed channel is still intact. Several of the current and retired agency personnel interviewed about the Valdez Creek Mine described the mining area as "a mess."

The Cambior reclamation at Valdez Creek cannot be used to demonstrate the feasibility of restoration of a watershed, numerous shallow and deep aquifers, and a Pacific salmon spawning and rearing stream. As previously described, Valdez Creek is a grayling stream. Grayling and anadromous salmon have very different life histories and grayling can survive where Pacific salmon cannot. As long as Valdez Creek has adequate surface flow in the summer graying can survive in the Valdez Creek system if the one mile restored section has adequate summer flow to allow grayling to reach upstream areas, and the Cambior culverts in Valdez Creek and its tributaries are not blocking fish passage. Winter conditions in the Creek aren't important because adult and newly hatched juvenile grayling leave streams such as Valdez Creek before they freeze to the bottom and migrate to deep rivers and lakes to overwinter. The eggs and larvae of anadromous salmonids found in the Chuitna drainage must remain in spawning and rearing systems overwinter, and if the stream freezes to the bottom, dries up, or goes anoxic, they die.

On page 83 of Commissioner Sullivan's petition rejection it states that "While there are no anadromous fish that are supported in the **river sic**, it is an important example of stream reclamation after substantial disturbance to the hydrological balance by a relatively deep surface mining operation. The post-mining stream on this site was constructed on reclaimed mine spoils that were replaced in the same general configuration as the pre-mining stratigraphy, including substantial thicknesses of glacial fluvial material overlying Tertiary fluvial deposits and deeply incised paleochannels." No post project scientific studies or scientific reports on fish populations, fish habitat, or hydrology could be located to support Commissioner Sullivan's claim that the Valdez Creek Mine is an example of mining-related successful stream reclamation from a fisheries and hydrological perspective, and that the stream channel and hydrological balance were restored when the post mining stream "was constructed on reclaimed mine spoils that were replaced in the same general configuration as the pre-mining stratigraphy, including substantial thicknesses of glacial fluvial material overlying tertiary fluvial deposits and deeply incised paleochannels." Commissioner Sullivan's statement creates the impression that the hydrology of Valdez Creek was disrupted by placer mining and then restored by replacing "reclaimed mine spoils in the in the same general configuration as the pre-mining stratigraphy." However, there is nothing in Commissioner Sullivan's Valdez Creek references or the record that supports the claim that the hydrology of Valdez Creek was disrupted and then restored. The Bundtzen and Reger (1990) citation provided by Commissioner Sullivan to support this claim is only a description of glaciations and gold-placer formation in the Clearwater Mountains and does not discuss how Cambior replaced mine spoils to restore the pre-mining stratigraphy or the hydrological balance. The Bundzen and Reger report was apparently written before the Valdez Creek channel reconstruction occurred (Bundtzen and Reger, 1990). ADNR's publication on *Mining Reclamation in Alaska* which was also cited does not provide any information on hydro-geological reclamation techniques used at mines (ADNR, 1997). There is no evidence in the record that supports the statement that the pre-mining stratigraphy and hydrology were restored.

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ADNR Decision 177 Resurrection Creek

The United States Forest Service (U.S. Forest Service) reclamation of Resurrection Creek and its riparian area does not demonstrate the technological feasibility of restoring the Chuitna drainage after strip mining because the type and extent of mining was very different. Resurrection Creek is approximately 25 miles long. All five species of Pacific salmon are found in Resurrection Creek. Salmon spawning and rearing has been documented from tide water to river mile 18. Placer mining operations altered the stream channel and the riparian area of Resurrection Creek from approximately river mile 2 to river mile 6.5 (U.S. Forest Service, 2002). Although, little pre-mining information is available it is likely that Resurrection Creek was a productive salmon spawning and rearing stream and the heavily mined section may have contained the best spawning and rearing habitat (Blanchet, 2011). The portions of Resurrection Creek above and below the mined area were largely undisturbed. In the heavily mined area placer miners straightened and lowered the Creek, destroyed the riparian area, and washed the organic material into the Creek (Blanchet, 2011; U.S. Forest Service, 2002; and Wild Fish Initiative, 2006). The Resurrection Creek stocks of spawning salmon had access to all areas of the Creek even during mining. The watershed wasn't mined; only 4.5 miles of the Creek bed and portions of the flood plain. Because placer mining did not penetrate bedrock/aquitards underlying the Creek the aquifers providing phreatic and hyporheic flow to Resurrection Creek and its tributaries did not require restoration (McFarland, 2011; U.S. Forest Service, 2002; and U.S. Forest Service, 2007).

