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Title:
Comments: Scoping comments from conservation groups

Ms. Elliott,

Attached you will find a scoping comment letter from a coalition of 11 conservation groups. Also attached are three Appendices.

Per our discussion on Tuesday, we have sent a CD with all of the references on it. It is postmarked today and should arrive at your office within a few days. I appreciate you extending us this courtesy.

Please include me on all future communications/distribution lists regarding this EA. Thank you for your engagement with the public throughout this process.

Best,

-Patrick Donnelly

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We write to urge the Forest Service ([ldquo]USFS[rdquo]) to withhold consent to the Bureau of Land Management[rsquo]s ([ldquo]BLM[rdquo]) proposal to offer approximately 54,000 acres within the Ruby Mountains District of the Humboldt-Toiyabe National Forest for oil and gas leasing. Before BLM can issue leases on those lands, BLM must obtain the Forest Service[rsquo]s authorization (or [ldquo]consent[rdquo]) from the Forest Service. See 30 U.S.C. [sect] 226(h). The Forest Service may consent to leasing only after it makes the lands administratively [ldquo]available[rdquo] and verifies that [ldquo]leasing of the specific lands [1] has been adequately addressed in a NEPA document, and [2] is consistent with the Forest land and resource management plan.[rdquo] 36 C.F.R. [sect] 228.102(e)(1). In 2007, the Forest Service expressly concluded that the availability analysis contained in the 1986 Humboldt National Forest Land and Resource Management Plan does not meet the requirements under Forest Service regulations at 36 C.F.R. part 228 because it was completed prior to the passage of the Federal Onshore Oil and Gas Leasing Reform Act of 1987 and prior to the new Forest Service leasing regulations of 1990, making it necessary to conduct an entirely new oil and gas leasing analysis prior to making lands in the White Pine and Grant-Quinn areas of Humboldt

National Forest available for leasing by BLM.1 As discussed below, it is plain that the Forest

Service cannot rely on the [ldquo]open[rdquo] determinations for the Ruby Mountain area in the 1986 forest plan, and must engage in a comprehensive analysis of the impacts of contemporary oil & gas extraction practice by high volume hydraulic fracturing prior to making an availability determination and consenting to a BLM lease sale.

1 See U.S. Dept. of Agriculture, Amendment #9, White Pine and Grant-Quinn Oil and Gas Leasing Availability Analysis, Humboldt National Forest Land and RMP (2000) at page 1-6.

Oil and gas leasing of federal minerals on Forest Service lands is subject to an eight-step process. The eight steps are: (1) leasing analysis by USFS; (2) leasing decision by USFS to make lands administratively available; (3) verification by USFS; (4) BLM assessment; (5) sale by the BLM; (6) issuance of lease; (7) application for permit to drill; and (8) application for permit to drill to develop a field. Under the Federal Onshore Oil and Gas Leasing Reform Act ([ldquo]FOOGLRA[rdquo]), the Forest Service and BLM share responsibility for the issuance of leases on Forest Service lands, but the Act gives the Secretary of Agriculture authority to prevent the issuance of leases on Forest Service Lands. See 30 U.S.C. [sect] 226(h). For National Forest lands, the Secretary of Agriculture must regulate all surface-disturbing activities conducted pursuant to any lease issued and shall determine reclamation and other actions as required in the interest of conservation of surface resources. 30 U.S.C. [sect] 226(g).

At the [ldquo]leasing analysis[rdquo] stage, the Forest Service makes a determination about which lands within the national forest in question should be deemed [ldquo]open[rdquo] or [ldquo]closed[rdquo] for leasing, or open subject to constraints. See 36 C.F.R. [sect] 228.102(c). The determination must comply with the planning regulations at 36 CFR part 219 when it occurs through the planning process. 36 C.F.R.

[sect] 228.102(c). The [ldquo]open[rdquo] or [ldquo]closed[rdquo] determination may also be made through NEPA documents, where appropriate. 36 C.F.R. [sect] 228.102(c). As discussed below, with regard to prior

availability determinations for the Humboldt-Toiyabe National Forest, USFS has previously concluded that because the forest plan for the Humboldt National Forest predated FOOGLRA, a plan amendment was required prior to making an availability determination. Any plan amendment must comply with the 2012 planning regulations at 36 CFR part 219, including substantive requirements to provide for ecological sustainability and species diversity, which are directly related to any decision to consent to leasing in the Ruby Mountains. See 36 C.F.R. [sect][sect] 219.8, 219.9, 219.13(b)(5) (requiring application of substantive rule requirements that are directly related to a proposed amendment).

At the [ldquo]leasing decision[rdquo] stage, the Forest Service identifies specific parcels for leasing, performs specific environmental review on those parcels, and determines whether to authorize BLM to lease those parcels. See 36 C.F.R. [sect] 228.102(e). Prior to authorizing BLM to offer the lands for leasing, the Forest Service must verify that [ldquo]oil and gas leasing of the specific lands has been adequately addressed in a NEPA document, and is consistent with the Forest land and resource management plan. If NEPA has not been adequately addressed, or if there is significant new information or circumstances as defined by 40 CFR 1502.9, additional environmental analysis shall be done before a leasing decision for specific lands will be made. If there is inconsistency with the Forest land and resource management plan, no authorization for leasing shall be given unless the plan is amended or revised.[rdquo] 36 C.F.R. [sect] 228.102(e)(1); see also 16 U.S.C. [sect] 1604(i); 36 C.F.R. [sect] 219.15(b).

Moreover, prior to authorizing BLM to offer lands for leasing, the Forest Service must ensure that conditions of surface occupancy identified during the leasing analysis stage are included as stipulations in the offered leases. 36 C.F.R. [sect] 228.102(e)(2). Additionally, prior to authorizing BLM to offer lands for leasing, the Forest Service must determine whether

operations or development could be allowed somewhere on each proposed lease, or else stipulate for that lease that no surface occupancy shall be allowed. 36 C.F.R. [sect] 228.102(e)(3).

USFS is presently considering whether to authorize BLM to offer specific lands for leasing. The Forest Service[rsquo]s decision to consent to the leasing starts from the premise that the lands previously were designated by USFS as [ldquo]open[rdquo] for leasing during the [ldquo]leasing analysis[rdquo] stage. As described below, such reliance is plainly irrational in light of the Forest Service[rsquo]s failure to revise or amend its now more than 30-year-old forest plan. The plan is based on plainly outdated information about forest resources including wildlife, the sensitivity of those species to harm from oil and gas development, and the impacts of contemporary oil and gas extraction practices through high volume hydraulic fracturing. Nor does the plan address the need to manage forest resources in light of the realities of climate change. Moreover, it is plain that the impacts of authorizing oil and gas leasing in the proposed areas have yet to be analyzed in any NEPA-compliant document that addresses the impacts of oil and gas extraction using modern high volume hydraulic fracturing operations combined with directional drilling; there appears to be no existing analysis of oil and gas development via high volume hydraulic fracturing in any prior NEPA analysis for the forest or area in question, thus there is no prior analysis to which the Forest Service could rationally tier an EA and FONSI. Moreover, the impacts of allowing modern hydraulic fracturing operations in this area are plainly significant, necessitating an EIS.

Prior to authorizing BLM to lease these lands, USFS must produce an EIS that evaluates the impacts of high volume hydraulic fracturing combined with directional drilling, and does so with regard to effects on the primary purposes for which USFS administers the lands under NFMA and MUSYA, and other applicable law that dictates how USFS manages the surface of these lands. USFS cannot rely on subsequent BLM analysis for that purpose because BLM will analyze the impacts with regard to its own authorizing statutes, not those of the USFS. Here, USFS indisputably has the authority to entirely block leasing on these lands to protect the purposes for which it is managing the surface. Consequently, USFS has an obligation under NEPA to fully analyze the impacts that will occur from it allowing lands to be leased. Moreover, USFS cannot rely on NSO stipulations to avoid analyzing harm to resources in those parcels.

USFS must consider whether leasing on the parcels without NSO stipulations would affect resources on the NSO parcels. USFS must do that now, at the consent stage, because it is the earliest and indeed only point where the total impact of making the area available to leasing will be evaluated by USFS at a point in time where USFS can prevent the entirety of the impact.

USFS cannot defer meaningful analysis of impacts until after the lease sale has occurred on the premise that ground disturbance is not authorized until after the sale. For non-NSO leases, it is plain that once the lease sale occurs, the ability of USFS to avoid harms is diminished and an irretrievable commitment of resources has occurred. NEPA requires analysis of all reasonably foreseeable impacts at the earliest practicable point, and before an irretrievable commitment of resources is made, which courts have routinely held is before leasing. 42 U.S.C. [sect] 4332(2)(C)(v); 40 C.F.R. [sect][sect] 1501.2, 1502.22; see also Pennaco Energy, Inc. v. U.S. Department of the Interior,

377 F.3d 1147 (10th Cir. 2004); Conner v. Burford, 848 F.2d 1441 (9th Cir. 1988); Sierra Club v.

Peterson, 717 F.2d 1409 (D.C. Cir. 1983); N.M. ex rel. Richardson v. BLM, 565 F.3d 683, 716 (10th Cir. 2009). As detailed below, this analysis must consider impacts to forest resources from the drilling itself, water consumption associated with the drilling, impacts of air and water pollution from exploration and production, impacts from road development associated with drilling, and the contribution of its decision to climate change. USFS must also consider the impacts above in light of the ongoing impacts of climate change on forest resources.

1. The Forest Service Cannot Rationally Rely on the Outdated 1986 [ldquo]Open[rdquo] Determination for the Lands in Question in Determining Whether to Consent to BLM Leasing

Prior to consenting to BLM[rsquo]s decision to lease, USFS must reconsider whether the lands in question should be open or closed to leasing through a new leasing analysis that comports with USFS regulations and NEPA. That reconsideration should be part of a comprehensive forest plan revision, and USFS should withhold consent for leasing until it has completed that revision. The forest plan here is more than 15 years out of date with regard to NFMA[rsquo]s statutory deadlines for revision. Furthermore, in light of the abundance of new information about climate change, the impacts of contemporary hydraulic fracturing practices, and the status of imperiled species such as sage grouse that has become available in the three decades since the forest plan was finalized, revision is warranted based on the significant change of conditions in the unit.

The lands addressed in the scoping notice are [ldquo]open[rdquo] based on a 1986 resource management plan. See Humboldt National Forest Land and Resource Management Plan Dated 1986.2 NFMA requires that forest plans be revised at least every fifteen years. 16 U.S.C. [sect] 1604(f)(5)(A). Work on a revision of the 1986 management plan was suspended in 2009; the stated reason for suspending the revision was inadequate resources and personnel.3 In October 2016, USDA indicated that plan revision was tentatively scheduled to resume in 2021.4 USFS regulations require that a leasing analysis determination of whether lands are [ldquo]open[rdquo] or [ldquo]closed[rdquo] or open subject to lease restrictions must be made in accordance with USFS planning regulations when the leasing analysis is made as part of a forest planning process under those regulations. 36

C.F.R. [sect] 228.102(c). The determination here was indeed made as part of such a planning process,

2 U.S. Dept. of Agriculture, Humboldt National Forest Land and Resource Management Plan (2000).

3 See U.S. Dept. of Agriculture, Forest Plans, Humboldt-Toiyabe National Forest (May 2009) ([ldquo]Work on Forest

Plan revision has been suspended as resources and personnel are devoted to travel management, environmental analysis of grazing, fire and fuels management, and implementation of the American Recovery and Reinvestment Act. The Humboldt-Toiyabe National Forest will make a public announcement when Forest Plan revision is re- initiated.[rdquo]) (accessed 10/10/2017).

