From: Hayes, Miriam (Nicole) <mnhayes@blm.gov>
Sent: Thursday, March 14, 2019 8:49 AM
To: coastalplainAR; Sean Cottle
Subject: Fwd: [EXTERNAL] Comment letter on DEIS for ANWR
Attachments: DEIS_CommentLetter_JanetJorgenson_3-2019.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Nicole Hayes
Project Coordinator
Bureau of Land Management
222 W. 7th Avenue #13
Anchorage, Alaska 99513
Desk: (907) 271-4354
Cell: (907) 290-0179

---------- Forwarded message ---------
From: **Jorgensons** <jorgenson@alaska.net>
Date: Wed, Mar 13, 2019 at 9:42 PM
Subject: [EXTERNAL] Comment letter on DEIS for ANWR
To: <mnhayes@blm.gov>

Hello, My comment letter is in the attached pdf file. Thank you for considering my comments and suggestions. Janet Jorgenson

LETTER FROM JANET C. JORGENSON, RETIRED U.S. FISH AND WILDLIFE SERVICE BOTANIST, FAIRBANKS, ALASKA, FOR PUBLIC COMMENT PERIOD ON DEIS FOR ARCTIC NATIONAL WILDLIFE REFUGE, MARCH 2019

THE DEIS DOES NOT INCLUDE THE INFORMATION AND ANALYSIS NEEDED

The DEIS does not include enough information and analysis to meet NEPA requirements. In Appendix F "Approach to the environmental analysis", the DEIS says 'CEQ regulations require that agencies "rigorously explore and objectively evaluate" the impact of all alternatives.' In the DEIS abstract it says "the Leasing EIS considers and analyzes the environmental impact of various leasing alternatives, including the areas to offer for sale, and the indirect impacts that could result in consideration of the hypothetical development scenario. The alternatives analyze various terms and conditions (i.e., lease stipulations and required operating procedures [ROPs]) to be applied to leases and associated oil and gas activities ". Elsewhere, "Stipulations and ROPs provide basis for analyzing the potential impacts". But the DEIS as written does a poor job of evaluating the alternatives. A sparse amount of information is provided, with very uneven coverage between different topics, and then little or no analysis is done. The different impacts to be expected from each alternative are seldom given or compared between alternatives.

The table comparing alternatives lists stipulations and ROPs but doesn't tell what differences they would have on impacts. The executive summary states that 'prescriptive ROPs are analyzed' under the alternatives. I see lists of ROPs but little or no analysis.

Three examples of information supplied but analysis apparently not done:

---

1 – In Appendix J, lists of vegetation types are given for different development alternatives but then no analysis is done. To help choose an alternative you would need more information, such as which vegetation types are most sensitive to disturbance, or most useful to differing wildlife. That information is available and should be used.

2 - ROP-11, First requirement: the difference between Alternatives B and C vs. Alternatives D1 and D2 is that A and B don't require 3 inches of snow water equivalent as a threshold for allowing seismic activity. After that I find no analysis in the document about what difference that would make. Where is the analysis? Just presenting information such as this is not enough. The EIS is supposed to summarize information and analyze the differences between alternatives.

---

3 – Chapter 2, Table 2.2. For soils, information listed under Alternative D doesn't tell whether impacts would be more or less than under Alternatives B or C. For the example below, are sand and silt more easily damaged than sands and gravels?: *"Alternative D.* Potential impacts on soils and permafrost under Alternative D would be the same as identified above for all action alternatives; however, lease stipulations would limit surface occupancy to the western third of the program area, which is primarily composed of fine sand and silt deposits with restricted use of areas next to alluvial plains, which are composed of sands and gravels" (p 348).

Hypothetical scenarios for development are given, but no hypothetical maps to help illustrate the differences between alternatives.

Appendix F needs more explanation of what it means and how it was used to evaluate the alternatives. Sections of this appendix table were evidently written by many different people and the way they treated the 'impact indicator' column is not at all standardized. For vegetation, the indicator column repeatedly says 'no indicator available to assess possible plant community changes'. That is not consistent with how the same problem of quantifying habitat changes is dealt with for other items, such as bird or caribou habitat. Compare the wording for vegetation with that for bird habitat. It is the same issue with regards to the difficulty of quantifying habitat changes, but they use completely different wording. For example "habitat affected (qualitative)", "describe extent of effect in qualitative terms", "potential impacts on bird populations". And then it's treated differently again for caribou habitat, such as "qualitative assessment". These should be rewritten and standardized.

In general any indicator of any type of habitat issue is listed as not quantifiable in this table. I don't believe that is true. For the example of vegetation, plant community composition and changes can be quantified with field work and/or satellite images and aerial photography. Indicators could be developed. Some sources of information to develop indicators: the EIS gives some assumptions about development footprint. The area that would be covered by 3-D seismic exploration can also be estimated, based on the draft EA for seismic and on past surveys in NPRA. There is information on vegetation changes during the production phase in Raynolds et al. (2014) and elsewhere.

There DEIS fails to make an effort to develop ecological indicators and then use them in analysis of alternatives. For an example, if it is not allowed to put production pads on floodplains, facilities are not normally put in the wettest tundra areas, and dry tundra covers a tiny amount of the 1002 Area, then you can assume that pads will go on moist tundra vegetation types. For 2000 total acres of gravel, that will cover nearly 2000 acres of moist tundra. You could use the percentages of each moist tundra type in different potential development areas and estimate the number of acres of each that will be covered by gravel or otherwise altered. Some vegetation indicators that could be used, include: acres altered, acres buried under gravel, acres of types with higher habitat value that would be altered or buried, acres with road dust-caused changes (buffer around the hypothetical road distance for each CPU), acres with thermokarst (buffer around gravel roads and pads for each CPU).

THE DEIS REQUIRES MAJOR REORGANIZATION AND REWRITING

The DEIS is too hard to follow, with all map and figures and much of the important information in Appendices. Because we all are reading digital copies, it is too hard to move around in the document, making it difficult to understand and compare information in order to comment. Summarizing information would also help greatly.

Don't be surprised if you receive comments from the public that you feel are ill-informed. The EIS should have been written and organized more clearly and should have included summarization of information and analysis of the information and the different alternatives. Then private citizens could be well informed and comment intelligently.

Two annoying examples of DEIS being too hard to follow:

1 - Too much searching is required to try to understand Table 2.2 of stipulations and ROPs. Example: ROP procedure 11: evidently there was some difference between requirement/standards for Alternatives D vs A and B, but they were too hard to find. They spread onto 2 different pages and I had to print out single-sided hard copies to compare them side to side. Eventually I could see that of 9 requirement/standards under ROP 11, there were only 2 differences between the 2 columns. That is much more work that most readers will bother to do.