The U.S. Forest Service projects to restore channel stability, create off-channel rearing habitat, level tailings piles, introduce large woody debris, and revegetate riparian areas in the 4.5 miles of Resurrection Creek that was altered by placer mining do not demonstrate the technological feasibility of restoring the Chuitna watershed and its salmon spawning and rearing streams to pre-mining levels of productivity. The USFS did not need to construct a new watershed, revegetate the watershed, construct new aquifers, and create new wetlands. Only a relatively small portion of the Resurrection Creek bed and riparian area were mined, compared to the 20,571 acre Chuitna coal lease area and the 5000 acres of the watershed proposed to be strip mined and then restored by PacRim (NMFS, 2007). Because the Resurrection River was never blocked all genetically distinct salmon stocks in Resurrection Creek are likely still present albeit in smaller numbers. This is much different from the PacRim Chuitna mining proposal where access to spawning and rearing areas would be blocked for decades. The USFS did not have to build a stable fully functioning stream on top of 300 feet of mine overburden as would be required if strip mining is permitted in the Chuitna River drainage. Comparing the difficulty of the work necessary to reclaim the 4.5 mile section of Resurrection Creek that was placer mined with the difficulty of reconstructing strip mined watersheds in the Chuitna drainage is akin to comparing the work required to restore a car after a severe accident with that required to building a new car from raw steel and rubber.

U.S. Forest Service reclamation to improve fish habitat in Resurrection Creek is laudable but does not demonstrate that reclamation of streams in the Chuitna watershed and compliance with the following Alaska Surface Coal Mining Regulations is technologically feasible for the following reasons:

1. *Restoring a strip mined watershed and associated anadromous waters to the uses which they were capable of supporting before any mining;* The Resurrection Creek watershed wasn't strip mined. A 4.5 mile section of Resurrection Creek and its flood plain were placer mined which, although very destructive, is a much lower level of disturbance than strip mining which would remove all features in the Chuitna watershed down to a depth of 300 feet below present stream level. The U.S. Forest Service has improved spawning and rearing fish habitat in the 4.5 miles of Resurrection but probably not to pre-mining levels (Blanchet, 2011).

2. *Avoiding long-term adverse changes in the hydrological balance in the permit area and adjacent area's;* Placer mining caused long term adverse changes in surface flow by lowering and straightening Resurrection Creek. However, because placer mining was limited to a very small portion of the watershed, and did not penetrate bedrock below the flood plain, ground water flow to the Creek was not altered (Blanchet, 2011 and McFarland, 2011). No aquifers were destroyed or reconstructed in the Resurrection Creek drainage.

3. *Minimizing changes in water quality and quantity, in the depth and flow pattern of ground water, and in the location of surface and subsurface water drainage can so that salmon spawning and rearing are not adversely impacted;* For reasons previously discussed placer mining in Resurrection Creek seriously impaired water quality and altered surface flow but apparently did not alter ground water depth and flow patterns (McFarland, 2011). The U.S. Forest Service has attempted to improve salmon spawning and rearing in the mined area in a 4.5 mile section of Resurrection Creek by stabilizing the channel, creating off channel rearing habitat, revegetating the flood plain and placing large woody debris in the channel for cover. Because the watersheds, existing salmon streams, and the existing shallow and deep aquifers in the Chuitna drainage would be completely destroyed by strip mining, changes in water quantity, the depth and flow patterns, of ground water, and the location and the location of surface and ground water would not be minimized and current salmon spawning and rearing areas would be destroyed.

