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Subject:	Scoping Comments for the Proposed Donlin Gold Mine
Date:	Friday, March 29, 2013 7:54:33 AM
Attachments:	CO2 sequestration in mine tailings - Harrison et al 6Jul12.pdf Env Accounting for Pollution - Muller Mendelsohn Nordhaus May09.pdf Miller M & Gustin M - Reducing Non-Point Hg Emissions - Draft 17Dec12.pdf Air Sensors 2013 conference - EPA Mar13.pdf CSP2 Perpetual Treatment Position Paper - Chambers Jun07.pdf Net Public Benefits Chuitna Coal Mine - Talberth & Branosky Sep11.pdf Smith(2012)-Diavik waste rock project-feild scale waste rock piles.pdf Technologies for Selenium Removal - CH2MHill Jun10.pdf DEIS Scoping Comments - CSP2 29Mar13.pdf

Attached are scoping comments, with reference documents. I will send a follow-on message which contains one additional reference: "Nevada Bureau of Mines and Geology, Report 52 Assessment of the Potential for Carbon Dioxide Sequestration by Reactions with Rocks in Nevada, Daniel M. Sturmer, Daphne D. LaPointe, Jonathan G. Price, Ronald H. Hess, 2007; and, Accelerated Carbonation of Brucite in Mine Tailings for Carbon Sequestration, Anna L. Harrison, Ian M. Power, and Gregory M. Dipple, Environmental Science & Technology, 2013." This is a large file, 9 MB, and I am not sure if your email system will accept a file that large.

Please let me know if you have any difficulty in opening the attached documents.

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March 29, 2013

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RE: Scoping Comments for the Proposed Donlin Gold Mine

The Center for Science in Public Participation provides technical advice to public interest groups, non-governmental organizations, regulatory agencies, mining companies, and indigenous communities on the environmental impacts of mining. CSP2 specializes in hard rock mining, especially with those issues related to water quality impacts and reclamation bonding.

Our comments fall into three general areas: (1) Alternatives and scenarios that should be included in the Draft Environmental Impact Statement (DEIS); (2) Clarification; and, (3) Transparency.

Alternatives and scenarios to include in DEIS

The Donlin Gold mine is proposed in one of the most pristine areas in Alaska, in the midst of an intact and vibrant Yup'ik culture. These people will be affected whether the mine goes in or not. Therefore, DEIS alternatives need to include state of the art protections against contamination of their environment, and the most accurate assessments of the current monetized and non-monetized economies.

Value

In addition to traditional assessments of jobs and economic benefits, an ecosystem services valuation needs to be conducted to accurately assess the value of the environment under a No Mine alternative.[1] This valuation will also assist when an Environmental Accounting is conducted; an Environmental Accounting follows standard procedures to determine the actual benefits provided during the life of the mine compared to the economic damage. Providing an

[1] For an example of an ecosystem services valuation, see Net Public Benefits of the Chuitna Coal Project, A Preliminary Assessment, John Talberth and Evan Branosky, Center for Sustainable Economy, September, 2011

Ecosystem Services valuation and an Environmental Accounting[2] will provide the most accurate assessment of the value of mining activities, and could also be of benefit to local residents if accidents occur and they request compensation. That is, it will help provide a baseline of current economics, and future economics under Mine Alternatives or a No Mine alternative.

Valuation assessments should also include scenarios with realistic carbon taxes, to provide a better sense of the boundaries of the profitability of the mine.

These economic assessments should include the scenario in which the mine goes through an interim closure period due to low metal prices and/or high transport/energy prices. Bonding should similarly be assessed with and without an interim closure scenario, with a goal of maintaining contaminant treatment operations (e.g. water treatment plant, dust control, etc.).

Construction rock

Rock will be needed to construct the tailings dams, roads, pad for the TSF, and other mine facilities. This will come from waste rock. Scoping documents discuss four types of Non-Acid Generating (NAG) rock, based on potential to generate acid and/or leach arsenic.[3] Nearly all the rock, except for NAG 1 and NAG 3, has the potential to leach arsenic. The concern is great enough that scoping documents discuss putting a liner on the outer face of the TSF dam, to reduce leaching.