2 - In the first table in the Alternatives chapter, it doesn't define acronyms TL, NSO, ROP etc. The public can't keep going back to acronym page. Should define each acronym at least the first time it is use in each chapter. For example, I did a word search for 'TL' and found it defined in the Executive Summary only, not anywhere in the main document and not before it is used in the descriptions of alternatives and the table of stipulations and ROPs.

The table of stipulations and ROPs would be easier to relate to impacts on the ground if the information of hypothetical alternative scenarios was available in the same chapter. For example, the projected number of CPUs.

Map legends: Legends should be improved. It is not clear how they are laid out, what is nested within what. For example on map 2-6, it's not clear if the first item in each 'column' is a heading that the other items are nested under or not. Also, boxes in legends are too small to read. For example: see ' hydrocarbon potential' zones, particular example map 3-7. Boxes are too small to show stripes. Same problem for maps 3-4 to 3-7 (showing hydrocarbon zones) plus similar problem on other maps. There are some color problems; I can't tell the 2 blues in legend of map 2-5 apart. Each map should have a scale bar.

DEIS SHOULD INCLUDE A FULL TREATMENT OF SEISMIC EXPLORATION AS AN INTEGRAL PART OF THE EIS

The DEIS has too little information about seismic exploration. The 3D seismic program as proposed by SAE (2018) has not occurred yet. It is an integral part of an oil and gas program and should be included as an integral part of the EIS. A draft EA for the proposed seismic exploration exists and it would be easy to pick information out of it to put in the EIS. For just one example, the EIS gives information on number of acres expected to be impacted during the construction phase. It would be easy to pick that same kind of information out of the seismic EA, to give number of miles of trail or of acres impacted during seismic exploration. There is enough information from previous seismic impacts studies to allow prediction of the amount of damage expected from seismic exploration in the 1002 area. There could be a map, acre estimates and trail-mileage estimates, etc. For example, the kind of information on seismic surveys that was included in the NPRA EIS (BLM 2012) should be developed for the DEIS (see quote below in blue). That EIS was for the whole NPRA, without site-specific information on where development would occur, so I think similar information could be produced for this EIS, to describe the impacts of the whole oil and gas program, including seismic exploration.

“Chapter 4: Environmental Consequences Basic Assumptions for the Environmental Consequences Assessment National Petroleum Reserve-Alaska, DRAFT Integrated Activity Plan/Environmental Impact Statement

The level of future seismic activity in the NPR-A will depend on: 1) new oil discoveries and emerging play fairways; 2) production and development; 3) regulatory restrictions on activities. It is reasonably foreseeable that one to two new geologic play trends will be explored in the NPR-A in the next 20 years. It is also reasonably foreseeable that Greater Mooses Tooth and Bear Tooth units and/or the Umiat Field will begin development. New and advanced seismic data surveys would likely be acquired over these producing fields within 10 to 20 years of production to enhance recovery of hydrocarbons. From ten to twenty years, three big assumptions are made: 1) a gas line delivering North Slope gas for export is built; 2) given a future price, the economically recoverable oil and gas identified by the USGS is produced; 3) existing or planned stipulations do not adversely affect oil and gas development. Beyond 10 years, these numbers reflect a maximum level of foreseeable seismic exploration activity. A basic assumption for this analysis is that exploration seismic surveys would not be repeated in areas for which survey data are already available. It is assumed to be less expensive to purchase data from the original contractor (or client) rather than conduct a new survey. Therefore, future exploratory seismic surveys with today’s technology would likely be conducted in unsurveyed areas. See Table 4-11 for a summary of seismic surveying potential in each alternative.

Alternative A (No-action Alternative). Under Alternative A, one 3-D seismic survey would occur in the first 10 years after the signing of the record of decision. It is foreseeable that four seismic surveys—one 2-D (approximately 500 linear miles) and three 3-D—would occur in the following 10 years. It is assumed that exploration-focused 3-D surveys acquired in economic zone 130 would be 900 square miles. Oil fields in this area could be trapped in relatively small accumulations or clusters across a relatively large geographic area requiring larger 3-D volumes for identification of potential traps. Producing oil fields would likely have repeated 3-D seismic imaging to enhance recovery after 10 years of production (i.e., approximately 10 to 30 years from the record of decision). These reshoots would amount to four surveys. Gas discoveries in the Nanushuk fold and thrust belt would likely be developed with 3-D seismic resulting in two 3-D surveys. Therefore it is foreseeable that there would be up to 11 seismic surveys, 5 exploration-focused and 6 production-focused surveys, acquired in the NPR-A under the no-action alternative.

Alternative B.Under Alternative B, large areas are unavailable for leasing and drilling activities. One 3-D seismic survey would occur in the first 10 years after the signing of the record of decision. It is foreseeable that four seismic surveys—one 2-D (approximately 500 linear miles) and three 3-D—could occur in the following 10 years. It is assumed that exploration-focused 3-D surveys acquired in economic zone 130 would be 900 square miles. Oil fields in this area could be trapped in relatively small accumulations or clusters across a relatively large geographic area requiring larger 3-D volumes for identification of potential traps. Producing oil fields would likely have repeated 3-D seismic imaging to enhance recovery after 10 years of production (i.e., approximately 10 to 30 years from the record of decision). These reshoots would amount to three surveys. Alternative B would have more seismic activity associated with gas production than Alternative A because 1,671 more square miles would be available for leasing in economic zones 230 and 220. Gas discoveries in the Nanushuk fold and thrust belt would likely be developed with 3-D seismic resulting in three 3-D surveys. Therefore, it is foreseeable that there would be up to 11 seismic surveys, 5 exploration-focused and 6 production-focused surveys acquired in the NPR-A under Alternative B.