4. *Conducting strip mining for coal so as to restore the capacity of the area as a whole to transmit water to the ground water system supporting salmon spawning and rearing;* there was no strip mining in the Resurrection Creek drainage, and as a result no need to attempt to restore aquifers throughout the drainage which would be disrupted by strip mining.

5. *Minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and enhanced these values where practical;* placer mining in Resurrection Creek did not minimize disturbances or adverse impacts.

6. *Restore the recharge capacity to a condition that supports salmon spawning and rearing in reconstructed streams*. Resurrection Creek was not strip mined so the U.S. Forest Service did not have to attempt to restore the recharge capacity.

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ADNR Decision 178: Clear Creek

Historically, lower Clear Creek in California supported populations of fall-run, late fall-run and, to a lesser extent, spring-run Chinook salmon (*Oncorhyncuhus tshawytscha*) and steelhead (*Orcorhynuchus mykiss*). The latter two populations are presently extirpated from the stream. The cumulative effects of placer mining, gravel extraction, dams, timber harvest, developments, and roads in the lower Clear Creek watershed have led to degradation of stream channel and riparian conditions and the decline of the lower Clear Creek fishery (Wildfish Habitat Initiative, 2011).

Restoration included returning Clear Creek to a more natural meandering course and pits and ponds that once stranded out migrating juvenile salmon were eliminated. A dam was removed. Some riparian areas were replanted. Floodplains were repaired to allow the stream to respond to, and recover from high water flows (U.S. Bureau of Land Management [BLM], 2006). Gravel needs to be added to Clear Creek in perpetuity to replace alluvial material which has been lost because of gravel mining and dams (Wildfish Habitat Initiative, 2011).

The impacts to Clear Creek and the reclamation projects described in the literature have little relevance to the magnitude of watershed disruption and reclamation challenges presented by strip mining anadromous streams and their drainages in the Chuitna River drainage. Clear Creek and its drainage was not strip mined so the aquifers feeding the r Creek were not detached from the Creek (Wildfish Habitat Initiative, 2011 and NSR/ McBain&Trush/Matthews&Associates, 2000). One of the biggest impacts to salmon spawning was the construction of two dams and gravel mining in the flood plain which robbed Clear Creek of aggregate needed to replenish spawning gravels (Wildfish Habitat Initiative, 2011). Because of the dams and depletion of flood plain gravel, gravel will need to be added to Clear Creek in perpetuity. Gravel is purchased and dumped into Clear Creek annually to replace spawning gravel that is washed downstream (Brown, M. and J. De Staso, 2005).

The climate in the Clear Creek drainage is Mediterranean, subsequently there is no danger of salmon redds and rearing salmon fry freezing out in the winter. In contrast the Chuitna River drainage has a very cold climate. There are 5 months of below freezing weather in the winter where stream flow and juvenile salmon and egg survival is solely dependent on the uninterrupted flow of ground water.

Although reclamation has improved fish habitat in Clear Creek California, it does not demonstrate that compliance with the following Alaska Surface Coal Mining Regulations is technologically feasible for the following reasons:

1. *Restore a strip mined watershed and associated anadromous waters to the uses which they were capable of supporting before any mining;* The Clear Creek watershed was not strip mined. The BLM did not have to attempt to reconstruct an entire drainage and a functioning salmon stream on top of 300 feet of mine overburden. One of the biggest impacts to salmon spawning was the construction

of two dams and gravel mining in the flood plain which robbed Clear Creek of flood flows and gravels needed to replenish spawning beds (Wildfish Habitat Initiative, 2011). Because of the dams and depletion of flood plain gravel, gravel will have to be added to Clear Creek in perpetuity. Clear Creek is not really restored because gravel has to be purchased and dumped into Clear Creek annually to replace spawning gravel that is washed downstream (Brown, M, and J. De Staso, 2005). This system is being maintained artificially.