Despite the risk of leaching arsenic, the four NAG types are treated the same throughout the scoping documents, as “NAG 1-4”. No material with a high potential to leach arsenic should be used in construction. The DEIS alternatives need to provide a scenario in which only NAG 1 and NAG 3 are used in construction, and provide information on the volume of NAG 2 and NAG 4 rock that would go into the waste rock facility – how would that change the economics and waste management plans?

Additionally, kinetic tests should be continued throughout the life of the mine. Rock material is managed so that it poses a low risk during the anticipated 27.5 years of mine life. However, if there is an interim closure, the rock could be in place much longer than anticipated. Continuing kinetic tests on both Potentially Acid Generating (PAG) and NAG rock will help operators understand the potential risks, and be ready to mitigate for them, should there be an unexpected shut down.

[2] Environmental Accounting for Pollution: Methods with an Application to the United States Economy, Nicholas Muller, Robert Mendelsohn, and William Nordhaus, May 26, 2009

[3] Waste Rock Management Plan, Donlin Gold Project, Table 3-3: Donlin Gold Waste Rock Management Categories (SRK 2011), p. 3-7.

Waste Rock Management

Portions of the waste rock at Donlin have the potential to generate acid drainage, as well as to leach metals at neutral pH. Consultants for Donlin have developed a waste rock management plan that involves "blending" various categories of waste rock to neutralize any acid that will be generated. There are two significant issues raised by waste rock blending that should be addressed in the DEIS.

NP/AP Ratio: First, categorizing the waste rock as Potentially Acid Generating (PAG) or Non Acid Generating (NAG) is an inexact science. Most experts agree that rock with a ratio of Neutralizing Potential (NP) to Acid-Generating Potential (AP) of 3:1 or greater is not likely to produce acid. Most experts also agree that rock with an NP/AP ratio of 1:1 or below will produce acid. Rock with an NP/AP ratio between 1:1 and 3:1 is generally treated as having 'uncertain' potential to produce acid.

Donlin's consultant, SRK, has chosen to define rock with an NP/AP ratio of 1.3:1 or greater as Non-Acid Generating. This leaves little margin between what is widely accepted as PAG (1:1) and the value Donlin has chosen to define as NAG (1.3:1). If this choice for the differentiation of PAG/NAG is not correct, of if the rock is not correctly placed and 'blended' during mine operation, acid drainage could be a problem in the long term.

The agencies conducting the EIS should not accept the Donlin/SRK determination at face value. They should engage in a rigorous review of this determination to insure that the determination between PAG/NAG waste rock is conservative, and will not constitute a potential long term risk of the rock going acid – which could produce contaminants which would be very expensive to collect and treat.

Waste Rock Blending: Second, the waste rock management plan depends on 'blending' NAG waste rock with PAG waste rock to neutralize and acid produced. Blending waste rock to prevent acid drainage has a spotted history. In addition to this fundamental issue with blending, it is noted in the Donlin Waste Rock Management Plan that:

> *"… the quantity of PAG 5 waste rock is considered to be within the range that could be accommodated by blending with NAG 1-4 rock to create an overall mixture that does not produce ARD. However, for the blended approach described in Section 4.3 below to be successful in mitigating ARD, waste rock must be managed to ensure that PAG 5 and NAG 1-4 waste rock is* ***intimately mixed at a small enough scale. This has been confirmed by water quality predictions*** *based on HCT results that indicate acidity is mitigated by reaction with acid-consuming minerals for well-mixed conditions (SRK 2007).*[4] *(emphasis added)*

[4] Plan of Operations, Integrated Waste Management Plan, Waste Rock Management Plan, Donlin Gold Project, prepared by SRK Consulting (U.S.), Anchorage, AK, July 2012, p. 3-8

It is not clear from the Waste Rock Management Plan what "intimately mixed" means and how this will be accomplished for millions of tons of PAG and NAG waste rock (the SRK report is not publically available). The DEIS should rigorously investigate this very important operational requirement, especially since it must be implemented for millions of tons of material over several decades of operation of the mine.

In the DEIS there should be a review of both the theoretical requirement for blending, and the quality assurance requirements for insuring the theoretical requirement is met over the life of the mine.