Table 4-11. Mileage and acreage estimates of seismic surveying for all alternatives

Table 4-11. Mileage and acreage estimates of seismic surveying for all alternatives

Alternative	Survey Type	Surveying miles[1]	Surveying[2] acres	Camp Train miles[3]	Camp Train acres[4]
A	2-D	500	12,121	523	6,339
	3-D	53,678	496,125	1,936	23,467
B	2-D	500	12,121	523	6,339
	3-D	57,838	535,882	2,232	27,055
C	2-D	1,000	24,242	1,203	14,582
	3-D	69,906	645,597	2,844	34,473
D	2-D	1,000	24,242	1,203	14,582
	3-D	76,562	709,209	3,182	38,570

Surveying miles estimates total distance traveled by seismic equipment during seismic acquisition. These estimates assume 1,500 ft. source and 1,100 ft. receiver spacing for exploration 3-D surveys, which are typical for the NPR-A, and 700 ft. source and receiver spacing for production focused 3-D surveys.2. Estimates potential impacted area assuming about 17 percent of surveyed lands are impacted during 3-D seismic acquisition. Under Alternative A there would be one 900-square-mile 3-D survey; in the other alternatives there would be two 900-square-mile 3-D surveys. All other 3-D surveys are assumed to cover 400 square miles. For 2-D surveys, a 200-foot-wide swath along 2-D lines is assumed to be impacted.3. Camp train miles estimates distance camp train travels during seismic acquisition starting from staging area, which is either from the Alpine Field for the northern half of the NPR-A or the Umiat field for the southern half of the NPR-A. 4. Camp train acres is a calculation of the impacted area attributable to camp train travel assuming a 100-foot-wide area of disturbance.

Alternative C. All NPR-A lands would be available excluding about 4.4 million acres in the southwestern NPR-A, about 219,000 acres under Teshekpuk Lake and its islands, the existing Kasegaluk Lagoon Special Area, the proposed (smaller size) Peard Bay Special Area, and the major coastal waters of Elson Lagoon, Dease Inlet, and Admiralty Bay. One 3-D seismic survey would occur in the first 10 years after the signing of the record of decision. It is foreseeable that five seismic surveys - two 2-D (approximately 500 linear miles each) and three 3-D - could occur in the following 10 years. It is assumed that exploration-focused 3-D surveys acquired in economic zone 130 would be 900 square miles. Oil fields in this area could be trapped in relatively small accumulations or clusters across a relatively large geographic area requiring larger 3-D volumes for identification of potential traps. Producing oil fields would likely have repeated 3-D seismic imaging to enhance recovery after 10 years of production (i.e., approximately 10 to 30 years from the record of decision). These reshoots would amount to four surveys. Gas discoveries in the Nanushuk fold and thrust belt would likely be developed with 3-D seismic resulting in four 3-D surveys. Therefore it is foreseeable that there would be up to 14 seismic surveys, 6 exploration-focused and 8 production focused-surveys, acquired in the NPR-A under alternative C.Alternative D. All lands would be available. Under Alternative D, two 3-D seismic surveys would occur in the first 10 years after the signing of the record of decision. It is foreseeable that six seismic surveys - two 2-D (approximately 500 linear miles each) and four 3-D - could occur in the following 10 years. It is assumed that exploration focused 3-D surveys acquired in economic zone 130 would be 900 square miles. Oil fields in this area could be trapped in relatively small accumulations or clusters across a relatively large geographic area requiring larger 3-D volumes for identification of potential traps. Producing oil fields would likely have repeated 3-

D seismic imaging to enhance recovery after 10 years of production (i.e., approximately 10 to 30 years from the record of decision). These reshoots would amount to four surveys. Gas discoveries in the Nanushuk fold and thrust belt would likely be developed with 3-D seismic resulting in four 3-D surveys. Therefore it is foreseeable that there would be up to 16 seismic surveys, 8 exploration-focused and 8 production-focused surveys, acquired in the NPR-A under alternative D." (end of quote from NPRA EIS 2012)

DEFFICIENCIES IN INFORMATION ON DESCRIPTION OF PROPOSED SEISMIC EXPLORATION IN THE DEIS

There are just 2 short paragraphs on seismic exploration under the environmental impacts section for vegetation and wetlands. To include the exploration phase as an integral part of the DEIS, that needs to be expanded using information from the seismic EA.

For DEIS page 3-71: 1 -The text should be changed to say trails are still measurably disturbed after 33 years, not just after 25 years as stated in the first paragraph under 'Exploration'. Based on 2018 field work completed and reported in Jorgenson, J. C. 2018. Tundra disturbance and recovery on winter seismic trails in the Arctic National Wildlife Refuge, monitored from 1985 to 2018. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service, Fairbanks, Alaska, US.

For DEIS page 3-71: 2 – Second paragraph on page 3-71 states "Studies on BMPs for winter off-road vehicle traffic suggest that the impacts described above could be mitigated somewhat by using vehicles fewer less pounds per square inch and performing seismic operations later in the winter when there is more snow cover and soils are frozen deeper (Bader and Guimond 2004; Bader 2005)." However, the options of using lighter vehicles and starting later in the winter, shown to reduce damage in that study, are not feasible given the current methods for doing seismic exploration on Alaska's North Slope (with large, heavy camps and thousands of miles of survey to be completed each winter). They are not proposed in SAE's application to do seismic exploration in Arctic Refuge in 2018-2019. For example, see the equipment list in the SAE Plan of Operations (page 17) showing continued use of D-7 caterpillar tractors, which have high psi but are necessary to pull the heaviest cat trains, especially up steeper slopes more common in the western portion of the 1002 area.

In regards to the use of snow roads to decrease damage, no studies have been done, or at least I find no reports, on how well they protect tundra. A presentation by Alaska DNR in 2010 said that significantly more damage occurs along snow packed trails during low snow years than in high snow years. The tundra disturbance index during the low snow year is higher than the acceptable standards for AK DNR even when a snow packed trail is used. (Head 2010, AKDNR,http://www.itsalaska.org/Ice2010_Presentations/Ice2010_Head.pdf).

INADEQUATE ANALYSIS OF LONG-TERM EFFECTS OF WINTER SEISMIC EXPLORATION

Seismic exploration in the 1002 Area in 1984 and 1985 caused more damage than anticipated and the damage persists to the present, 34 years later. The vegetation type with the most lasting damage was Moist Sedge-Dryas Tundra (moist non-tussock tundra), which covers 13% of the 1002 Area. Figure 1 show examples of trails on that vegetation type.