2. *Avoiding long-term adverse changes in the hydrological balance in the permit area and adjacent area's;* Long term adverse changes were not avoided because the construction of dams and gravel mining robbed Clear Creek of the natural flow of essential spawning gravel. Gravel mining is very different than strip mining because it only removes the alluvium above underlying aquitards and does not penetrate or disrupt them. However, because gravel mining did not penetrate bedrock and the hardpan below the flood plain, ground water flow to Clear Creek was not curtailed (NSR/McBain&Trush/Matthews&Associates, 2000). No aquifers were reconstructed during reclamation.

3. *Minimizing changes in water quality and quantity, in the depth and flow pattern of ground water, and in the location of surface and subsurface water drainage can so that salmon spawning and rearing are not adversely impacted;* For reasons previously discussed, gravel mining and dam construction in Clear Creek seriously depleted stream gravel, and made stream channels wider and shallower but did not alter ground water quantity, depth and flow patterns. The BLM has attempted to improve salmon spawning and rearing in the mined area in Clear Creek by restoring the stream channel, revegetating portions of the flood plain and placing root wads to retard stream bank erosion and provide cover for juvenile salmon.

4. *Conducting strip mining for coal so as to restore the capacity of the area as a whole to transmit water to the ground water system supporting salmon spawning and rearing;* there was no strip mining for in the Clear Creek drainage, and as a result no need to attempt to restore ground water discharge disrupted by strip mining.

5. *Minimize disturbances and adverse impacts on fish, wildlife, and related environmental values and enhanced these values where practical;* placer mining, gravel extraction, dams, timber harvest, developments, and roads in the lower Clear Creek watershed were not conducted in a manner which minimized disturbances and adverse impacts to fish, wildlife, and enhanced those values

6. *Restore the recharge capacity to a condition that supports salmon spawning and rearing in reconstructed streams*. Clear Creek was not strip mined so the BLM did not have to attempt to restore the recharge capacity of the Clear Creek drainage.

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ADNR Decision 179 Silver Bow Creek Butte Montana

Cleanup and remediation of toxic mine waste in the Silver Bow Creek drainage does not demonstrate the technical feasibility of strip mining a drainage and recreating a watershed, shallow and deep aquifers, and a productive salmon spawning and rearing stream on top of 300 feet of mine overburden Silver Bow Creek and its drainage was not strip mined. Silver Bow Creek was used as a conduit for mining, smelting, industrial, and municipal waste for more than a hundred years (EPA, 2011). Resident fish, other aquatic life, and riparian vegetation originally found in and along the Creek were killed by acid mine drainage and heavy metals leaching from vast piles of mine tailings piles dumped in and along Silver Bow Creek (EPA, 2011, and Montana Department of Environmental Quality [DEQ], 2009). Both surface and ground waters were contaminated with toxic levels of copper, zinc, cadmium and lead. Municipal sewage from Butte Montana also contributed to the pollution of Silver Bow Creek. EPA declared the area as a superfund site in 1983 and subsequently obtained a $215 million dollar settlement from ARCO.

Remediation of Silver Bow Creek included removal of 4.5 million cubic yards of contaminated mine tailings from the creek bed and riparian area, Clean fill material was brought in to construct a 200-400 foot wide flood plain and a low flow meandering stream channel (TT Strategic Media, 2011). The flood plain and stream banks were revegetated. In 2008 electro fishing at six locations captured hundreds of suckers and four trout (Montana DEQ, 2008).