Pumping system

A complex system of pipelines is proposed to transport fresh water, groundwater from dewatering wells, waste rock facility leachate, tailings storage facility slurry, and process water. The DEIS should discuss whether reducing the length and number of pipelines would increase the risk (less redundancy to accommodate failures) or reduce the risk (fewer places to fail). An alternative that includes insulating pipes that carry contaminants should be included in the DEIS.

Contaminants

Industrial mining operations only market less than 1% of the material they move, and should be considered foremost as waste treatment plants, paid for by the bit of metal at the end that can be sold. With this in mind, although the Donlin ore is primarily hosted in arsenopyrite (FeAsS), the waste is complex. The mined rock will be divided into seven different categories, four different types of Non-Acid Generating rock (NAG) and three types of Potentially Acid Generating rock (PAG). These materials will leach a variety of contaminants. Additionally, the groundwater that needs to be pumped to lower the water table so that mining can take place, particularly the deep groundwater, contains constituents that exceed water quality standards.

All told, 115 wells will be pumping deep and shallow groundwater away from the pit area, while billions of tons of rock are mined, crushed, and eventually deposited as waste rock or tailings across several square miles. All told, the crushed rock and pumped water will release arsenic (As), aluminum (Al), iron (Fe), manganese (Mn), antimony (Sb), molybdenum (Mo), selenium (Se), lead (Pb), cadmium (Cd), copper (Cu), nickel (Ni), zinc (Zn), mercury (Hg), silver (Ag), sulfate (SO4), and total dissolved solids (TDS). Additionally, there are processing chemicals such as cyanide, ammonia, and nitrate that will enter the tailings storage facility (TSF).

Eventually, all of these contaminants need to be moved through a water treatment plant and discharged to Crooked Creek. It appears that one Water Treatment Plant (WTP) is planned to run during operations, primarily to treat dewatering well water, and a different one is to run after closure to treat pit lake water. There is no one technology that will sufficiently reduce these materials to the most stringent water quality standards. Factors such as pH and cyanide complicate treatment.

The scoping documents mention that treatment will be based on a High-Density Sludge (HDS) lime system. The neutral-alkaline pH of HDS will precipitate metals such as iron, manganese, copper, cadmium and zinc, and is essential in the TSF to keep cyanide from off-gassing as toxic hydrogen cyanide. However, the metalloids arsenic, antimony, molybdenum, and selenium do not precipitate, they mobilize. Additionally, cyanide in the TSF will keep mercury and selenium dissolved.

The scoping documents address the complex mix. Ferric sulfate is added to precipitate arsenic, Octolig resin columns are to assist in removal of selenium, and UNR reagent 829 is to assist with mercury removal. However, with regards to selenium, iron co-precipitation is not sufficient to treat it to the low levels required for disposal into a creek, and the proposed Octolig columns appear to be completely untested.[5] With regards to mercury, the UNR reagent seems to have not performed well on TSF water, although it performed better with filtrate. There is no mention of treatment for ammonia.

Given the risks that contamination of air and water pose in this region, DEIS alternatives should assess the technologies in the scoping documents, and identify and assess additional wastewater treatment technologies. An alternative should be provided that employs redundant and backup water management and treatment systems.

DEIS mine scenarios alternatives need to consider that mine technology evolves over time, and allow for the inclusion of, but not sole reliance on, evolving science in contaminant monitoring, water management, and waste management. The following are examples of innovative technologies that could currently be employed, and should be assessed in mine alternatives in the DEIS.

- Thermistors, lysimeters, and gas detectors should be installed during construction of the Waste Rock Facility (WRF) to track potential acid development, and thermistors and lysimeters installed around the tailings facility and roads to track potential changes in permafrost and freeze/thaw cycles that could impact mine operations.

- Passive air monitors[6] should be placed around the mine footprint, with placement guided by local knowledge. This is an innovative application of air monitors, but could be part

[5] Sandy, T and C DiSante. 2010. Review of available technologies for the removal of selenium from water for North American Metals Council. CH2M Hill. http://www.namc.org/docs/00062756.PDF
[6] Next generation air monitoring workshop series, USEPA Research Triangle Park, NC, March, 2013.

of assessment of new technology to manage fugitive emissions,[7] particularly in mines that emit mercury.[8]

- CO2 capture with tailings. Donlin Gold LLC has shown an interest in innovative technology (e.g. use of the untested Octolig columns for selenium removal; application of UNR reagents for removal of mercury from tailings stream) and has also shown an interest in reducing carbon emissions through the use of natural gas and wind power instead of coal. The DEIS should include a discussion of the latest research into capturing CO2 in mine tailings, and particularly the chemical and mechanical details, [9] and economic scenarios (e.g. carbon tax), that make the technology potentially feasible or not feasible at the Donlin ore body. If the idea is feasible, Donlin Gold LLC should begin lab scale testing with site rock, or engage in a partnership with researchers currently studying CO2 capture. If it is not feasible, a detailed explanation of why it is not needs to be provided in the DEIS.