4 See U.S. Dept. Agriculture, Forest Plan Revision, Intermountain Region Newsletter (Oct. 2016) (accessed Oct. 31, 2017).

as it was part of the 1986 Humboldt Forest LRMP. Because the determination was made through that process, it is subject to the requirement that, as part of the plan, it be revised at least every 15 years. 36 C.F.R. [sect] 219.7(a).

Revision of the forest plan is also warranted because [ldquo]conditions in a unit have significantly changed.[rdquo] 16 U.S.C. [sect] 1604(f)(5). The impacts of climate change, the status of imperiled species, and the nature of oil and gas operations are significantly different at present than in 1986. Conclusions about conditions in the unit shaped the Forest Service[rsquo]s judgment in 1986 about which areas should be open to oil and gas leasing; because those conditions have significantly changed, the conclusions made in reliance on them must be reconsidered. The Forest Service cannot properly reconsider those conclusions without re-evaluating the forest plan in its entirety. The relative value of the resources managed as part of the plan are not the same now as they were in 1986, the balancing of uses and the impacts of uses on each other also is not the same now as in 1986. Continued reliance on a plan that does not reflect present realities ensures that forest resources will not be managed in compliance with the requirements or goals of NFMA and MUSYA. For example, the significant impacts of climate change on water availability are a critical consideration that should drive determinations of the proper

management of forest resources to protect watersheds.5 The impacts of high volume hydraulic

fracturing on water availability cannot be properly evaluated without first conducting a comprehensive reassessment of the value of water resources, and the relationship of forest vegetation to water resources, in light of declines in water availability caused by climate change.

5 See, e.g., Cayan, Daniel et al., Natural variability, anthropogenic climate change, and impacts on water availability and flood extremes in the Western United States, Water Policy and Planning in a Variable and Changing Climate (2016), at 35 ([ldquo]In addition to natural variation from synoptic to multidecadal timescales, conditions in the West appear to be undergoing long-term changes. An interconnected set of hydrologic shifts, including more rain and less snow, diminished spring snowpack, and earlier mountain runoff, have been observed in snow-dominated watersheds in response to warmer winters and springs since the mid-1970s. Although the region exhibits natural climate variability on decadal timescales and long droughts have occurred in the past, there is a striking similarity of observed trends to those that are projected under climate warming. This, combined with evidence from a series of detection and attribution studies, indicates that the hydrologic changes are, to some degree, the early phase of a response to anthropogenic climate change. Exceptionally warm dry spells in the Colorado Basin and over the West Coast during the past decade add to concerns about changing climate. The projected effects of increasing concentrations of atmospheric GHGs on western US hydrology are substantial, even under moderate scenarios of climate change. Under higher (SRES A2 or RCP 8.5) scenarios, these changes and impacts would be extremely challenging. The region[rsquo]s water supply and its vulnerability to flood hazards depend on high-volume precipitation events, so understanding the disposition of the region[rsquo]s major storm events under climate change is vital in preparing for future impacts.[rdquo]); Meixner, T. et al., Implications of Projected Climate Change for Groundwater Recharge in the Western United States, 534 Journal of Hydrology 124 (2016) ([ldquo]The key outcome is that existing information supports a [lsquo]wet gets wetter, dry gets drier[rsquo] scenario. Southern portions of the western U.S. are likely to experience declines in [groundwater] recharge of varying magnitudes. [hellip] Mountain System Recharge (MSR) is expected to decrease with high certainty in the southern and western portions of the region[.][rdquo]); Elias, Emile et al., Climate Change, Agriculture and Water Resources in the Southwestern United States, 158 Journal of Contemporary Water Research & Education1: 46 (2016) (describing USDA efforts to provide farmers and foresters with information needed to adapt to impacts of climate change on water availability and stating [ldquo]climate change affects water resources of the SW to a degree that is probably unmatched anywhere in the U.S. SW agriculture, which relies heavily on available water for production, is particularly vulnerable to the reduced water availability stemming from current and predicted climate changes.).

At the very least, a robust plan amendment, with updated NEPA analysis, will be necessary. However, because any such amendment would be directly related to substantive requirements to provide for ecological sustainability and species diversity [ndash] particularly given the important ecological and habitat values associated with the area [ndash] the amendment would be significant enough in scope to warrant a full revision. See 36 C.F.R. [sect] 219.15(b)(5).

Moreover, regardless of whether USFS must complete a forest plan revision prior to making the lands [ldquo]available[rdquo] for a BLM lease sale, USFS must consider, prior to consenting to the lease sale, whether reliance on the 30 year old status determinations is rational in light of the vast differences between the oil & gas operations contemplated in 1986 and modern extraction methods. Moreover, USFS must consider how new information about the impacts of those extraction methods affects its reliance on the 1986 determination. USFS must also consider whether such reliance is rational in light of the significant differences in the sensitivity and vulnerability of forest resources and wildlife to harm between 1986 and the present due to escalating threats that were not considered at the time of the 1986 plan, such as the impacts of climate change. USFS cannot rationally rely on a forest plan where significant changes in the condition of the unit make it plain that revision of that plan is warranted. As mentioned above, in 2007, USFS concluded that the leasing analysis in the 1986 Humboldt LRMP did not comply with the requirements under 36 C.F.R. part 228, and that therefore USFS had to conduct a new leasing analysis prior to making a determination whether lands in White Pine and Grant-Quinn should be made available for leasing. Thus, in addition to the obvious inadequacy of the outdated determinations in the Humboldt LRMP, the USFS itself has already conceded that, because of the inadequacy of the Humboldt LRMP, it must go back to step 1 of the eight-step process under FOOGLRA before making the step 2 availability determination.

At present, it appears that USFS lacks any NEPA-compliant environmental analysis of the impacts of modern high volume hydraulic fracturing operations and directional drilling on the lands within the Ruby Mountain area.

With regard to its management direction for the Ruby Mountains, the existing Humboldt National Forest Plan says this: [ldquo]Most of the Forest is classified as "Lands Valuable for Oil and Gas" except the extreme tops of the Snake and Grant Ranges, the Ruby Mountains, East Humboldt and Santa Rosa Ranges and part of the Mountain City District (p. II-21, emphasis added). The existing plan also says:

Based on present knowledge and concepts of oil and gas formation and entrapment, few wells will likely be drilled on the Forest. There are no areas with high potential for oil and gas accumulation, due to the mountainous, structurally complex and faulted nature of the ranges which comprise forest lands. It is still possible, though, that new concepts and exploration methods will enable operators to find oil and gas in these mountain ranges. (p. II-22)

The forest plan[rsquo]s assessment of the potential value of the lands here for oil and gas extraction thus makes plain that the plan was considering only conventional oil and gas extraction. Its determination as to which areas should be open therefore clearly does not consider the potential for oil and gas development using the methods which certainly would be utilized for extraction today, nor does it contemplate the environmental impacts and impairment of forest resources that would be associated with contemporary extraction methods.

Notably, in 2007, when USFS made 255,603 acres in the White Pine and Grant-Quinn area available for oil and gas leasing, it did so only after completing an EIS and plan amendment.6 Yet even at that time, the oil and gas operations contemplated were not the modern high volume hydraulic fracturing operations that would occur on the lands were they to be leased now. The White Pine and Grant-Quinn Oil and Gas Leasing Project Final Environmental Impact

Statement includes only a brief discussion of hydraulic fracturing and directional drilling, and that cursory discussion of hydraulic fracturing appears to be contemplating only low-volume hydraulic fracturing for secondary well stimulation of sandstone units rather than high-volume hydraulic fracturing that has since come to be used commonly for extraction from tight shale units that otherwise would be uneconomic to develop at all. The assumptions regarding water use per well in that EIS make it plain that the EIS is not contemplating high volume hydraulic

fracturing.7 Moreover, the Humboldt LRMP is now a decade more out of date than it was at the

time of White Pine availability determination, and the USFS has promulgated new planning regulations that better reflect current circumstances and resource management and protection needs. Thus, even if a plan amendment was sufficient to address the 2007 availability determination for White Pine and Grant-Quinn, a mere amendment would not be sufficient here because the nature of the extraction methods used now are drastically different than contemplated in the 1986 plan, and the plan[rsquo]s determinations about forest resources and their management in the unit are now so out of date at to make reliance upon them irrational.

For example, the vast quantities of fracturing fluid injected during modern high volume [ldquo]fracking[rdquo] operations and subsequently removed as [ldquo]flowback[rdquo] waste water require USFS to reconsider its open determination in light of, inter alia, (1) the impact of removing this enormous volume of water from the local hydrological system that supports forest resources, including the ESA listed Lahontan cutthroat trout; (2) surface area requirements for the storage of large volumes of fracking fluid and flowback; (3) the impact of potential spills associated with the handling of vast amounts of fracking fluid and flowback; and (4) the risk of surface and groundwater contamination during fracturing operations resulting from casing failures.

Furthermore, such hydraulic fracturing operations have direct or local air quality impacts that are more severe than those associated with conventional oil and gas extraction. The USFS must

6 See U.S. Dept. of Agriculture, Amendment #9, White Pine and Grant-Quinn Oil and Gas Leasing Availability Analysis, Humboldt National Forest Land and RMP (2000)

7 See U. S. Forest Service, White Pine and Grant-Quinn Oil and Gas Leasing Project Final EIS (2007) at 1-10 through 1-12 (estimating water use of 420,000 gallons total per well drilled). By contrast, modern high volume

hydraulic fracturing operations typically require millions of gallons of water per well. See, e.g., Bobby Magill, Water Use Rises as Fracking Expands, Scientific American , July 1, 2015 ([ldquo]Between 2000 and 2014, the average water used to drill a horizontal natural gas well increased from 177,000 gallons to 5.1 million gallons per well[.][rdquo])

therefore consider these air impacts in deciding whether the proposed Ruby Mountains areas should be made available for leasing.

In light of 30 years of new information about the nature of the extractive activities; the status of forest resources;

and the impact of those activities, USFS should not make an availability determination without first revising the 1986 forest plan. Moreover, USFS must at minimum produce a new leasing analysis and an EIS fully analyzing the impacts of making the 54,000 acres in question available for high volume hydraulic fracturing operations.

2. USFS Must Develop an EIS Prior to Consenting to Leasing

USFS must develop an EIS prior to consenting to leasing. First, as described above, USFS cannot rationally consent to the leasing until it has revised the forest plan. A forest plan revision itself would necessarily require an EIS. See 36 C.F.R. [sect] 219.5(a)(2)(i). However, regardless of whether a plan revision is required, an EIS is required here because consenting to lease the area in question here would have significant environmental impacts in light of the factors set forth for the evaluation of significance. See 40 C.F.R. [sect] 1508.27. For example, the area in question here is in proximity to wilderness areas and extremely important greater sage grouse habitat, such that the intensity of the impact, and its significance must be measured with regard to damaging those unique and highly valuable resources. See 40 C.F.R. [sect] 1508.27(b)(3). Moreover, the effects of high volume hydraulic fracturing operations on the sensitive resources of the Ruby Mountains area are both highly controversial and involve uncertain and unique or unknown risks. 40 C.F.R. [sect] 1508.27(b)(4)-(5). Moreover, the action will have effects on the Lahontan cutthroat trout, implicating 40 C.F.R. [sect] 1508.27(b)(9).