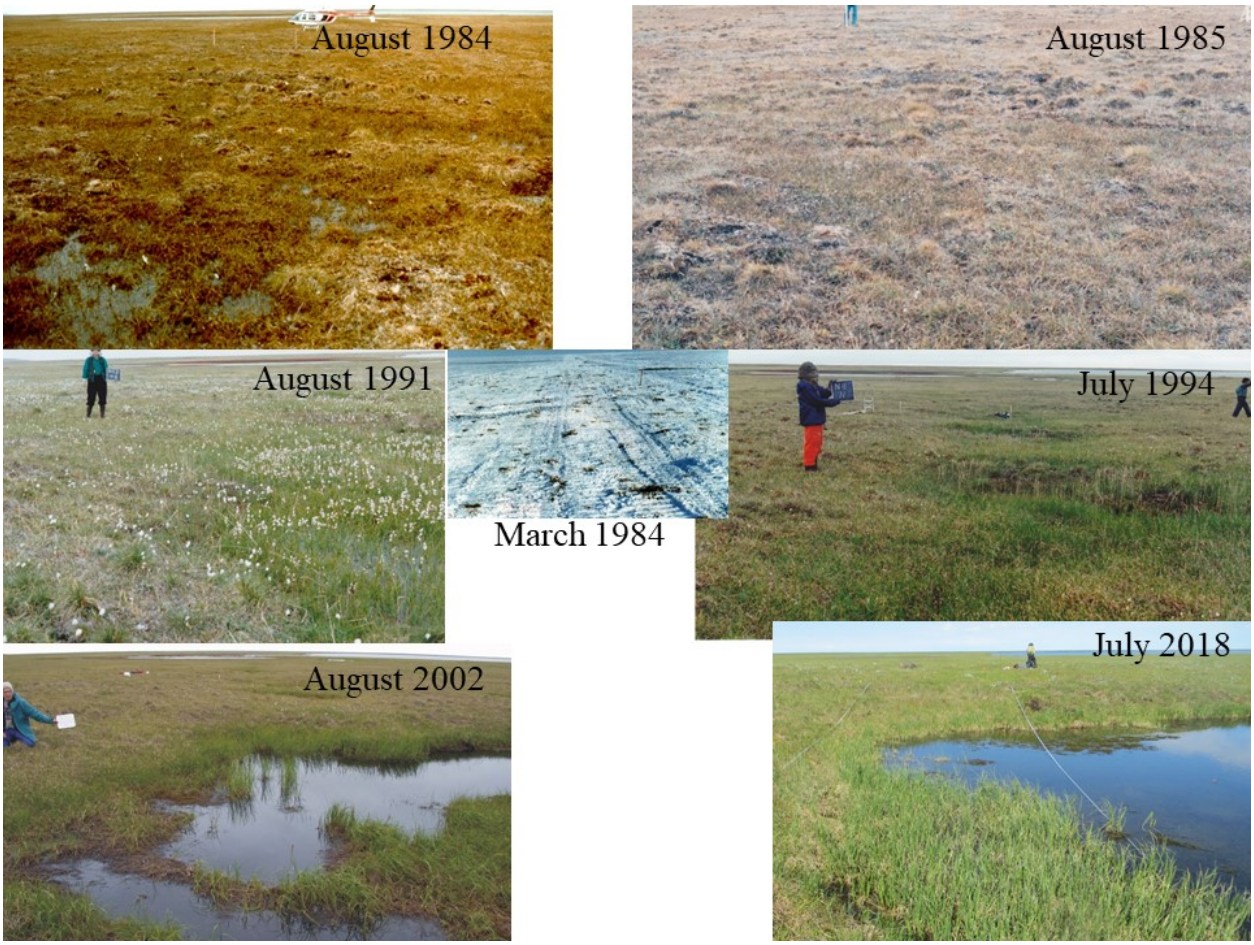

Figure 1. Thermokarst in Moist sedge-Dryas tundra with hummocks and frost boils resulting from seismic trails in the 1002 Area. This vegetation type typically has lots of buried ice wedges and high soil ice content. Excess ice in upper permafrost measured in undisturbed tundra adjacent to the plot in 1985 was 40% (not including ice wedges). At first, this place didn't look too damaged, but soil ice began to thaw. After about 5 years, ponds started to form. This picture is of the largest of three ponds that developed in the trail in this permanently marked plot (30 m X 4 m size). All photos are taken from the same place looking north.

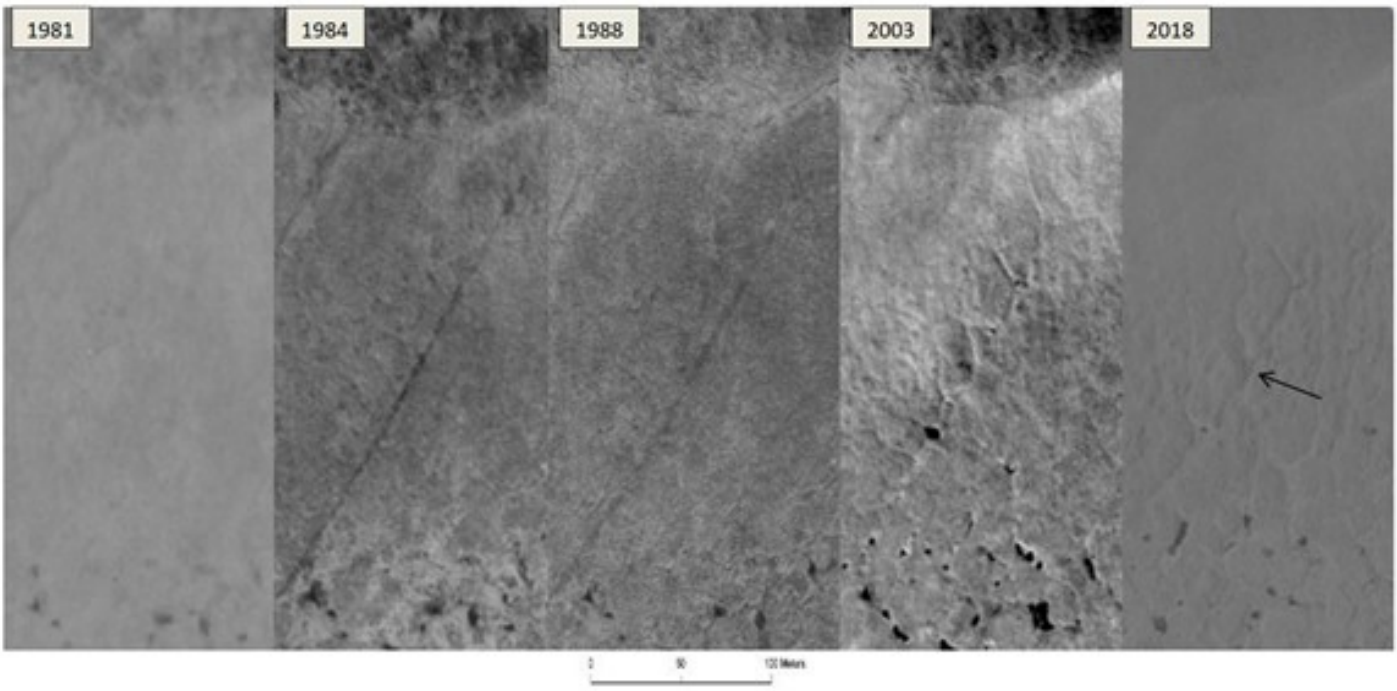

Figure 2. Impacts from a camp-move trail made in winter of 1984 across a north-facing hillside of Moist Sedge-Dryas Tundra. Time series of three aerial photographs and two satellite images from 1981 through 2018.Trail is visible running diagonally across the slope of the hill, as black lines in 1984 and 1988 and as troughs in 2003 and 2018. (Compare trail angle to natural drainages visible on 2018 image, which run downhill).