- Technologies that potentially reduce fugitive mercury emissions should be employed. A recent report noted that covering tailings and heap leaches (should they be constructed in the future) tentatively reduces emissions, while using magnesium chloride as a dust suppressant tentatively increases emissions.[10]

- The current proposal for treatment of selenium in wastewater appears to rely on a new, untested technology (Octolig resin columns). While we encourage testing of innovative technologies, the mine alternatives need to provide proven treatment options and/or backup mitigations.

In addition, the DEIS should provide for a process of regularly assessing technology effectiveness and new technologies that could be employed.

Similarly, the DEIS should discuss the currently proposed water management and treatment technologies along with Mine Alternatives that include redundant systems for moving, managing, and treating water.

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[7] Blowes, D, L Smith, D Sego, J Bennett, and D Gould. 2005. Diavik mine waste project, progress update, March 29, 2005 for Gord MacDonald Diavik Diamond Mine

[8] Testing and modeling the influence of reclamation and control methods for reducing nonpoint mercury emissions associated with industrial open pit gold mines, Matthieu B. Miller, Mae S. Gustin, University of Nevada Reno, Journal of the Air & Waste Management Association, Draft, December 17, 2012.

[9] Nevada Bureau of Mines and Geology, Report 52 Assessment of the Potential for Carbon Dioxide Sequestration by Reactions with Rocks in Nevada, Daniel M. Sturmer, Daphne D. LaPointe, Jonathan G. Price, Ronald H. Hess, 2007; and, Accelerated Carbonation of Brucite in Mine Tailings for Carbon Sequestration, Anna L. Harrison, Ian M. Power, and Gregory M. Dipple, Environmental Science & Technology, 2013, 47, 126–134.

[10] Testing and modeling the influence of reclamation and control methods for reducing nonpoint mercury emissions associated with industrial open pit gold mines, Matthieu B. Miller, Mae S. Gustin, University of Nevada Reno, Journal of the Air & Waste Management Association, Draft, December 17, 2012.

- An alternative that includes two Water Treatment Plants (WTPs) so that one could be pulled online when the other undergoes maintenance or failures.

- An alternative that maintains an operational WTP continually from the start of the mine through perpetuity. The current proposal appears to include a decades-long interim after operations shut down but before the pit lake WTP comes online, even though runoff from the TSF cover may need to be discharged into Crevice Creek. It is not clear how TSF cover water will be managed if it does not meet water quality standards.

- The Draft EIS should include a closure plan complete with financial surety, including a financial surety for perpetual water treatment, since it appears that long-term/perpetual water treatment is probable.[11] While perpetual water treatment poses a significant long-term final risk to the public,[12] failure to provide a detailed analysis of mine closure costs and long-term water treatment costs would be a failure to disclose financial liabilities that will probably be hundreds of millions of dollars for the Donlin mine.[13]

- An alternative that considers the best models for climate change and how water would be managed and treated in a worst-case scenario.[14] For instance, how might this affect the proposal for a TSF seepage pond built to accommodate three days of seepage? How might rain-on-snow events affect water balance?

The DEIS needs to define a process for determining when the mine should be closed due to environmental contamination or health and safety hazards.

Mercury storage and transport

A forthcoming "mercury management plan" is referred to in scoping documents, but few details are provided. Mercury from ore processing will be captured in solid and liquid forms. There is no discussion of how this mercury will be stored or transported. The DEIS should describe the current mercury storage and management system in place by the Department of Defense, including multiple layers of containment. If Donlin mine operators intend to use a different storage and management system, the DEIS needs to describe in detail how it improves in the Department of Defense method.