The USFS cannot provide its consent to leasing without first conducting a full analysis of the significant impacts that will result from that consent. Without an EIS, any decision to consent to leasing would be arbitrary and capricious and violate NEPA.

3. The scope of the analysis must include impacts on areas outside the leased parcels from connected actions such as pipelines, roads, and powerlines

Connected actions which must be considered for each alternative considered in evaluating whether the 54,000 acres in question should be made available for leasing should include post-leasing activities that will occur through the lessee[rsquo]s surface use plans of operation and the rights-of-way for development such as gathering lines, pipelines, compressor stations, roads, and powerlines outside the physical bounds of leased parcels that are needed for

exploration, development, production, and other activities under the lease. See 36 C.F.R.[sect] 228.102(c)(4); 40 C.F.R. [sect] 1508.25.

4. USFS must fully consider the impacts of leasing of non-NSO lease parcels on resources within NSO lease parcels prior to making any availability determination

USFS cannot defer analysis of impacts on areas with sensitive resources such as sage grouse, Lahontan cutthroat trout, or riparian habitat merely by asserting that areas with those resources will be leased only through no surface occupancy ([ldquo]NSO[rdquo]) leases. In making a determination about which of the 54,000 acres considered here should be made available for leasing and under what stipulations, the Forest Service must fully consider how oil & gas extraction via high volume hydraulic fracturing on any portion of the Ruby Mountain lands in question would affect sensitive resources. It is indisputable that the environmental impacts of surface oil and gas development on a particular parcel will extend beyond that parcel. Air and water pollution, and habitat fragmentation are some of the impacts of hydraulic fracturing activities that would invariably extend beyond the edges of a parcel where surface occupancy occurs to adjacent parcels. Put differently, the leasing analysis must explicitly justify and consider the proper buffer size between non-NSO leases and sensitive resources, and must rely on the most current available science in arriving at those buffer sizes. Moreover, the leasing analysis determination must consider the impact of connected actions such as pipelines, compressor stations, powerlines, and roads on areas with sensitive resources, even if leases for those areas would be NSO. In other words, the present analysis must consider whether the non- NSO leases will require pipelines, roads, power lines or other infrastructure that will cut through the NSO lease areas. That analysis must consider the best available information on the fragmentation impacts of such linear disturbances on sensitive habitats and species such as sage grouse.

Moreover, leasing of non-NSO parcels and nearby NSO parcels are interdependent because the economic feasibility and profitability of engaging in exploration and extraction activities will in many cases depend on whether the subsurface in nearby NSO parcels will be accessible through horizontal drilling originating from vertical bores on non-NSO parcels.

Deferring the consideration of impacts to later stages improperly segments the analysis of impacts.

5. USFS must consider a No-Leasing Alternative

Regardless of whether USFS is considering NSO stipulations, the agency must consider a no-leasing option. See Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1229 n.4 (9th Cir. 1988) (agency must consider a no leasing option, even in the context of an NSO stipulation because, [ldquo]by definition, the no-leasing option is no longer viable once leases have been issued; it must be considered before any action is taken[rdquo]). USFS has statutory authority to entirely block leasing of the lands in question by BLM at this stage. USFS must consider an alternative where it exercises that authority.

6. USFS cannot rely on stipulations to defer consideration of impacts to a later stage.

Where the lease stipulations either do not preclude surface occupancy from an entire parcel, or do not preclude surface occupancy, the sale of that lease typically confers a guaranteed right to the lease holder to occupy as much of the surface of the parcel as is necessary to explore and extract the oil and gas resources underlying that parcel.8 Thus, where the NSO stipulation applies to only a portion of a parcel, the remainder of that parcel will be subject to all and any surface occupation necessary for exploration and extraction of resources underlying the entirety of the parcel. Similarly, non-NSO parcels will be subject to occupation in their entirety as

necessary to explore and extract the resources underlying the parcel. Consequently, once the lease sale occurs, the Forest Service is limited to mitigating the impacts associated with the lease holder[rsquo]s exercise of its right, whereas prior to the sale, the Forest Service has the authority to prevent the impacts altogether. The establishment of the lease holder[rsquo]s right through the lease sale thus represents an irretrievable commitment of resources. The Forest Service cannot lawfully consent to a sale without fully analyzing the environmental impacts of exploration and development occurring on the parcels. As discussed above, that analysis must also include an assessment of the impacts of such development on sensitive resources within the bounds of areas excluded from surface occupancy and must evaluate the adequacy of the size of the zone stipulated for no surface occupancy to actually protect the sensitive resources from impact resulting from activities on and under adjacent areas.

Even if there were a NSO stipulation covering an entire parcel[mdash]the mere issuance of the lease confers a right to the resources thereunder. Whether through directional drilling or some other method of extraction, the leaseholder has an exercisable interest as soon as the lease is conferred, which it then relies upon in proceeding with its development plan. Therefore, significant environmental impacts, based on those lease rights, may also occur once a lease is issued. Although [ldquo]some or all of the environmental consequences of oil and gas development may be mitigated through lease stipulations, it is equally true that the purpose of NEPA is to examine the foreseeable environmental consequences of a range of alternatives prior to taking an

8 Oil and gas leases confer [ldquo]the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold.[rdquo] 40 C.F.R. [sect] 3101.1-2.

action that cannot be undone.[rdquo] Montana Wilderness Ass[rsquo]n v. Fry, 310 F.Supp.2d 1127, 1145 (D. Mont. 2004); see also 40 C.F.R. [sect] 1501.2.

[ldquo][M]itigation measures, while necessary, are not alone sufficient to meet the [Agency[rsquo]s] NEPA obligations to determine the projected extent of the environmental harm to enumerated resources before a project is approved.[rdquo] Northern Plains Resource Council v. Surface Transportation Board, 668 F.3d 1067, 1085 (9th Cir. 2011) (emphasis in original). If USFS delays detailed analysis until after the lease issues, and therefore discovers significant impacts only after the lease has issued, it may no longer be able to prevent them.

For that reason, the Forest Service must engage in detailed analysis of impacts now, at the stage where it has authority to prevent them.

Moreover, as described above, due to the inadequacy of existing [ldquo]open[rdquo] and [ldquo]closed[rdquo] determinations, USFS must return to the leasing analysis stage prior to making any availability determination. Forest Service regulations make plain that in conducting the leasing analysis, USFS must, [ldquo][p]roject the type/amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative[rdquo] and must [ldquo][a]nalyze the reasonable foreseeable impacts of post-leasing activity projected.[rdquo] 36 C.F.R. [sect] 228.102(c)(3)-(4). These regulations do not allow for the Forest Service to defer such projection and analysis of impacts to the post-leasing stage.

7. The Forest Service must consider climate change

Meaningful consideration of greenhouse gas emissions (GHGs) is clearly within the scope of required NEPA review.9 As the Ninth Circuit has held, in the context of fuel economy standard rules:

The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct. Any given rule setting a CAFE standard might have an [ldquo]individually minor[rdquo] effect on the environment, but these rules are [ldquo]collectively significant actions taking place over a period of time.[rdquo] 10

The courts have ruled that federal agencies consider indirect GHG emissions resulting from agency policy, regulatory, and leasing decisions. For example, agencies cannot ignore or dismiss as speculative the indirect air quality and climate change impact of decisions that would open up access to coal reserves. 11 Moreover, just days ago, the U.S. Tenth Circuit Court of

9 Ctr. for Biological Diversity v. Nat[rsquo]l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008).

10 Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1216 (9th Cir. 2008) (quoting 40 C.F.R. [sect] 1508.7).

11 See Mid States Coal. For Progress v. Surface Transp. Bd., 345 F.3d 520, 532, 550 (8th Cir. 2003); High

Country

Conservation Advocates v. U.S. Forest Serv., 52 F. Supp. 3d 1174, 1197-98 (D. Colo. 2014).

Appeals for the Tenth Circuit reaffirmed in strikingly clear language that the National Environmental Policy Act does not allow agencies to dismiss downstream combustion effects of fossil fuel leasing decisions based on the unsupported assumption that leasing actions will have no net effect on greenhouse gas emissions. In Wildearth Guardians v. U.S. Bureau of Land Management, the Court of Appeals ruled unanimously that BLM [ldquo]failed to comply with the

National Environmental Policy Act (NEPA) when it concluded that issuing the leases would not result in higher national carbon dioxide emissions than would declining to issue them.[rdquo]12 Agencies cannot ignore basic economic principles and assume that there will be no net effect on oil and gas production, markets, price, and ultimate consumption when it opens new federal minerals to oil and gas exploration and development.

Fugitive methane emissions that escape from wells, oil storage, and processing equipment are a [ldquo]major source of global CH4 emissions.[rdquo] Methane is a highly potent greenhouse gas with a large global warming potential (GWP). The 2013 IPCC Fifth Assessment Report established a GWP of 87 for fossil fuel sources of methane over a 20-year time period, and a GWP of 36 over a 100-year time period.13 That means that over a 20-year period, methane is 87 times stronger in trapping heat than CO2. The EA must quantify the fugitive and non-fugitive CH4 emissions that would come from the wells.

The EA also must quantify the indirect downstream emissions from the end-use combustion of oil and gas produced by the wells. Furthermore, the EA must provide estimates of the indirect methane and N2O emissions that would be produced from combustion of oil and gas.

Furthermore, a large body of scientific research has established that the vast majority of global and U.S. fossil fuels must stay in the ground in order to hold temperature rise to well below 2[deg]C.14 Studies estimate that 68 to 80 percent of global fossil fuel reserves must not be extracted and burned to limit temperature rise to 2[deg]C based on a 1,000 GtCO2 carbon budget.15 For a 50 percent chance of limiting temperature rise to 1.5[deg]C, 85 percent of known fossil fuel

12 Wildearth Guardians v. U.S. Bureau of Land Mgmt, No. 15-8109 (10th Cir. Sept. 15, 2017), slip op. at 2-3.

13 Myhre, Gunnar et al., 2013: Anthropogenic and Natural Radiative Forcing, In: Climate Change 2013: The

Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change IPCC. Cambridge University Press, Cambridge UK and New York USA (2013), at Table 8.7.

14 The IPCC estimates that global fossil fuel reserves exceed the remaining carbon budget for staying below 2[deg]C by 4 to 7 times, while fossil fuel resources exceed the carbon budget for 2[deg]C by 31 to 50 times. See Bruckner, Thomas et al., 2014: Energy Systems. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working

Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA (2014), at Table 7.2.