Figure 3. Impacts of a camp move trail made in winter of 1984 and photographed in July 2018.

Listed below are some reasons why vegetation damage from new 3D seismic exploration in the 1002 area could be worse than the 2D exploration covering the same area in the 1980s:

1 – Denser grids. With the denser grid of seismic lines, much more area is driven on and many more vehicles and people are needed to do the work. The denser grid, with the seismic lines only ~660 feet apart rather than 3 to 5 miles apart, as in the 1980s, will cause more impacts to hydrology, because in any given area, drainages and surface flow of water at spring snow melt will be interrupted more frequently and increasing the chance that different drainage areas to become connected, causing changes in drainage patterns. Changes in drainage patterns can become permanent when trail compression and heat from standing or flowing water in the trails melts the underlying permafrost and ice wedges, creating new channels, some of which become connected and could drain large areas.

2 – Issues with avoiding polar bear denning habitat. During future seismic exploration and other winter overland travel, efforts to avoid tundra damage must be weighed against efforts to avoid harassment of polar bears, because the polar bear is now listed as a threatened species under the ESA since 2008. With the current increased concern for polar bears, regulations for winter vehicle travel on tundra should be developed as to whether or not operators should drive up drainages as was done during the 1980s seismic exploration in the 1002 area, as the drainages are prime habitat for polar bear dens because of the snow accumulated in the drainages.

If the choice is between protecting polar bears and protecting vegetation and soils, the polar bears will take priority. In winter, vehicles should not be allowed to travel along snow-accumulation areas because those are where polar bear dens are most likely to occur (see map in DEIS). During exploration in the 1002 area in 1984-85, camp moves were preferentially routed over snow-accumulation areas to avoid tundra damage. This was particularly practiced in 1985, based on experience gained during the 1984 winter season. From a 1989 paper on the 1984-85 seismic study: “Due to the routing of camp moves through drainages with drifted snow,1985 camp move trails also had more level-0 disturbance than other trail types.” (meaning more miles of trail with no vegetation and soil disturbance and therefore fewer miles disturbed) (Raynolds and Felix 1989). This routing along drainages is visible on maps of trails made in 1984 and 1985. See one example of routing below (Figure 4). USFWS monitors travelling with the seismic crews hand-drew the seismic grid and the camp move routes as they progressed. On this map, the straight lines are seismic lines and the curving lines are the camp move routes. You can see that the camp moves did not follow the shortest distance between two points. Instead they preferentially travelled up rivers, creeks and small drainages which had greater snow depth that the surrounding tundra. They chose to travel along these routes in an effort to stay on deeper snow and avoid damage to the open tundra between the drainages. The two curving lines running north-south through the center of this picture are both following small creeks, shown as blue lines on the topographic map (but not often visible here because the routes are drawn on top of them). These are within 7 miles of the sea coast (see Camden Bay in NE corner). (Each square on the map is 1 mile across.) (All lines hand-drawn on the map are vehicle trails made in 1984 and 1985 except the yellow line, which just shows the 200 foot elevation contour line for some reason. Note ‘tractor trail’ across head of Camden Bay; that is an older trail made in the 1950s.) I conclude that winter vehicle travel should not occur on the small creeks and drainages in the future, which will force the seismic camp move and other

vehicle trails out onto the tundra between drainages, which will be easily damaged because of lower snow cover and the prevalence of moist tundra vegetation types, which are sensitive to winter vehicle damage.