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[11] Water Resources Management Plan, Donlin Gold Project Appendix B, p. B-7.
[12] A Position Paper on Perpetual Water Treatment for Mines, David Chambers, June 2007.
[13] "The total amount to cover reclamation / closure costs and post-reclamation and closure maintenance is estimated at $273.7 million, paid annually at $8.6 million over 32 years, including the construction period and 27-year life-of-mine." NovaGold Resources Inc. Donlin Gold Project, Alaska, USA, NI 43-101 Technical Report on Second Updated Feasibility Study, 20 January 2012, submitted by: Tony Lipiec, P.Eng., AMEC, Gordon Seibel, R.M. SME, AMEC; and, Kirk Hanson, P.E., AMEC, p. 1-6.
[14] Scenario Network for Arctic and Alaska Planning at http://www.snap.uaf.edu/

The DEIS should also describe a system of tracking mercury similar to the system currently in place to track cyanide.[15] Mercury captured at each point source should be logged; when, where, and how it is stored in a warehouse should be tracked; storage containers should be clearly labeled; and shipment should be clearly tracked clearly all the way to the receiver. No mercury should be disposed of on-site in a landfill or in the TSF. Mercury tracking should be sufficient to ensure that no disposal has occurred on-site.

The DEIS should evaluate the economic and environmental risks and benefits to barging the waste versus flying the waste out; flying it out could provide a much lower risk to the Kuskokwim River. If mercury were to be discharged into the Kuskokwim due to an accident, it would never leave the river system, but would remain in sediments and accumulate in the food web essentially forever. An evaluation of the actual and perceived risks posed could make flying a better option.

Clarity and Transparency

Clarity can be provided in the DEIS in two general aspects: through clarifying and improving information provided in the scoping documents, and through providing clear diagrams and maps of processes that the general public can easily understand.

Improving social cost/benefit information

The mining operation could potentially bring new or expanded cell and internet service to the area, and options for heating and electricity. The DEIS should discuss these potentials, and options/costs of ownership and maintenance of them after mine closure.

Impacts on employees during the closure and post-closure operations, such as the 38 years of TSF drain-down should also be discussed.

Diagrams

Visual diagrams make the project easier to understand. Visuals should be provided, including

- A series of diagrams showing the mine footprint every ten years, or at every major change in footprint (e.g. the steps in closing the TSF and WRF, startup of the pit lake WTP). For example, a series of diagrams could show pit advancement at 5 or 10 year intervals, including new groundwater wells, expected size and placement of waste rock piles as they grow or move (waste rock moves to the pit in year 20), expected size of TSF dams as they get successively larger, expected size of TSF pond/beach as it grows over the years. Another example would be diagrams to show closure operations over the years, as the WRF is reclaimed with gravel and organic material, the TSF is drained and

[15] http://www.cyanidecode.org/about-cyanide-code/cyanide-code

successively reclaimed with rock, gravel, and organic material, and mine facilities are removed.

- Physical layout of the water treatment plan, and a brief description of what occurs at each piece of equipment, similar to the diagrams of ore processing in scoping document section 2.3.
- Physical layout of the mercury abatement process, and a brief description of what occurs at each piece of equipment.
- Maps of groundwater wells should show depth of well and depth of sample collection, and wells should be color-coded to indicate whether they are in mineralized or unmineralized blocks.
- Maps of surface water sampling sites should have sampling locations color coded to indicate whether they represent sites draining undisturbed unmineralized locations, undisturbed mineralized locations, or disturbed/mineralized locations.

Monitoring

The long history of local knowledge of the environmental cycles should not be ignored, but rather should be tapped through a Citizen's Advisory Board for advice on monitoring, and for comments on whether and how cycles are observed to be changing. The establishment of a Citizen's Advisory Board should be included in the DEIS.

Scoping documents categorize surface waters as draining Background 1 (undisturbed, unmineralized), Background 2 (undisturbed, mineralized), or Baseline (disturbed or mineralized) areas. This is helpful, but we are then provided only with averages for water quality parameters.[16] Mineralized and non-mineralized sites are expected to have different water quality, and water quality changes seasonally. The DEIS should provide a section or Appendix that lists all the surface water and groundwater quality data for every site, by every date for the reader to understand the range of water quality, changes by season, and the number of samples at each site.