15 Carbon Tracker Initiative, Unburnable Carbon-Are the world[rsquo]s financial markets carrying a carbon bubble?, Carbontracker.org (2013) To limit temperature rise to 2[deg]C based on a 1,000 GtCO2 carbon budget from 2011

onward, studies indicate variously that 80 percent, 76 percent ([ldquo]Raupach 2014[rdquo]), and 68 percent (Oil Change International Sept. 2016), of global fossil fuel reserves must stay in the ground. See Carbon Tracker Initiative.; Raupach, Michael et al., [ldquo]Sharing a quota on cumulative carbon emissions,[rdquo] 4 Nature Climate Change 873 (2014), doi: 10.1038/nclimate2384; Muttitt, Greg et al., The Sky[rsquo]s Limit: Why the Paris Climate Goals Require A Managed Decline of Fossil Fuel Production, Oil Change International (Sept. 2016) ([ldquo]Oil Change International 2016[rdquo]).

reserves must stay in the ground.16 Effectively, fossil fuel emissions must be phased out globally within the next few decades.17

A 2016 global analysis found that potential carbon emissions from developed reserves in currently operating oil and gas fields and mines would lead to global temperature rise beyond 2[deg]C.18 Excluding coal, currently operating oil and gas fields alone would take the world beyond 1.5[deg]C.19 To stay well below 2[deg]C, the clear implication is that no new fossil fuel extraction or transportation infrastructure should be built, and governments should grant no new permits for new fossil fuel extraction and infrastructure.20 Moreover, some fields and mines, primarily in rich countries, must closed before fully exploiting their resources. The analysis concludes that, because [ldquo]existing fossil fuel reserves considerably exceed both the 2[deg]C and 1.5[deg]C carbon budgets[, i]t follows that exploration for new fossil fuel reserves is at best a waste of money and at worst very dangerous.[rdquo]21

According to a U.S.-focused analysis,22 the United States alone has enough recoverable

fossil fuels, split about evenly between federal and non-federal resources, that if extracted and burned, would exceed the global carbon budget for a 1.5[deg]C limit, and would consume nearly the entire global budget for a 2[deg]C limit.23 Specifically, the analysis found:

Potential greenhouse gas emissions of federal fossil fuels (leased and unleased) if developed would release up to 492 gigatons (Gt) of carbon dioxide equivalent pollution (CO2e), representing 46 percent to 50 percent of potential emissions from all remaining

U.S. fossil fuels.

Of that amount, up to 450 Gt CO2e have not yet been leased to private industry for extraction. Releasing those 450 Gt CO2e (the equivalent annual pollution of more than 118,000 coal-fired power plants) would be greater than any proposed U.S. share of global carbon limits that would keep emissions well below 2[deg]C.24

Fracking has also opened up vast resources that otherwise would not be available, increasing the potential for future greenhouse gas emissions. The long-lived GHG emissions and

16 Oil Change International 2016, at 6.

17 Rogelj et al. (2015) estimated that a reasonable likelihood of limiting warming to 1.5[deg] or 2[deg]C requires global CO2

emissions to be phased out by mid-century and likely as early as 2040-2045. See Rogelj, Joeri et al., Energy system transformations for limiting end-of-century warming to below 1.5[deg]C, 5 Nature Climate Change 519 (2015). Climate Action Tracker indicated that the United States must phase out fossil fuel CO2 emissions even earlier[mdash]between 2025 and 2040[mdash]for a reasonable chance of staying below 2[ordm]C. See, e.g. Climate Action Tracker, USA (2017).

18 Oil Change International 2016, at 5.

19 Id., at. 5.

20 Id., at. 5.

21 Id., at. 17.

22Mulvaney, Dustin et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, Ecoshift Consulting (2015).

23 Id., at. 4.

24 For the United States, Raupach 2014 provided a mid-range estimate of the U.S. carbon quota of 158 GtCO2 for a 50 percent chance of staying below 2[deg]C, using a [ldquo]blended[rdquo] scenario of sharing principles for allocating the global carbon budget among countries. This study estimated US fossil fuel reserves at 716 GtCO2, of which coal comprises the vast majority, indicating that most fossil fuel reserves in the US must remain unburned to meet a well below 2[deg]C carbon budget. Raupach 2014, at Supplementary Figure 7.

fossil fuel infrastructure that would result from this project will contribute to undermining national and state climate commitments and increase climate change impacts, at a time when there is urgent need to keep most fossil fuels in the ground.

The final CEQ Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA review is dispositive on the issue of federal agency review of greenhouse gas emissions as foreseeable direct and indirect effects of the proposed action. 81 Fed. Reg. 51,866 (Aug. 5, 2016). The CEQ guidance provides clear direction for agencies to conduct a lifecycle greenhouse gas analysis because the modeling and tools to conduct this type of analysis are readily available to the agency:

If the direct and indirect GHG emissions can be quantified based on available information, including reasonable projections and assumptions, agencies should consider and disclose the reasonably foreseeable direct and indirect emissions when analyzing the direct and indirect effects of the proposed action. Agencies should disclose the information and any assumptions used in the analysis and explain any uncertainties. To compare a project[rsquo]s estimated direct and indirect emissions with GHG emissions from the no-action alternative, agencies should draw on existing, timely, objective, and authoritative analyses, such as those by the Energy Information Administration, the Federal Energy Management Program, or Office of Fossil Energy of the Department of Energy. In the absence of such analyses, agencies should use other available

information.25

CEQ[rsquo]s guidance even provides an example of where a lifecycle analysis is appropriate in a leasing context at footnote 42:

The indirect effects of such an action that are reasonably foreseeable at the time would vary with the circumstances of the proposed action. For actions such as a Federal lease sale of coal for energy production, the impacts associated with the end-use of the fossil fuel being extracted would be the reasonably foreseeable combustion of that coal.26

Although the 2016 CEQ guidance has been "withdrawn for further consideration," 82 Fed.

Reg. 16,576 (April 5, 2017), the underlying requirement to consider climate change impacts under NEPA, including indirect and cumulative combustion impacts foreseeably resulting from fossil fuels leasing decisions, has not changed.27

25 81 Fed. Reg. 51,866 at 16 (Aug. 5, 2016)(citations omitted).

26 Id.

27 See Wildearth Guardians v. United States BLM, 870 F.3d 1222, 1234-38 (10th Cir. 2017); Montana Environmental Information Center v. U.S. Office of Surface Mining, No. 9:15-cv-00106 (D. Mont. Aug. 14, 2017); see also S. Fork

Band, 588 F.3d at 725; Ctr. for Biological Diversity, 538 F.3d at 1214-15; Mid States Coalition for Progress, 345 F.3d at 550; WildEarth Guardians, 104 F. Supp. 3d at 1230; Dine Citizens Against Ruining Our Env't, 82 F. Supp. 3d at 1201; High Country Conservation Advocates, 52 F. Supp. 3d at 1174.

8. USFS must consult with the FWS regarding the impacts on Lahontan cutthroat trout.

Prior to making the lands at issue here available for leasing, the Forest Service must consult with the U.S. Fish and Wildlife Service regarding the effects of leasing on Endangered Species Act-listed species such as the threatened Lahontan cutthroat trout. Any prior consultation that may have occurred in connection to the Humboldt LMRP is plainly now stale, would fail to consider the impacts of modern hydraulic fracturing operations, and would fail to consider the realities of climate change, habitat loss, and other circumstances and threats that have changed since 1986. In addition, since consultation must address both survival and recovery of listed species, consultation on the existing plan, plan changes and/or a leasing decision must consider the Recovery Plan that was adopted in 1995 and any more recent information relevant to recovery. The documentation associated with compliance with ESA section 7[rsquo]s requirements should inform the environmental analysis required under NEPA. Moreover, the effects of impacts from leasing on water quantity and quality, and potential impacts to this ESA listed species make it plain that the impacts will be significant, and should the Forest Service recommend the parcels for leasing, these impacts must be analyzed in an EIS.

9. USFS must ensure compliance with the Roadless Area Conservation Rule and analyze impacts to roadless characteristics of Inventoried Roadless Areas

Recognizing their myriad social and ecological benefits [ndash] including clean air and water, critical wildlife habitat, climate refugia, and opportunities for primitive forms of recreation [ndash] the 2001 Roadless Area Conservation Rule (RACR) protected over 58 million acres of Inventoried Roadless Areas (IRAs) from road construction and timber harvesting. 66 Fed. Reg. 3244, 3245- 47 (Jan. 12, 2001), 36 C.F.R. part 294. Leasing IRAs for oil and gas development is contrary to the spirit and intent of the RACR and, absent stipulations that guarantee development will not result in surface disturbance, is likely to result in a violation of the rule[rsquo]s prohibition on road construction and reconstruction. See 36 C.F.R. [sect] 294.12(a).

The USFS is considering consenting to lease nearly 29,000 acres located across four

IRAs:

Inventoried Roadless Area	Overlap Acreage
Ruby - Lamoille Cyn	4,549
Ruby - Smith Ck	594
Ruby - South	5,379
Pearl Peak	18,301
Total	28,822

These areas [ndash] which also exhibit wilderness characteristics [ndash] are generally inappropriate for leasing. To the extent the USFS does consent to lease them, the RACR requires assurances that future development of the leases will not result in road construction or reconstruction. This necessarily requires the agency to impose NSO stipulations that are not subject to exceptions, waivers, or modifications.

In addition to ensuring compliance with the RACR, USFS must thoroughly analyze the impacts of its consent to lease the Ruby Mountains on the roadless characteristics of the affected IRAs. Binding Ninth Circuit precedent requires analysis of impacts to roadless attributes such as water resources, soils, wildlife habitat, and recreation opportunities, which have independent environmental significance, and also to the area[rsquo]s potential for designation as wilderness. Lands Council v. Martin, 529 F.3d 1219, 1230-32 (9th Cir. 2008); Smith v. U.S. Forest Serv., 33 F.3d 1072, 1077-79 (9th Cir. 1994).

As described in more detail in section 10(G) below, the affected IRAs will undoubtedly be included in the mandatory wilderness inventory and evaluation during any upcoming forest plan revision and be high priorities for designation as recommended wilderness. See 36 C.F.R. [sect] 219.7(c)(2)(v); Forest Service Handbook 1909.12, ch. 70. Indeed, each of these IRAs have long been proposed for wilderness recommendation, including most recently in 2007 by Friends of Nevada Wilderness.

The necessary NEPA analysis must thoroughly analyze the adverse impacts of oil and gas leasing to roadless and wilderness characteristics, including potential road building, diminishment of the areas[rsquo] natural appearance, adverse impacts to air and water quality and wildlife habitat, and interference with opportunities for solitude and primitive forms of recreation. Importantly, even with respect to consent to leasing with non-waivable NSO stipulations (which would be required to ensure compliance with the RACR), the USFS must analyze and acknowledge the reduced political potential that the areas would eventually be recommended or designated as wilderness. An adequate NEPA analysis of these impacts will be exceptionally difficult absent a comprehensive plan revision to determine how to balance leasing and development potential with the compelling conservation values of the Ruby Mountains.

10. USFS must fully consider the environmental, health, and social impacts of oil and gas extraction through high volume hydraulic fracturing

As mentioned above, contemporary hydraulic fracturing practices, which include the use of vast volumes of fracturing fluid to enable production from tight rock units from which extraction would otherwise not be economically feasible, differ significantly from both conventional oil and gas extraction and hydraulic fracturing for secondary stimulation of

relatively permeable reservoir rocks. Utilizing an updated forecast of the development scenario that is likely to occur, USFS must consider the impact of oil and gas development utilizing high volume hydraulic fracturing on:

[middot] Air quality

[middot] Water quality and quantity

[middot] Human health

[middot] Wildlife

[middot] Vegetation

[middot] The wilderness qualities of nearby wilderness areas

[middot] The wilderness qualities of proposed wilderness areas and areas that may be identified as suitable for inclusion in the National Wilderness Preservation System through a forest plan revision

[middot] The roadless characteristics of inventoried roadless areas

[middot] Visual resources

[middot] Cultural resources

[middot] Recreational opportunities and values

[middot] Environmental justice

A. Air Quality

Oil and gas operations emit numerous air pollutants, including volatile organic compounds (VOCs), NOX, particulate matter, hydrogen sulfide, and methane. Hydraulic fracturing ([ldquo]fracking[rdquo]) operations are particularly harmful, emitting especially large amounts of pollution, including air toxic air pollutants. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions in these and other regions. USFS must analyze increased emissions from foreseeable oil and gas development for these lease parcels in order to prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

Forecasting air quality impacts from the leasing and resource management of fossil fuel development is required by well-established law.28 Without such analysis in this EA, the only time the cumulative impacts of oil and gas development projects could be analyzed is when the

28 WildEarth Guardians v. United States Office of Surface Mining Reclamation & Enforcement, 104 F. Supp. 3d 1208, 1227-1228 (D. Colo. 2015). [ldquo]The question posed by the plaintiff is not whether the increased mining will result in a release of particulate matter and ozone precursors in excess of the NAAQS, but whether the increased emissions will have a significant impact on the environment. One can imagine a situation, for example, where the particulate and ozone emissions from each coal mine in a geographic area complied with Clean Air Act standards but, collectively, they significantly impacted the environment. It is the duty of OSM to determine whether a mining plan modification would contribute to such an effect, whether or not the mine is otherwise in compliance with the Clean Air Act's emissions standards.[rdquo](internal citations omitted).

last oil and gas well in a given area is proposed[mdash]a result that contravenes NEPA[rsquo]s intent, to study and analyze potential significant and cumulative environmental effects of a proposed action before they occur.