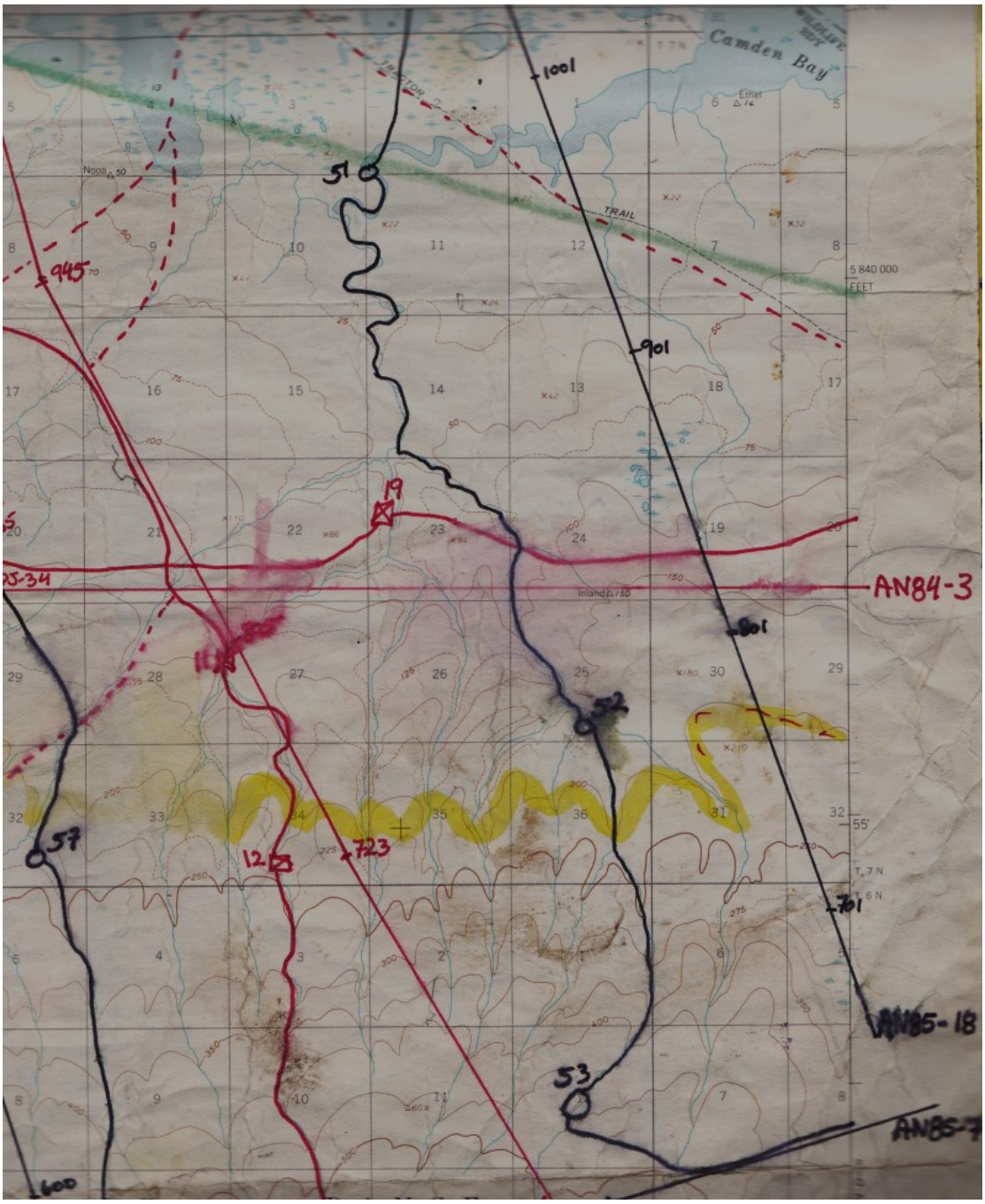

Figure 4. This is a scan of part of a USGS topographic map used during the 1984-1985 seismic exploration in the Arctic NWR. The black and red straight lines are seismic lines. The black and red curving lines are camp move trails, following drainages. (Ignore yellow line.)

I include some text excerpted from the DEIS and other relevant documents that deals with protection of denning habitat for polar bears, to show that it is reasonable to foresee that restrictions on driving on drainages would be warranted and very likely to be applied on winter overland travel:

Text from DEIS:
'Under ROP 10, the pre-activity surveys required to locate dens, plus the 0.5-mile and 1-mile buffers for seismic and heavy equipment operation around occupied dens of grizzly and polar bears, respectively'.

Under Lease stipulation 5: Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas.

Requirement/Standard for all Alternatives: Comply with ESA and Marine Mammal Protection Act (MMPA) requirements. Additional for Alternative D: 'TL) From the coastline to 5 miles inland, between October 30 and April 15 of any year, the lessee/operator/contractor would not conduct oil and gas activities within 1 mile of **potential** polar bear denning habitat on the Niguanak River, Katakturuk River, Marsh Creek, Carter Creek, and Sadlerochit River, and all associated tributaries as defined by Durner et al. (2006), unless the BLM Authorized Officer approves alternative protective measures'. Also ROP 10, but it refers only to **occupied** dens.

(Note that on all of these rivers except the Niguanak, the maps from 1984 and 1985 show camp move trails following the river for many miles, starting right at the coast. Two rivers had camp move trails along them in both years, 1984 and 1985, and two had camp trails just in 1985.)

Text from other relevant documents:

From the Ecological Assessment for Greater Mooses Tooth seismic exploration (BLM):

From 4.5 Additional Mitigation and Monitoring
The BLM will incorporate the following additional mitigation measures into approvals for the seismic permit…….
5. The following measures are designed to minimize disturbance of denning polar bears and minimize alteration of potential denning habitat during travel and camp site selection. The permittee and designees are required to review educational materials (available from the BLM) that describe: (1) characteristics of polar bear dens so immediate mitigation measures can be implemented should crews find one; i. **No human activities can take place within one mile of known polar bears dens or areas where denning frequently occurs**. Locations of current and past polar bear dens or where denning occurs frequently can be obtained from MMM (contact Michael Hendrick at 907-786-3479); and (2) **suitable polar bear denning habitat so crews can avoid: i. potentially disturbing polar bears in unseen dens; ii. altering denning habitat** . (3) If field crews discover a new den, they must cease activities within one mile of it and contact MMM to report to report the den as soon as possible to seek guidance before proceeding with activities…….".

From SAE plan of operations for seismic in 1002 area: procedures to protect polar bear include ' All personnel must use caution when operating near polar bear denning habitat during the denning period' and 'SAE must observe a 1.6 km (1 mi) operational exclusion zone around all known polar bear dens during the denning season….'.

COMMENTS ON SECTIONS ABOUT IMPACTS TO VEGETATION

In the DEIS, the section on impacts to vegetation and wetlands is only 4 ½ pages long ('direct and indirect impacts', page 3-70, under Biological Resources). That includes all information on potential impacts to vegetation and wetlands, plus the supposed analysis of how each of the alternatives affects them. I find little information, no summarization of information, and no analysis.

North Slope oil fields have been put in areas adjacent to existing ones, which requires less infrastructure per field and therefore less disturbance. DEIS page B-6 states "Since no infrastructure exists in the Coastal Plain, developers are expected to follow oil occurrence potential very closely, rather than trying to build off existing infrastructure, as might occur in a field with existing development". This will probably mean more miles of roads and pipelines and more acres covered by gravel for central facilities. In the 1002 Area, much new infrastructure would be needed and it would be far from existing fields so there would more disturbance. This applies to all stages of development and also to most of the potential impacts listed in the DEIS.

Regarding reclamation: The exploratory oil and gas well on KIC corporation land within the boundaries of the Arctic NWR, mentioned on DEIS page B-6, was drilled in 1986. Millions of dollars have been spent over the intervening years to try to restore the site, but in 2018 it was still highly disturbed.

Page B-7 says "it could be 85 years or more after the first lease sale before all facilities described in the scenarios are abandoned and reclaimed. However, just as development is expected to occur in phases, reclamation would occur in phases. The first field to be developed could be reclaimed long before the last field is abandoned.". In the current oil fields on the North Slope, some old gravel pads are removed in order to reuse the gravel. These sites are reseeded but I don't think they can be considered reclaimed. They usually suffer from permafrost and ice wedge thawing and subside into standing water or develop a polygonal surface from thawing ice wedges.

DEIS page B-8 states that an assumption used in the DEIS to develop the 'hypothetical scenario projections, a crucial element of analyzing the various alternatives, " is that processed area-wide three-dimensional (3D) seismic data would be available for licensing to all potential bidders at the time of the first lease sale. With the current expedited schedule for leasing, they would not have that. That lack of information requires reanalyzing the alternatives.