The long list of water chemistry analytes[17] should be sampled for on a monthly basis during the mine construction and early operation phase, and only reduced to quarterly sampling if several years of sampling indicate that quarterly sampling is sufficient to protect water quality; at that point, quarterly sampling should be scheduled by season to determine constituent concentrations at low flow, early snowmelt, late snowmelt, and summer flow. Sampling should not be reduced to the short list of analytes[18] until several years of operation indicate that the list is sufficient to

[16] Vol II Section 2.4.3, Figure 2-2, Table 2-8
[17] Vol IIIA QAPP Table 6
[18] Vol IIIA QAPP Table 5

protect water quality. Temperature needs to be added to the short list of analytes, and petroleum hydrocarbons need to be added to the long list.

The DEIS also suggests that cyanide is found in background water samples. Cyanide is analyzed as “total cyanide” and as “WAD-cyanide”, and false positives are not uncommon. In order to accurately determine the concentration of cyanide in water or soil, replicate samples and blanks should be run together every time, and the results of all should be reported – and available on request by regulators and local governments – if cyanide is detected.

Water chemistry sampling relies on the concentrations of individual analytes to determine water quality. However, mixes of chemicals can have effects that single analyte concentrations do not. In addition to the lists of analytes, benthic community sampling and Whole-Effluent Testing (WET) should be included on a quarterly basis, with sampling conducted seasonally at low flow, early snowmelt, late snowmelt, and summer, or as guided by a local Citizen’s Advisory Board. Benthic and WET testing are key indicators of stream health as a whole, even if the specific reasons for decline are not determined. Sample site locations should be consistent throughout the project, and not moved downstream over time.

Documents

Material referenced in the scoping documents should be made available electronically on the Donlin EIS website, and made available as hard copies on request. Some of these include:

- BGC Engineering Inc., 2011. Donlin Creek Gold Project Feasibility Study Update II, Tailings Storage Facility Design, Final Report, July 22.
- BGC Engineering Inc., 2011. Donlin Creek Gold Project Feasibility Study Update II, Water Management Plan, Final, July 22.
- BGC Engineering Inc., 2011. Donlin Creek Gold Project Feasibility Study Update II, Conceptual Hydrologic Model, Final, July 22.
- BGC Engineering Inc., 2011. Donlin Creek Gold Project Feasibility Study Update II, Waste Rock Facility Design, Final Report, July 22.
- HMH Consulting, LLC. 2004. Donlin Creek Project Year 2003 Baseline Surface Water Monitoring Report.
- Lorax Environmental, 2011. Donlin Creek Gold Project Feasibility Study Update II, Pit Lake Modeling Assessment, Draft, June.
- SRK Consulting (U.S.), Inc., 2007. Waste Rock Metal Leaching and Acid Rock Drainage Assessment for Feasibility Study, Donlin Creek Project, Alaska, September.
- SRK Consulting (U.S.), Inc., 2011. Metal Leaching and Acid Rock Drainage Assessment for Feasibility Study – Donlin Creek Project, Alaska Update Report, February.
- SRK Consulting (U.S.), Inc., 2012. Donlin Gold Project Reclamation and Closure Plan, July.

- Other documents on baseline studies of water, fish, wildlife (including birds), soil, air, and vegetation

<u>Summary</u>

The DEIS should include Alternatives, including analysis of true value and costs of the mining operation; an analysis of the risks of using NAG 2, NAG 4, and PAG rock in construction; alternatives to reduce risks of contamination during pumping system failures; innovative waste and wastewater management backed up by proven technologies; redundancy in treatment technologies and treatment plants; pro-active monitoring of soil temperature and air quality; adequate water sampling analytes and sampling frequency; scenarios for water management based on climate modeling; well-considered no mine and interim mine closure alternatives; and alternatives for hazardous waste tracking, storage, and transport.

The DEIS should provide more information on the social effects of transition from construction to operations to closure.

The DEIS should provide full information on water quality data, and all referenced material should be made available electronically.

A key concept the DEIS should evaluate is the formation of a Citizen’s Advisory Board to provide a venue for full inclusion of local views and knowledge.

Thank you for the opportunity to comment on this permit.

Sincerely:

David M. Chambers, Ph.D., P. Geop.