USFS must review both (a) the foreseeable site-specific emission sources from the proposed lease parcels and (b) the sources of air emissions from existing, permitted, and other leased sources, and analyze how increased emissions from future oil and gas development will impact, cause or contribute to exceedances of the NAAQS.

USFS can readily identify oil and gas volume estimates for lease parcels by utilizing their own EPCA Phase III spatial data and overlaying the lease parcel boundary map provided in the lease sale notice.29 Estimating emissions from production of oil and gas wells per volume produced can be readily calculated using a number of EPA emissions inventory calculation tools.30 The type, quantity and future impact of additional air emissions from this new potential development can and must be analyzed in conjunction with the existing air quality landscape in this region.

USFS should look no further than a recent interagency guidance outlining proper air quality analysis and modeling in lease sale decisions. In 2011, the Environmental Protection Agency (EPA), the Department of Interior, and the Department of Agriculture entered into a Memorandum of Understanding (MOU) to establish a [ldquo]a clearly defined, efficient approach to compliance with [NEPA] regarding air quality . . . in connection with oil and gas development on Federal lands.[rdquo]31 The MOU [ldquo]provides for early interagency consultation throughout the

NEPA process; common procedures for determining what type of air quality analyses are appropriate and when air modeling is necessary; specific provisions for analyzing and discussing impacts to air quality and for mitigating such impacts; and a dispute resolution process to facilitate timely resolution of differences among agencies.[rdquo]32 The goal of this process is to ensure that [ldquo][F]ederal oil and gas decisions do not cause or contribute to exceedances of the National Ambient Air Quality Standards (NAAQS).[rdquo]33 The MOU outlines recommended technical, quantitative procedures to follow, which include identifying the reasonably foreseeable number of oil and gas wells and conducting an emissions inventory of criteria pollutants. Further air quality modeling is required if certain criteria are met, based on the level of emissions impact

29 United States Dept. of Interior, Agriculture, and Energy, Inventory of Onshore Federal Oil and Natural Gas Resources and Restrictions to Their Development, Phase III Inventory-Onshore U.S. (2008) ("EPCA Phase III Inventory").

30 Russell, James et al., An Emission Inventory of Non-point Oil and Gas Emissions Sources in the Western Region, ENVIRON International Corporation, See also, Bar-Ilan, Amnon et al., A Comprehensive Emissions Inventory of Upstream Oil and Gas Activities in the Rocky Mountain States (2010).

31 U.S. Dept. of Agriculture, Memorandum of Understanding Among the U.S. Dept. of Agriculture, U.S. Dept. of the Interior, and U.S. Environmental Protection Agency, Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process (2011).

32 Id. at 4.

33 Id. at 1, 2.

and the geographic location of the action.34 The MOU indicates that [ldquo][e]xisting reasonably foreseeable development scenarios can be used to identify the number of wells.[rdquo]35

Given the likelihood that fracking and other similarly harmful techniques would be employed in the exploration and development of the parcels, USFS has an obligation to analyze and disclose the potential impacts resulting from such frequently used practices. The purpose of an environmental assessment is for USFS to look at the impacts in total, and to take a hard look at all [ldquo]reasonably foreseeable[rdquo] impacts now, before leasing the land. NEPA regulations and case law clearly establish that uncertainty about the precise extent and nature of environmental impacts does not relieve an agency of the obligation to disclose and analyze those impacts utilizing the best information available. See 40 C.F.R. [sect] 1502.22(a),(b).

1. Types of Air Emissions

Unconventional oil and gas operations emit large amounts and a wide array of toxic air pollutants,36 also referred to as Hazardous Air Pollutants, which are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.37 Air pollutants emitted by unconventional oil and gas production include toxic BTEX compounds (benzene, toluene, ethylbenzene, and xylene); volatile organic compounds (VOCs) such as methylene chloride; nitrogen oxides (NOx); particulate matter (including diesel exhaust); alkanes (methane, ethane, propane); formaldehyde; hydrogen sulfide; silica; acid mists; sulfuric oxide; and radon gas.38 These toxic air contaminants and smog- forming chemicals (such as VOCs, NOx, methane and ethane) threaten local communities and regional air quality.

The reporting requirements recently implemented by the California South Coast Air Quality Management District ([ldquo]SCAQMD[rdquo]) have shown that at least 44 chemicals known to be air toxics have been used in fracking and other types of unconventional oil and gas recovery in California.39 Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics, including crystalline silica, methanol,

hydrochloric acid, hydrofluoric acid, 2-butoxyethanol, ethyl glycol monobutyl ether, xylene, amorphous silica fume, aluminum oxide, acrylic polymer, acetophenone, and ethylbenzene.

34 Id. [sect] V.E.1., pg. 9.

35 Id.

36 Sierra Club et al., Before the U.S. Environmental Protection Agency, Comments on New Source Performance

Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) ([ldquo]Sierra Club Comments[rdquo]) at 13.

37 See U.S. Environmental Protection Agency, Health and Environmental Effects of Hazardous Air Pollutants (accessed Jan 5, 2017)

38 McKenzie, Lisa M. et al., Human Health Risk Assessment of Air Emissions From Development of Unconventional Natural Gas Resources, 424 Science of the Total Environment 79 (2012) ([ldquo]McKenzie 2012);

Shonkoff, Seth B.C. et al., Environmental Public Health Dimensions of Shale and Tight Gas Development, 122 Environmental Health Perspectives 787 (2014) ([ldquo]Shonkoff 2014[rdquo]).

39 Center for Biological Diversity, Air Toxics One Year Report (June 2014) at 1.

Many of these chemicals also appear on the U.S. EPA[rsquo]s list of hazardous air pollutants.40 EPA has also identified six [ldquo]criteria[rdquo] air pollutants that must be regulated under the National Ambient Air Quality Standards (NAAQS) due to their potential to cause primary and secondary health effects. As detailed below, concentrations of many of these pollutants[mdash]ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead[mdash]have been shown to increase in regions where unconventional oil and gas recovery techniques are permitted.

VOCs, from car and truck engines as well as the drilling and completion stages of oil and gas production, make up about 3.5 percent of the gases emitted by oil or gas operations.41 The VOCs emitted include the BTEX compounds [ndash] benzene, toluene, ethyl benzene, and xylene [ndash] which are listed as Hazardous Air Pollutants.42 There is substantial evidence showing the grave harm from these pollutants.43 Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.44 For example, a study covering sites near oil and gas wells in five different states including Colorado, Wyoming, Ohio, Pennsylvania, and Arkansas, found that concentrations of eight toxic volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded federal health and safety standards, at times by several orders of magnitude.45 Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.46 Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the Denver-Julesburg Fossil Fuel Basin, north of Denver.47 Another study found that oil and gas operations in this area emit approximately 55percent of the VOCs in northeastern Colorado. 48

VOCs, NOx, methane, and ethane are potent ground-level (tropospheric) ozone precursors that are emitted by oil and gas drilling and fracking operations. Ozone can result in serious health conditions, including heart and lung disease and mortality.49 Exposure to elevated

40 U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site (accessed July 29, 2015).

41 Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking (July 28, 2011) ([ldquo]Brown Memo[rdquo]) at 3.

42 42 U.S.C. [sect] 7412(b).

43 Colborn, T. et al., Natural Gas Operations from a Public Health Perspective, 17 Human And Ecological Risk Assessment 1039 (2011) ([ldquo]Colborn 2011[rdquo]); McKenzie 2012.

44 McCawley, Michael et al., Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), West Virginia University School of Public Health, Morgantown, WV (2013) ([ldquo]McCawley 2013[rdquo]); Center for Biological Diversity, Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin (Sept. 2013).

45 Macey, Gregg P. et al., Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community- Based Exploratory Study, 13 Environmental Health 82 (2014) at 1.

46 McCawley 2013.

47 P[eacute]tron, Gabrielle et al., Hydrocarbon Emissions Characterization in the Colorado Front Range [ndash] A Pilot Study, 117 Journal of Geophysical Research D04304 (2012) at 8, 13 ([ldquo]P[eacute]tron 2012).

48 Gilman, Jessica B. et al., Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado, 47 Environmental Science & Technology 1297 (2013) at 1297, 1303 ([ldquo]Gilman 2013[rdquo]).

49 U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related

Photochemical Oxidants, National Center for Environmental Assessment-RTP Division (2013).

levels of ozone is estimated to be cause ~10,000 premature deaths per year in the United States.50 VOCs can form ground-level (tropospheric) ozone when combined with nitrogen oxides ([ldquo]NOX[rdquo]) from compressor engines, turbines, other engines used in drilling, and flaring,51 in the presence of sunlight. This reaction can diminish visibility and air quality and harm vegetation.

Many regions around the country with substantial oil and gas operations are now suffering from extreme ozone levels due to heavy emissions of these pollutants.52 A recent study of ozone pollution in the Uintah Basin of northeastern Utah, a rural area that experiences hazardous tropospheric ozone concentrations, found that oil and gas operations were responsible for 98 to 99 percent of VOCs and 57 to 61 percent of NOX emitted from sources within the Basin

considered in the study[rsquo]s inventory.53

Ground-level ozone can also be caused by methane, which is leaked and vented at various stages of unconventional oil and gas development, as it interacts with nitrogen oxides and sunlight.54 In addition to its role as a potent greenhouse gas, methane[rsquo]s effect on ozone concentrations can be substantial. One paper modeled reductions in various anthropogenic ozone

precursor emissions and found that [ldquo][r]educing anthropogenic CH4 emissions by 50% nearly halves the incidence of U.S. high-O3 events . . . .[rdquo]55

Ethane is also a potent precursor of ground-based ozone pollution as it breaks down and reacts with sunlight to create smog, as well as being a greenhouse gas. Ethane emissions have risen steeply in recent years due to U.S. oil and gas production. A recent study documented that ethane emissions in the Northern Hemisphere increased by about 400,000 tons annually between 2009 and 2014, with the majority coming from North American oil and gas activity, reversing a

decades-long decline in ethane emissions.56 Shockingly, about 60 percent of the drop in ethane

levels that occurred over the past 40 years has already been made up in the past five years. At this rate, U.S. ethane levels are expected to hit 1970s levels in about three years. About two percent of global ethane emissions originate from the Bakken Shale oil and gas field alone,

50 Caiazzo, Fabio et al., Air Pollution and Early Deaths in the United States. Part I: Quantifying the Impact of Major Sectors in 2005, 79 Atmospheric Environment 198 (2013).