The Silver Bow reclamation project has little relevance to the reconstruction challenges presented by proposed strip mining in the Chuitna drainage. Silver Bow Creek was not strip mined, it was poisoned by heavy metals and acid mine drainage. There never were any anadromous salmon (*Onchoryncus* sp.) in Silver Bow Creek. The life history and habitat requirements of the freshwater suckers and trout currently inhabiting Silver Bow Creek are very different than anadromous salmon (Raleigh, et al, 1984 and Edwards,. 1983). The Creek's aquifers and ground water supply were contaminated, but not destroyed. The aquifers did not have to be constructed. Remediation undoubtedly improved Silver Bow Creek which was devoid of aquatic life, but it has not been restored to its pre-mining condition. According to Joel Chavez, Montana DEQ project manager, "it is not a thriving fishery or a blue ribbon trout stream but it's evident that the work we have been doing is helping" (Montana DEQ, 2008).

Given the extensive differences in the Silver Bow restoration project compared to the type of reclamation necessary to reclaim streams mined in the Chuitna watershed, the Silver Bow restoration project fails to provide any support that reclaiming streams and restoring pre-mining fish productivity in the Chuitna watershed from coal strip mining is technologically feasible.

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ADNR Decision 180: Consol Energy's Burning Star 4 Mine, and Pipestone Creek Reclamation

Other than the fact that both Consol Energy's Burning Star No. 4 mine, and AMAX's Pipestone Creek were former strip coal mines there is no similarity between the reclamation at these mine sites and the reclamation challenges presented by PacRim's proposal to strip mine coal on 5000 acres of the Chuitna River drainage. The Burning Star No. 4 mine and Pipestone projects are located in southern Illinois. According to the Consol website approximately 3,200 acres of land that previously contained wetlands and prime farmland were reclaimed. The highlight of this project was the restoration of more than 148 acres into wetlands, and the reestablishment of 1,400 acres of cropland (Consol Energy, 2011). For the first time in Illinois two major streams in a minefield were diverted during mining and then restored to their original locations and reclaimed as a habitat for ***wildlife and waterfowl***. (Consol Energy, 2011 and Nawrot et al, 2010 and Illinois Department of Natural Resources, 2010). The primary fish species within the reclaimed mine area are largemouth bass (*Micropterus salmoides*), bluegills (*Lepomis marochirus*), and catfish (*Ictalurus* sp.) - all warm water species.

Restoration on the AMAX Pipestone project in began in the 1980's and continued to the 1990's. The Pipestone mine was reclaimed to wetlands, ponds, lakes and farmland. According to a monitoring report the reclaimed section of Pipestone Creek is a low gradient turbid warm water stream which according to post-restoration reports supports brook silverside and blackstripe top minnow (Illinois Department of Natural Resources, 2010).

Reclamation at the Burning Star 4 and Amax Pipestone mines does not support Commissioner Sullivan's finding that it is technologically feasible to restore salmon producing steams, and their associated drainages and aquifers in the Chuitna watershed to pre-mining level of productivity after strip mining. Reclamation at these mines also does not demonstrate compliance with the following Alaska Surface Coal Mining regulations:

1. Restoring a strip mined watershed and associated anadromous stream to the uses which they were capable of supporting before any mining. There are no salmon in the warm water streams in the Burning Star No. 4 and Amax Pipestone mine areas. The literature for Burning Star No. 4 indicates that the primary species in the former mine area are largemouth bass, bluegills, and channel catfish. Only brook silverside and blackstripe top minnow, which are warm water fish were identified in the monitoring report for the Pipestone Project. These species could not survive or reproduce in the Chuitna River drainage. Similarly salmon could not survive or reproduce in southern Illinois streams because the habitat and water quality is not suitable. The mined lands were restored to farmland, and wildlife and water fowl habitat, not salmon spawning and rearing habitat. The land in Illinois is generally flat with well developed soils, unlike Chuitna which is mountainous with poorly developed soils. The climate at Chuitna is also much colder and the winters are much longer. There are three months (December-February) with below freezing weather conditions in Illinois. Average monthly lows range from 29 degrees (Fahrenheit) in December to 28 degrees

(Fahrenheit) in February. The Chuitna drainage has over 5 months of below freezing weather. Temperatures range from an average of 16.5 degrees (Fahrenheit) in December to 25.5 degrees (Fahrenheit) in March. Long months of below freezing temperatures eliminate surface flow. Long cold winter makes it critical that the flow of phreatic ground water to streams supporting developing salmon eggs and larvae is maintained, whereas this is not an issue in Illinois or Indiana.