DEIS appendix B, section B-9 on page B-21: should include seismic exploration. And include in the tables B4 and B5, area estimates of longer term surface disturbance from seismic (using data from ANWR seismic trail study, perhaps use number of acres with longer-term disturbance, such as 'still disturbed after 10 years'). Alternative D would presumably involve less future seismic exploration that B or C.‟

Sensitivity of different vegetation types to disturbance:

Information on tundra sensitivity to disturbance for different vegetation types is lacking in the current draft of the DEIS. Different vegetation types have different sensitivity to disturbance. For example, the least sensitive to winter activities is wet graminoid tundra. Tall shrub tundra is easily damaged but recovers well, because the only tall shrubs on the tundra are willows along drainages and willows are

well adapted to disturbance that removes branches, such as browsing. Sensitivity varies between summer and winter. For example, wet tundra with standing water freeze solid in winter and therefore can be driven on in winter with little damage. In contrast, on moist or dry vegetation types, the soil is not saturated. If there is insufficient snow cover, vehicles can churn up the soil because it is loose (not a frozen block of ice), tearing plant roots and leaving exposed bare soil, which absorbs heat in the following summers causing permafrost and ice wedges to thaw. So in winter it is better to drive preferentially on wet graminoid tundra. In summer, wet tundra should be avoided because summer activities on wet tundra cause high disturbance.

Information is available in these reports:

Jorgenson, J.C., Hoef, J.M.V. and Jorgenson, M.T., 2010. Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications*, *20*(1), pp.205-221.

Felix, N. A., M. K. Raynolds, J. C. Jorgenson, and K. E. DuBois. 1992. Resistance and resilience of tundra plant communities to disturbance by winter seismic vehicles. Arctic and Alpine Research 24(1)69-77.

Jorgenson, J. C. 2018. Tundra disturbance and recovery on winter seismic trails in the Arctic National Wildlife Refuge, monitored from 1985 to 2018. Arctic National Wildlife Refuge, U.S. Fish and Wildlife Service, Fairbanks, Alaska, US.

Wildlife habitat:

Different vegetation types have different values for wildlife habitats and diversity of plant species. A review of wildlife literature should be done. For example, high-value habitats in the 1002 Area include riparian shrublands for many different species, wet herbaceous tundra for birds if adjacent to salt water or lakes, tussock tundra for caribou forage during the calving season, and moist herbaceous tundra (the non-acidic subtype) for high diversity of plant species. The DEIS lists percentages of area covered by different vegetation types for the different alternatives, but then leaves it at that. No effort is made to actually analyze which alternatives impact more or less habitat for different wildlife species.

P 3-72 Rare plants. States that rare plant species occur broadly across all vegetation types, with few exceptions. That is never true for any plant species. They all have specific habitat requirements, maybe even more than usual in the Arctic.

Pg 3-72 Invasive plants, states ‘the potential impacts from introduction of invasive plants are assumed to be the same for all alternatives’. That is not true, because alternative D excludes leasing in most of the eastern part of the 1002 Area, so less area would be at risk. The federally-owned land in the eastern part of 1002 would be free of roads and vehicles that spread seeds. Seeds do not spread only on the gravel road footprint but are also carried far into the surrounding area by wind and over-surface water flow during spring thaw.

Chapter 3, Environmental consequences section. This information should have been analyzed when comparing alternatives but was not. Eg. Alternative D excludes much of the 1002 area from occupancy, so that alternative would have less impact on all these and more: subsistence access, change to wildlife

migration, loss of soil productivity due to fewer CPUs and fewer long gravel roads to the coast, blockage of surface drainage patterns, fragmentation of caribou habitat.

Sections 3.5 'Unavoidable adverse effects' and 3.7 'Irreversible and irretrievable commitments of resources' – It says that the items listed are described in greater detail in Sections 3.1 to 3.4. I don't think that these are described well enough. For example this 'Irreversible and irretrievable commitments of resources': 'Loss or change in vegetation and wetlands where gravel is placed, regardless of whether it is removed at abandonment' is not sufficiently explained and is not analyzed by different alternatives.

COMMENTS ON VEGETATION TYPE DESCRIPTIONS

Vegetation/landcover types are presented in section 3.3.1 ("Vegetation and wetlands" in Affected Environment chapter), Appendix J, and Map 3-10 in Appendix A. The lists of vegetation/landcover types are not consistent in the different parts of the EIS. The text in 3.3.1 and J-2 and the map show 4 vegetated types plus 3 unvegetated types. In contrast, Tables J-1 to J-7, listing vegetation types affected by various development scenarios, have 9 vegetated categories and 4 unvegetated types, which do not match the ones in the text and on the map. The latter types should nest within the former, but there is no information apparent to tell us which types are equivalent. Please use a common vegetation classification scheme throughout the EIS or clearly show how the two schemes compare.

Tables J-1 to J-7 need to be redone. Right now the vegetation types are in alphabetical order, which makes no sense. They need to be rearranged to make ecological sense. The table needs to be arranged in a hierarchy, with types nested into the other types used in the text and on the map. That would be into shrub-dominated, moist herbaceous, wet herbaceous, and other (barren, sparse and water). That's how Viereck's veg of Alaska and all vegetation classifications are done. For example, under wet herbace ous meadow would be listed 3 types: 'herbaceous (wet), herbaceous (marsh), and herbaceous (wet-marsh)'. Then on page J-2, under the heading 'wet herbaceous meadow', all 3 types would be described, with the most common one described first. Right now, that paragraph on page J-2 describes only the 2 types that cover <1% of the study area. The third type that fits in this category (herbaceous (wet)), which covers 16% of the area as mapped, is currently not described. It includes large areas of wet tundra that are not in lakes or on edges of lakes or coast. It should be described first and then the other 2 less common ones described.

Similarly, the category 'moist herbaceous meadow' includes moist tussock sedge tundra (26% of area) and 'herbaceous (mesic)', (31% of area). In the description on page J-2, the first 2 sentences describe the herbaceous (mesic), but most readers would not know that.

Also, where the vegetation types are described in the text, it should give in parentheses the % of the whole 1002 area covered by each type. The alternative list of types used in tables in Appendix J are not described in the text, but should be described and also given their %s.