51 See, e.g., U.S. Environmental Protection Agency, Oil and Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution: Background Technical Support Document for Proposed Standards at 3-6 (July 2011); Armendariz, Al, Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (2009) ([ldquo]Armendariz 2009[rdquo]) at 24.

52 Armendariz 2009 at 1, 3, 25-26; Koch, Wendy, Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling,

USA Today, May 9, 2011; Craft, Elena, Texas Clean Air Matters- Do Shale Gas Activities Play a Role in Rising Ozone Levels?, Environmental Defense Fund (2012); Colorado Dept. of Public Health and Environment, Colorado Weekly and Monthly Oil and Gas Statistics, Conservation Commission (July 6, 2012) at 12.

53 Lyman, Seth & Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013) ([ldquo]Lyman 2013[rdquo]); see also Gilman 2013.

54 Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29

Geophysical Research Letters 19 (2002) ([ldquo]Fiore 2002[rdquo]); U.S. Environmental Protection Agency, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews Proposed Rule, 76 Federal Register 163 (Aug 23, 2011).

55 Fiore 2002; see also Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.

56 Helmig, Detlev et al,, Reversal of Global Atmospheric Ethane and Propane Trends Largely Due to US Oil and

Natural Gas Production, 9 Nature Geoscience 490 (2016).

which emits 250,000 tons of ethane per year.57 Because global ethane levels were decreasing until 2009, the U.S. shale gas boom is thought to be responsible for the global increase in levels since 2010.

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas [ldquo]sour.[rdquo]58 Hydrogen sulfide may be emitted during all stages of operation, including exploration, extraction, treatment and storage, transportation, and refining. Long-term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.59

The oil and gas industry is also a major source of particulate matter. The heavy equipment regularly used in the industry burns diesel fuel, generating fine particulate matter60 that is especially harmful.61 Vehicles traveling on unpaved roads also kick up fugitive dust, which is particulate matter.62 Further, both NOX and VOCs, which as discussed above are

heavily emitted by the oil and gas industry, are also particulate matter precursors.63 Some of the health effects associated with particulate matter exposure are [ldquo]premature mortality, increased hospital admissions and development of chronic respiratory disease.[rdquo]64

Fracking results in additional air pollution that can create a severe threat to human health. One analysis found that 37 percent of the chemicals found at fracked gas wells were volatile, and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.65 The SCAQMD has identified three areas of dangerous and unregulated air emissions from fracking:

(1) the mixing of the fracking chemicals; (2) the use of the silica, or sand, as a proppant, which causes the deadly disease silicosis; and (3) the storage of fracking fluid once it comes back to the surface.66 Preparation of the fluids used for well completion often involves onsite mixing of gravel or proppants with fluid, a process which potentially results in major amounts of particulate matter emissions.67 Further, these proppants often include silica sand, which increases

57 Kort, Eric A. et al., Fugitive Emissions From the Bakken Shale Illustrate Role of Shale Production in Global Ethane Shift, 43 Geophysical Research Letters 4617 (2016).

58 Sierra Club Comments.

59 U.S. Environmental Protection Agency, Report to Congress on Hydrogen Sulfide Air Emissions Associated with

the Extraction of Oil and Natural Gas, Office of Air Quality Planning and Standards (Oct. 1993) at i ([ldquo]USEPA 1993[rdquo]).

60 Earthworks, Sources of Oil and Gas Air Pollution (2011).

61 Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter (2012).

62 U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter, Office of Air Quality Planning and Standards (June 2012) ([ldquo]EPA RIA[rdquo])

63 EPA RIA at 2-2.

64 U.S. Environmental Protection Agency, National Ambient Air Quality Standards for Particulate Matter Proposed Rule, 77 Federal Register 126 38,890, 38,893 (June 29, 2012).

65 Colborn 2011 at 8.

66 South Coast Air Quality Management District, Draft Staff Report on Proposed Rule 1148.2 - Notification and

Reporting Requirements for Oil and Gas Wells and Chemical Suppliers (January 2013) at 15 ([ldquo]SCAQMD Draft Staff Report PR1148-2[rdquo]).

67 Id.

the risk of lung disease and silicosis when inhaled.68 Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.69

The EA should study the potential for oil and gas operations sites in the planning area to emit such air toxics and any other pollutants that may pose a risk to human health, paying particular attention to the impacts of air pollution on environmental justice communities that already bear the burden of disproportionately high levels of air pollution.

The EA should rely on the most up-to-date information regarding the contribution of oil and gas operations to air pollution levels. Numerous studies demonstrate that state and federal emissions inventories significantly underestimate the levels of hazardous air pollution coming from oil and gas drilling and fracking operations. For example, aerial surveys of more than 8,000

oil and gas wells in seven US regions found that well pads emit considerably more methane and VOCs that captured by existing inventories.70 Recent studies in Weld County, Colorado, show that existing emissions inventories likely underestimate the contribution of oil and gas operations to VOC levels by at least a factor of two, and that benzene emissions are underestimated by four to nine times71 These studies suggest that the health risk assessments conducted using these inventories are inaccurate and underestimate exposures and health risks.72 Similarly, the assessment of fracking in California by the California Council on Science and Technology found that current inventory methods underestimate methane and VOC emissions from oil and gas operations.73

2. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of unconventional oil and gas development, including drilling, completion, well stimulation, production, and disposal, as well as from transportation of water, sand, chemicals, and to and from the well pad.74 The well stimulation stage can emit diesel exhaust, VOCs, particulate matter, ozone precursors, silica, and acid mists.75 Drilling and casing the wellbore require substantial power from large equipment.

68 South Coast Air Quality Management District, Response to Questions re Air Quality Risks of Hydraulic Fracturing in California, Submission to Joint Senate Hearing (2013) at 3.

69 SCAQMD Draft Staff Report PR1148-2 at 15.

70 Lyon, David R. et al., Aerial Surveys of Elevated Hydrocarbon Emissions From Oil and Gas Production Sites, 50 Environmental Science & Technology 4877 (2016).

71 P[eacute]tron 2012 at 1, 18 (noting state and federal inventories likely underestimate hydrocarbon emissions from oil and gas operations by as much as factor of two); P[eacute]tron, Gabrielle et al., A New Look at Methane and Non-Methane

Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin, 119 Journal of Geophysical Research: Atmospheres 6836 (2014) at 6836 ([ldquo]P[eacute]tron 2014[rdquo]).

72 P[eacute]tron 2014.

73 Brandt, Adam et al., Ch. Three: Air quality impacts from well stimulation, An Independent Assessment of Well Stimulation in California, Volume 2, California Council on Science and Technology (2015) ([ldquo]CCST 2015[rdquo]).

74 Shonkoff 2014.

75 Id.

The engines used typically run on diesel fuel, which emits particularly harmful types of air pollutants when burned. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too can amount in large volumes of air pollution. Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. Emissions from flaring typically include carbon monoxide, nitrogen oxides, benzene, formaldehyde and xylene, but levels of these smog-forming

compounds are seldom measured directly.76

Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Methane emissions from oil and gas production are as much as 270 percent greater than previously estimated by calculation.77 Recent studies show that emissions from pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.78

Evaporation from pits can also contribute to air pollution. Pits that store drilling waste, produced water, and other waste fluid may be exposed to the open air. Chemicals mixed with the wastewater[mdash]including the additives used to make fracking fluids, as well as volatile hydrocarbons, such as benzene and toluene, brought to the surface with the waste[mdash]can escape into the air through evaporation. Some pits are equipped with pumps that spray effluents into the air to hasten the evaporation process. For example, evaporation from fracking waste pits in

western Colorado was found to have added tons of toxic chemicals to the air, increasing air pollution in Utah.79 In Texas, toxic air emissions from fracking waste pits are unmonitored and unregulated.80 In California, unlined disposal pits for drilling and fracking waste are documented sources of contamination.81 Even where waste fluid is stored in so-called [ldquo]closed loop[rdquo] storage

tanks, fugitive emissions can escape from tanks.

As mentioned above, increased truck traffic will lead to more air emissions. Trucks capable of transporting large volumes of chemicals and waste fluid typically use large engines

76 Physicians for Social Responsibility and Concerned Health Professionals of NY, Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking, Fourth Edition, November 17, 2016 ([ldquo]PSR 2016[rdquo]).

77 Miller, Scot M. et al., Anthropogenic emissions of methane in the United States, 110 PNAS 50 (2013) doi: 10.10773/pnas.1314392110.

78 Allen, David et al., Measurements of Methane Emissions at Natural Gas Production Sites in The United States, 110 PNAS 17768 (2013) ([ldquo]Allen 2013[rdquo]); Harriss, Robert et al., Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas, 49 Environmental Science Technology 7524 (2015).

79 Maffy, Brian , Utah grapples with toxic water from oil and gas industry, The Salt Lake Tribune, August 28, 2014;

The company responsible for the waste pits was found to have operated without a permit, underreported emissions and provided erroneous data to regulators.

80 Hasemyer, David, Open Pits Offer Cheap Disposal for Fracking Sludge But Health Worries Mount, Center for Public Integrity October 2, 2014 ([ldquo]CPI 2014[rdquo]).

81 Stringfellow, William T. et al., Ch. 2: Impacts of Well Stimulation on Water Resources, An Independent Assessment of Well Stimulation in California, 2 California Council on Science and Technology (2015) ([ldquo]CCST

2015[rdquo]) at 110-113.

that run on diesel fuel. Air pollutants from truck engines will be emitted not only at the well site, but also along truck routes to and from the site.

The EA must provide an adequate analysis and disclosure of the effects the lease sale could have on air quality, including the impacts that would result from fracking. The EA cannot postpone the discussion of air pollution impacts until site-specific plans are proposed. Because USFS must analyze impacts at [ldquo]the earliest practicable time,[rdquo] 82 and no benefit would be gained from postponing the analysis, USFS must discuss these cumulative impacts before the lease sale.

3. Impact of Increased Air Pollution

The potential harms resulting from increased exposure to the dangerous air pollutants from unconventional oil and gas development are serious and wide-ranging. A growing body of scientific research has documented adverse public health impacts from unconventional oil and gas development, including studies showing air pollutants at levels associated with reproductive and developmental harms and the increased risk of morbidity and mortality.83 A comprehensive

review of the risks and harms of fracking to public health came to several key findings related to air pollution: (1) [ldquo]drilling and fracking emissions contribute to toxic air pollution and smog (ground-level ozone) at levels known to have health impacts,[rdquo] (2)[ldquo]public health problems associated with drilling and fracking, including reproductive impacts and occupational health and safety problems, are increasingly well documented[rdquo]; and (3)[ldquo]fracking infrastructure poses serious potential exposure risks to those living near it.[rdquo]

Air toxics and hazardous air pollutants, by definition, can result in harm to human health and safety. Understanding the full extent of the health effects of exposure is still far from being complete, but already there are numerous studies that have found these chemicals to have serious health consequences for humans exposed to even minimal amounts. The negative effects of criteria pollutants are well documented and are summarized by the U.S. EPA[rsquo]s website:

Nitrogen oxides (NOx) react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. NOx and volatile organic compounds react in the presence of heat and sunlight to form ozone.