2. Avoiding long-term adverse changes in the hydrological balance in the permit area and adjacent area's; The literature on these mines that I was able to find did not indicate that the hydrological balance in restored stream had been restored, but that they were in a "long-term geomorphological and biotic recovery process." (Nawrot et al, 2010).

3. Minimizing changes in water quality and quantity, in the depth and flow pattern of ground water, and in the location of surface and subsurface water drainage can so that salmon spawning and rearing are not adversely impacted. There are not now and never were salmon spawning and rearing in the streams in the mining areas. The climate, streams, substrate, water temperatures etc are all unsuitable for salmon.

4. Conducting strip mining for coal so as to restore the capacity of the area as a whole to transmit water to the ground water system supporting salmon spawning and rearing; No information was provided as to how or if the capacity of the area to transmit water to the ground water system was restored. However, because the life history and habitat requirements of the fish species found in southern Illinois are completely different (i.e. they do not depend on upwelling ground water for spawning or overwintering) it may not have been an issue.

5. Minimizing disturbances and adverse impacts on fish, wildlife, and related environmental values and enhanced these values where practical. Because of the nature of strip mining it is very difficult to minimize impacts to fish and wildlife populations since they are all removed during mining.

6. Restoring the recharge capacity to a condition that supports salmon spawning and rearing in reconstructed streams. None of the citations provided by ADNR indicated how or if the recharge capacity was restored. There are no salmon in streams in these mining areas. The warm water fish species found there have completely different life histories and habitat requirements than salmon and do not require upwelling ground water for spawning or overwintering.

For the aforementioned reasons reclamation at these two mines does not demonstrate that reclamation of salmon producing drainages in the Chuitna watershed, that restoration of fish productivity to pre-mining levels and that compliance with Alaska Surface Coal Mining regulations is technologically feasible after coal strip mining.

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Conclusion

None of the projects cited by Commissioner Sullivan in his rejection of the Unsuitability Petition demonstrate the technological feasibility of reconstruction of a salmon producing drainage with its associated riparian areas, aquifers and wetlands, and the creation of an entirely new salmon spawning and rearing stream with its associated confined and unconfined aquifers on top of 300 feet of porous mine overburden. Furthermore the projects cited by ADNR fail to demonstrate strip mining through streams in the Chuitna watershed is consistent with the requirements of the Alaska Surface Coal Mining Control and Reclamation Act Regulations regarding avoidance of impacts and reclamation. The strip mines used as examples by ADNR did not impact or restore anadromous salmon stocks or their habitat. Strip mining has much greater impacts on anadromous salmon habitat than the placer mines cited by ADNR. Restoration of a strip mined salmon producing drainage would be exponentially more difficult than grading dredge spoils, revegetating stream banks, and attempting to confine an unstable placer mined stream to a single channel. In fact there is no evidence in ADNR's rejection of the Unsuitability Petition or anywhere in the scientific literature that a strip mined salmon stream and its drainage have ever been recreated on top of several hundred feet of mine overburden. Reviewers need to keep in mind that all of the techniques cited as examples by ADNR including riparian revegetation, spawning channels, fertilization, channel relocation, channel reconstruction etc. were developed in the Pacific Northwest and British Colombia in an attempt to halt or reverse the continuing decline of anadromous salmon populations. None of these techniques have succeeded even though hundreds of millions of dollars have been spent on reclamation. If the techniques cited by ADNR worked they would have been used everywhere and salmon populations would be increasing. The problem is that from a salmon habitat perspective, the effect of permanent landscape changes such as the deep strip mining proposed for the Chuitna River drainage probably cannot be reversed (Lackey, 2000).

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