VEGETATION MAP

Description of vegetation map in Appendix J. Page J-1 states that "The primary data source used for the program area was a moderate resolution (30-meter pixel) raster vegetation mosaic map compiled by multiple contributors including the North Slope Science Initiative, United States (US) Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), National Park Service (NPS) Alaska Center for Conservation Science (ACCS), Ducks Unlimited, Inc., Spatial Solutions Inc., and Michigan Tech Research Institute (Ducks Unlimited 2013). The intent of the 2013 mapping effort was to update existing vegetation maps to more recent Landsat Thematic Mapper imagery where available." That may be true for the whole extent of the map (the entire North Slope of Alaska), but the part of the map covering the area of this EIS was derived from a Landsat-MSS image, not Landsat Thematic Mapper, which is much older (1981) and much lower resolution (60-meter pixel). This map and the others available for the 1002 Area are not good enough to use to describe the different development scenarios as done in Appendix J tables 3 – 7. They are all too old, too inaccurate, too low-resolution or all of the above. A new vegetation/landcover map of the 1002 Area is being produced on contract to DOI and may be done by sometime in 2020. The exercise of comparing impacts to tundra vegetation from different alternatives should be deferred until that map is available. Similarly, analysis of the effects of different alternatives on wetlands distribution and function could be done once a new wetlands map is completed. It is probably on a similar timeline for completion as the vegetation map.

CHOICE OF MAP USED TO DELINEATE BOUNDARY BETWEEN COASTAL PLAIN AND FOOTHILLS

Physiography section on page 3-23 and map 3-1 in Appendix A:

This map based on Wahrhaftig (1965) should not be used to delineate the boundary between coastal plain and foothills in the 1002 Area. The hand-drawn paper map was created in the days before geographic information systems, at a very broad scale of 1:2,500,000. Given the scale, it is inappropriate to zoom into a small area of the state and use that map to show divisions. The line work on the original map was not done at a scale to justify that. The division between coastal plain and foothills provinces is roughly drawn and follows no discernable topographical breaks on the landscape. Similarly, the piece of the 1002 Area shown as mountains on map 3-1 is not topographically distinct from the foothills. The distinct edge of the Brooks Range is 6 miles further south and the whole part mapped as mountains inside the 1002 Area is not really mountains, but still foothills. At the scale the map was drawn in 1965, a few miles hardly mattered. To use this map meant you had to add length to the EIS by describing the mountains and their percent cover in the different development scenarios. It was unnecessary.

Newer and better maps exist. All recent documents produced by the FWS (such as the Arctic NWR CCP 2015) use the Nowacki et al. digital map of ecological regions (2001). It is available at https://agdc.usgs.gov/data/usgs/erosafo/ecoreg/. That map is also used by many different agencies in Alaska, for example ADFG: http://www.adfg.alaska.gov/index.cfm?adfg=ecosystems.ecoregions.

The Nowacki map should be presented in the EIS instead of map 3-1. The descriptions of the major divisions of the 1002 Area (as on pages 3-23 to 3-25) should be rewritten using the map in Nowacki et al. 2001. It is a newer, more detailed map than the one used. The two maps differ greatly in the 1002 Area.

The Wahrhaftig map shows only the very highest parts of the foothills as foothills, generally above 1000 feet elevation.

For Wahrhaftig's 'coastal plain' (EIS said it is ~90% of the 1002 Area), the description says 'a smooth plain rising gradually from the Beaufort Sea to a maximum elevation of 600 feet above sea level (asl).' But in the 1002 Area, the area mapped as 'coastal plain' on Map 3-1 (following Wahrhaftig) does not fit the description given in the EIS. Checking a USGS topographic map, it is clear that the mapped 'coastal plain' reaches well above 600 feet elevation, to an elevation of 1000 feet in many places. In fact, the boundary seems to be drawn attempting to follow the 1000 foot elevation line. That elevation is almost double the maximum elevation given for the "coastal plain" division in the EIS. The area mapped as 'coastal plain' also is very hilly, especially in the western half of the 1002 Area. For example, in the Carter Creek Hills, there is a summit 354 feet elevation that is less than 1.5 miles from the coast. South of it the terrain drops off and then rises again to the Brooks Range. The 'plain' is certainly not 'smooth'.

The text descriptions of the "coastal plain" and "foothills" as mapped on the Wahrhaftig map are confounded with descriptions of those divisions as mapped on the Nowacki map. They should not be interchangeable because the Wahrhaftig map shows 90% of the 1002 Area as 'coastal plain', compared to less than 50% on the Nowacki map. Wahrhaftig's description of the 'coastal plain' was actually 'a smooth plain rising imperceptibly from the Beaufort Sea to a maximum elevation of 600 feet'. Instead, as mapped it rises to an elevation of 1000 feet as close as 13 miles to the coast. Since the 600-foot elevation and the "smooth plain rising imperceptibly" clearly weren't correct in the 1002 Area, descriptions in EIS were taken from descriptions of the smaller-extent 'coastal plain' as mapped by Nowacki. For example, the paragraph in the DEIS about alluvial fans is taken from the Arctic NWR CCP, from a description of the coastal plain as defined by Nowacki.

TREATMENT OF MISSING INFORMATION

The introduction to Chapter 3 states that "The BLM has relied on the best available science to inform its consideration of the environmental impacts surrounding an oil and gas leasing program in the Coastal Plain; however, the nature, abundance, and quality of the data often vary, depending on the action, the geographic region in which it occurs, and the environmental resources that may be affected. All these variables influence the understanding of how certain oil and gas exploration and development activities may affect environmental features. Where information is missing, this EIS complies with 40 CFR 1502.22." It is hard to tell if the 'best available science' was actually used. There should be more citations in the DEIS. More effort should have been made to include information about resources of the 1002 Area, since this document is 'tiered' off of documents written for a different area, the NPRA. There are many GIS analyses that could be done with existing data for the 1002 Area.

Regarding "Where information is missing, this EIS complies with 40 CFR 1502.22", write out what was done rather than just saying it complies with a certain federal regulation.

I looked up the regulation and copied most of it below. If I am interpreting it correctly, it says in (a) below that if information missing from an EIS is essential to make a reasoned choice between alternatives and not exorbitantly expensive to get, then you should arrange to get. That would imply

slowing down the EIS process, determining what information you need, and then getting it. (For example, waiting until you receive the new vegetation and wetlands maps.)

“40 CFR § 1502.22 - Incomplete or unavailable information.

- CFR

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

(a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.

(b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:

(1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, “reasonably foreseeable” includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason. “

Thank you for consideration of my comments and suggestions, Janet C. Jorgenson