82 N.M. ex rel. Richardson v. BLM, 565 F.3d 683, 717-18 (10th Cir. 2009) (citing 42 U.S.C. [sect] 4332(2)(C)(v)); compare with Center for Biological Diversity, 937 F. Supp. 2d at 1152 (N.D. Cal. 2013) ([ldquo]Agencies are required to conduct this review at the [lsquo]earliest possible time[rsquo] to allow for proper consideration of environmental values. . . A review should be prepared at a time when the decisionmakers [lsquo]retain a maximum range of options.[rsquo][rdquo]).

83 Hays, Jake & Seth B.C. Shonkoff , Towards an Understanding of the Environmental and Public Health Impacts of Unconventional Natural Gas Development: A Categorical Assessment of the Peer-Reviewed Scientific Literature, 2009-2015, 11 PLoS ONE 4: e0154164 (2016); Shonkoff 2014; Webb, Ellen et al., Developmental and reproductive

effects of chemicals associated with unconventional oil and natural gas operations, 29 Rev Environ Health 307 (2014); McKenzie 2012;Fleischman, Lesley et al., Fossil Fumes: A Public Health Analysis of Toxic Air Pollution From the Oil and Gas Industry, Clean Air Task Force (2016).

Particulate matter (PM) - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased

respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.84

Sulfur Dioxide (SO_2) [ndash] has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.85 Studies also show a connection

between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.86

Carbon Monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.87 Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the

heart), often accompanied by chest pain (angina), when exercising or under increased stress.88 For these people, short-term CO exposure further affects their body[rsquo]s already compromised ability to respond to the increased oxygen demands of exercise or exertion.89

Ozone (O_3) can trigger or worsen asthma and other respiratory ailments.90 Ground level ozone can have harmful effects on sensitive vegetation and ecosystems. Ozone may also lead to loss of species diversity and changes to habitat quality, water cycles, and nutrient cycles.

The range of illnesses that can result from the wide array of air pollutants from fracking were summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.91 This study analyzed air samples taken during drilling operations near natural gas wells and residential areas in Garfield County, and detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.92 For example:

Thirty-five chemicals were found to affect the brain/nervous system, 33 the liver/metabolism, and 30 the endocrine system, which includes reproductive and developmental

84 U.S. Environmental Protection Agency, Particulate Matter (accessed July 30, 2015); Ostro, Bart et al., Long-term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study, 118 Environmental Health Perspectives 3 (2010).

85 U.S. Environmental Protection Agency, Sulfur Dioxide (accessed July 29, 2015).

86 Id.

87 U.S. Environmental Protection Agency, Carbon Monoxide (accessed July 29, 2015).

88 Id.

89 Id.

90 U.S. Environmental Protection Agency, Ground Level Ozone (accessed July 29, 2015).

91 Colborn 2011; Colborn, T. et al., An Exploratory Study of Air Quality near Natural Gas Operations, Human and

Ecological Risk Assessment: An International Journal, (2012) doi: 10.1080/10807039; see note 120 & accompanying text below.

92 Colborn 2012, at pp. 21-22 (pages refer to page numbers in attached manuscript and not journal pages).

effects. The categories with the next highest numbers of effects were the immune system (28), cardiovascular/blood (27), and the sensory and respiratory systems (25 each). Eight chemicals had health effects in all 12 categories. There were also several chemicals for which no health effect data could be found.93

The study found extremely high levels of methylene chloride, which may be used as cleaning solvents to remove waxy paraffin that is commonly deposited by raw natural gas in the region. These deposits solidify at ambient temperatures and build up on equipment.94 While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study noted that such thresholds are typically based on [ldquo]exposure of a grown man encountering relatively

high concentrations of a chemical over a brief time period, for example, during occupational exposure.[rdquo]95 Consequently, such thresholds may not apply to individuals experiencing [ldquo]chronic, sporadic, low-level exposure,[rdquo] including sensitive populations such as children, the elderly and pregnant women.96 For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of [ldquo]clinical significance,[rdquo] as recent studies have linked low levels of exposure to lower mental development in children who were prenatally exposed.97 In addition, government safety standards do not take into account [ldquo]the kinds of effects found from low-level exposure to endocrine disrupting chemicals[hellip], which can be particularly harmful during prenatal development and childhood.98

Adverse health impacts documented among residents living near drilling and fracking operations include reproductive harms, increased asthma attacks, increased rates of hospitalization, ambulance runs, emergency room visits, self-reported respiratory problems and rashes, motor vehicle fatalities, trauma, and drug abuse. A recent review concluded:

By several measures, evidence for fracking-related health problems is emerging across the United States. In Pennsylvania, as the number of gas wells increase in a community, so do rates of hospitalization. Drilling and fracking operations are correlated with elevated motor vehicle fatalities (Texas), asthma (Pennsylvania), self-reported skin and respiratory problems (southwestern Pennsylvania), ambulance runs and emergency room visits (North Dakota), infant deaths (Utah), birth defects (Colorado), high risk pregnancies (Pennsylvania), premature birth (Pennsylvania), and low birthweight (multiple states). Benzene levels in ambient air surrounding drilling and fracking operations are sufficient to elevate risks for future cancers in both workers and nearby residents, according to studies. Animal studies show that two dozen chemicals commonly used in fracking operations are endocrine disruptors that can variously disrupt organ systems, lower sperm counts, and cause reproductive harm at levels to which people can be

realistically exposed.99

93 Colborn 2012, at 11.

94 Id. at 10.

95 Id. at 11-12.

96 Id. at. 12.

97 Id. at 10-11.

98 Id. at 12.

99 PSR 2016, at 93.

A rigorous study by Johns Hopkins University, which examined 35,000 medical records of people with asthma in Pennsylvania, found that people who live near a higher number of, or larger, active gas wells were 1.5 to 4 times more likely to suffer from asthma attacks than those living farther away, with the closest groups having the highest risk.100 Increased asthma risks occurred during all phases of well development. A recent Yale University study identified numerous fracking chemicals that are known, probable, or possible human carcinogens (20 air pollutants) and/or are linked to increased risk for leukemia and lymphoma (11 air pollutants),

including benzene, 1,3-butadiene, cadmium, diesel exhaust, and polycyclic aromatic hydrocarbons.101

Numerous studies suggest that higher maternal exposure to fracking and drilling can increase the incidence of high-risk pregnancies, premature births, low-birthweight babies and birth defects. A study of 9,384 pregnant women in Pennsylvania found that women who live near active drilling and fracking sites had a 40 percent increased risk for having premature birth and a 30 percent increased risk for having high-risk pregnancies.102 Another study found that pregnant

women who had greater exposure to gas wells (measured in terms of proximity and density of wells) had a much higher risk of having low-birthweight babies; the researchers identified air pollution as the likely route of exposure.103 In rural Colorado, mothers with greater exposure to natural gas wells were associated with a higher risk of having babies with congenital heart defects and possibly neural tube defects.104

Other studies have found that residents living closer to drilling and fracking operations had higher hospitalization rates105 and reported more health symptoms, including upper respiratory problems and rashes.106

Workers suffer high risks from toxic exposure and accidents.107 As summarized by a recent review:

100 Rasmussen, Sara G. et al., Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations, 176 JAMA Internal Medicine 1334 (2016).

101 Elliot, Elise G. et al., A Systematic Evaluation of Chemicals in Hydraulic-Fracturing Fluids and Wastewater for Reproductive and Developmental Toxicity, 27 Journal of Exposure Science and Environmental Epidemiology 90 (2016).

102 Casey, Joan A., Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA, 27 Epidemiology 2: 163 (2016).

103 Stacy, Shaina L. et al., Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. 10 PLoS ONE e0126425 (2015).

104 McKenzie, Lisa M., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, 122 Environmental Health Perspectives 412 (2014).

105 Jemielita, Thomas et al., Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. 10 PLoS ONE 7: e0131093 (2015).

106 Rabinowitz, Peter M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania, 123 Environmental Health Perspectives 1 (2015).

107Esswein, Eric J. et al., Occupational Exposures to Respirable Crystalline Silica During Hydraulic Fracturing, 10 Journal of Occupational and Environmental Hygiene 347 (2013); Esswein, Eric et al., Evaluation of Some Potential

Chemical Exposure Risks during Flowback Operations in Unconventional Oil and Gas Extraction: Preliminary Results, 11 Journal of Occupational and Environmental Hygiene D174 (2014); Harrison, Robert J. et al., Sudden Deaths Among Oil and Gas Extraction Workers Resulting from Oxygen Deficiency and Inhalation of Hydrocarbon

Drilling and fracking jobs are among the most dangerous jobs in the nation with a fatality rate that is five times the national average and shows no sign of abating. Occupational hazards include head injuries, traffic accidents, blunt trauma, burns, inhalation of hydrocarbon vapors, toxic chemical exposures, heat exhaustion, dehydration, and sleep deprivation. An investigation of occupational exposures found high levels of benzene in the urine of wellpad workers, especially those in close proximity to flowback fluid coming up from wells following fracturing activities. Exposure to silica dust, which is definitively linked to silicosis and lung cancer, was singled out by the National Institute for Occupational Safety and Health as a particular threat to workers in fracking operations where silica sand is used. At the same time, research shows that

many gas field workers, despite these serious occupational hazards, are uninsured or underinsured and lack access to basic medical care.108

Methods of collecting and analyzing emissions data often underestimate health risks by failing to adequately measure the intensity, frequency, and duration of community exposure to toxic chemicals from fracking and drilling; failing to examine the effects of chemical mixtures; and failing to consider vulnerable populations.109 Of high concern, numerous studies highlight that health assessments drilling and fracking emissions often fail to consider impact on vulnerable populations including environmental justice communities110 and children.111 For example, a recent analysis of oil and gas development in California found that 14 percent of the state[rsquo]s population (5.4 million people) live within a mile of at least one oil and gas well. More than a third of these people (1.8 million) also live in areas most burdened by environmental pollution.112

The EA should incorporate a literature review of the harmful effects of each of these chemicals known to be used in fracking and other unconventional oil and gas extraction methods. Without knowing the effects of each chemical, the EA cannot accurately project the true impact of unconventional oil and gas extraction. Before concluding that the lands in question should be available for oil and gas leasing, USFS must assess the quantity and timing of air pollution that will result from such development in light of an development scenario that reflects the most current information. Only then can USFS make an informed decision about whether making the lands available is consistent with proper management of those lands.

Gases and Vapors [mdash] United States, January 2010[ndash]March 2015, 65 Morbidity Mortal Weekly Report 1 (2016); PSR 2016.

108 PSR 2016 at 80

109 Brown, David et al., Understanding Exposure From Natural Gas Drilling Puts Current Air Standards to the Test, 29 Rev Environ Health 277 (2014).

110Srebotnjak, Tanja & Miriam Rotkin-Ellman, Drilling in California: Who[rsquo]s At Risk?, Natural Resources Defense

Council Report (October 2014) ([ldquo]NRDC 2014[rdquo]); Clough, Emily & Derek Bell, Just Fracking: A Distributive Environmental Justice Analysis of Unconventional Gas Development in Pennsylvania, USA, 11 Environmental Research Letters 025001 (2016); McKenzie, Lisa M. et al., Population Size, Growth, and Environmental Justice Near Oil and Gas Wells in Colorado, 50 Environmental Science & Technology 11471 (2016).

111 Webb, Ellen et al., Potential Hazards of Air Pollutant Emissions from Unconventional Oil and Natural Gas Operations on the Respiratory Health of Children And Infants, 31 Reviews on Environmental Health 225 (2016).

112 NRDC 2014.

B. Water

1. Groundwater Quality

Leasing and subsequent development on 54,000 acres of USFS land in the Ruby Mountains has the potential to cause impacts to groundwater quality. In addition to the comments presented here, Dr. Tom Myers has prepared a technical memorandum on this topic, attached to this letter as Appendix A.

Since the Ruby Mountains are situated at the top of the Humboldt River watershed, it is likely that tens of thousands of Nevadans and hundreds of agricultural operations rely on groundwater sourced in the Rubies for their survival. This means that it is incumbent upon USFS to conduct as rigorous of an analysis as possible to disclose and analyze the potential effects of drilling and fracking on the groundwater quality of the upper Humboldt River watershed, including the Huntington Valley.

Studies have reported many instances around the country of groundwater contamination due to surface spills of oil and gas wastewater, including fracking flowback.113 Fracking and other unconventional techniques likewise pose inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated. Once groundwater is contaminated, it is very difficult, if not impossible, to restore the original quality of the water.

As a result, in communities that rely on groundwater drinking water supplies, groundwater contamination can deprive communities of usable drinking water. Such long-term contamination necessitates the costly importation of drinking water supplies.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years.114 Poorly constructed or abandoned wells are recognized as one of the most likely ways by which contaminants may reach groundwater. Faulty well construction, cementing, or casing,115 as well as the injection of fracking waste underground, can all lead to

leaks.116 Older wells that may not have been designed to withstand the stresses of hydraulic

fracturing but which are reused for this purpose are especially vulnerable.117 Improper well construction and surface spills are cited as a confirmed or potential cause of groundwater contamination in numerous incidents at locations across the U.S. including but not limited to

113 Vengosh, Avner, et al., A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States, Environmental Science Technology (2014), doi: 10.1021/es405118y.

114 Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).

115 Natural Resources Defense Council, Water Facts: Hydraulic Fracturing can potentially Contaminate Drinking

Water Sources (2012) at 2; Food & Water Watch, The Urgent Case for a Ban on Fracking (2015) at 7.

116 Kusnetz, Nicholas, North Dakota[rsquo]s Oil Boom Brings Damage Along with Prosperity, ProPublica , June 13, 2012; Lustgarten, Abraham, Polluted Water Fuels a Battle for Answers, ProPublica (2012); Lustgarten, Abraham, Injection Wells: The Poison Beneath Us, ProPublica (2012) at 2; Lustgarten, Abraham, Whiff of Phenol Spells Trouble, ProPublica (2012).

117 U.S. Environmental Protection Agency, Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic

Fracturing Water Cycle on Drinking Water Resources in the United States (Dec. 2016) at ES-30 ([ldquo]EPA 2016[rdquo]).

Colorado,118 Wyoming,119 Pennsylvania,120 Ohio,121 West Virginia,122 and Texas.123 These sorts of problems at the well are not uncommon. Dr. Ingraffea of Cornell has noted an 8.9 percent failure rate for wells in the Marcellus Shale.124 Also, the Draft EPA Investigation of Ground Water Contamination near Pavillion, Wyoming, found that chemicals found in samples of groundwater were from fracked wells.125 These results have been confirmed with follow-up analyses.126 Moreover, another study based on modeling found that active transport of fracking fluid from a fracked well to an aquifer could occur in less than 10 years.127

Current federal rules do not ensure well integrity. The well casing can potentially fail over time and potentially create pathways for contaminants to reach groundwater. Well casing failure can occur due to improper or negligent construction. The EA should study the rates of well casing failures over time and evaluate the likelihood that well casing failures can lead to groundwater contamination.

Also, fluids and hydrocarbons may contaminate groundwater by migrating through newly created or natural fractures.128 Many unconventional techniques intentionally fracture the formation to increase the flow of gas or oil. New cracks and fissures can allow the additives or naturally occurring elements such as natural gas to migrate to groundwater. [ldquo]Migration

pathways to drinking water resources could develop as a result of changes in the subsurface flow or pressure regime associated with hydraulic fracturing; via fractures that extend beyond the intended formation or that intersect existing natural faults or fractures; and via fractures that intersect offset wells or other artificial structures.[rdquo]129 Fluids can also migrate through pre-

118 Gross, Sherilyn A. et al., Abstract: Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations, 63 Journal of Air and Waste Management Association 4, 424 (2013), doi: 10.1080/10962247.2012.759166.

119 U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming (2011) ([ldquo]EPA 2011[rdquo]).

120 Darrah, Thomas H. et al., Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-

Water Wells Overlying the Marcellus and Barnett Shales, PNAS Early Edition, (2014), doi: 10.1073/pnas.132210711 ([ldquo]Darrah 2014[rdquo]).

121 Begos, Kevin, Some States Confirm Water Pollution from Oil, Gas Drilling, Seattle Times, Jan. 6, 2014, ([ldquo]Begos, Seattle Times, Jan 6, 2014[rdquo]). See also, Ohio Dept. of Natural Resources, Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio, Division of Mineral Resources Management (Sept. 2008), supra.

122 Begos, Seattle Times, Jan 6. 2014.

123 Darrah 2014.

124 Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations 6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013).

125 EPA 2011.

126 Drajem, Mark, Wyoming Water Tests in Line with EPA Finding on Fracking, Bloomberg, Oct. 11, 2012; U.S. Environmental Protection Agency, Investigation of Ground Water Contamination near Pavillion, Wyoming Phase V

Sampling Event - Summary of Methods and Results (September 2012); Myers, Tom, Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming Prepared by the Environmental Protection Agency, Ada OK (Apr. 30, 2012).

127 Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers (Feb. 2012).

128 EPA 2011; Warner, Nathaniel R., et al., Geochemical Evidence for Possible Natural Migration of Marcellus

Formation Brine to Shallow Aquifers in Pennsylvania, PNAS Early Edition (2012).

129 EPA 2016 at 6-39.

existing and natural faults and fractures that may become pathways once the fracking or other method has been used.

According to the EPA, evidence of any fracturing-related fluid migration affecting a drinking water resources could take years to discover. EPA states:

While some of the types of impacts . . . can occur quickly (i.e., on the scale of days or weeks, as with mechanical integrity problems or well communication events), other impacts (e.g., in slow-moving, deep groundwater) may be detectable only on much longer timescales. Without comprehensive collection and review of information about how hydraulic fracturing operations perform, fluid movement could occur without early detection, which could, in turn, increase the severity of any resultant impacts to drinking water quality. For example, testing the mechanical integrity of wells, monitoring the extent of the fractures that form, and conducting pre- and post-hydraulic fracturing water quality monitoring can detect fluid movement (or the potential for fluid movement) and provide opportunities to mitigate or minimize the severity of impacts associated with

unforeseen events. 130

The EA must consider long-term studies on the potential for fluid migration through newly created subsurface pathways. Fluid migration is of particular concern when oil and gas operations are close to drinking water supplies.

Fracking fluid can also spill at the surface during the fracking process. For instance, mechanical failure or operator error during the process has caused leaks from tanks, valves, and pipes.131 At the surface, pits or tanks can leak fracking fluid or waste.132 Surface pits, in which wastewater is often dumped, are a major source of pollution. In California, a farmer was awarded $8.5 million in damages after his almond trees died when he irrigated them with well

water that had been contaminated by nearby oil and gas operations. The contamination was traced to unlined pits where one of California[rsquo]s largest oil and gas producers for decades dumped billions of gallons of wastewater that slowly leached pollutants into nearby groundwater.133

Also, New Mexico data shows, over the course of 3 decades, 743 instances of all types of oil and gas operations polluting groundwater [ndash] the source of drinking water for 90 percent of the state[rsquo]s residents.134

130 EPA 2016 at 6-77.

131 NRDC, Water Facts; Food & Water Watch 2012 at 5.

132 See, e.g., E&E Publishing, LLC, Fracking Fluid leaks from wellhead in Colo., E&E News Greenwire, Feb 14,

2013. ([ldquo]At least 84,000 gallons of water contaminated from hydraulic fracturing seeped from a broken wellhead and into a field . . . .[rdquo]); Michaels, Craig, et al., Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling, Riverkeeper (2010).at 12; NRDC Petition for Rulemaking at 20.

133 See No Fracking, Speak No Fracking at 6; see also Miller, Jeremy, Oil and Water Don[rsquo]t Mix with California Agriculture, High Country News (2012);

134 New Mexico Oil and Conservation Division, OGAP Analysis of data provided in New Mexico Energy, Minerals

and Natural Resources Dep[rsquo]t, Oil and Conservation Div., Cases Where Pit Substances Contaminated New Mexico[rsquo]s Ground Water (2008); see generally Natural Resources Defense Council, Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated

Unfiltered drinking water supplies, such as drinking water wells, are especially at risk because they have no readily available means of removing contaminants from the water. Even water wells with filtration systems are not designed to handle the kind of contaminants that result from unconventional oil and gas extraction.135 In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination. 136 The EA must disclose where the potential for such drilling exists.

Setbacks may not be adequate to protect groundwater from potential fracking fluid contamination. A recent study by the University of Colorado at Boulder suggests that setbacks of even up to 300-feet may not prevent contamination of clean water resources.137 The study found that 15 organic compounds found in hydraulic fracturing fluids may be of concern as groundwater contaminants based on their toxicity, mobility, persistence in the environment, and

frequency of use. These chemicals could have 10 percent or more of their initial concentrations remaining at a transport distance of 300 feet, the average [ldquo]setback[rdquo] distance in the U.S. The effectiveness and feasibility of any proposed setbacks must be evaluated.

Indeed, it is unlikely that even a No Surface Occupancy (NSO) stipulation would provide adequate protection for groundwater resources and their surface expressions. Hydrologist Dr.

Tom Myers analyses this further in the memorandum attached to this letter as Appendix A.

2. Surface Water Quality

Surface waters can be contaminated in many ways from unconventional well stimulation.

In addition to storm water runoff, surface water contamination may also occur from chemical and waste transport, chemical storage leaks, and breaches in pit liners.138 The spilling or leaking of fracking fluids, flowback, or produced water is a serious problem. Harmful chemicals present in these fluids can include volatile organic compounds ([ldquo]VOCs[rdquo]), such as benzene, toluene, xylenes, and acetone.139 As much as 25 percent of fracking chemicals are carcinogens,140 and flowback can even be radioactive.141 As described below, contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming and other activities, and may be infeasible to restore the

with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy (2010); Kusnetz, Nicholas, A Fracking First in Pennsylvania: Cattle Quarantine, ProPublica (July 2, 2010).

135 Physicians Scientist & Engineers for Healthy Energy, Letter from Robert Howarth Ph.D. and 58 other scientists to Andrew M. Cuomo, Governor of New York State re: municipal drinking water filtration systems and hydraulic fracturing fluid (Sept 15, 2011) (accessed July 29, 2015).

136 EPA 2016 at 6-69.

137 University of Colorado Boulder, New study identifies organic compounds of potential concern in fracking fluids, CU News Center, July 1, 2015 (accessed July 29, 2015).

138   Vengosh 2014.

139 U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (Nov. 2011) ([ldquo]EPA Plan to Study Fracking Impacts[rdquo]).

140 Colborn 2011.

141 EPA Plan to Study Fracking Impacts; White, Ivan E., Consideration of radiation in hazardous waste produced from horizontal hydrofracking, National Council on Radiation Protection (2012).

original water quality once surface water is contaminated. USFS should consider this analysis in the EA.

Massive volumes of chemicals and wastewater used or produced in oil and gas operations have the potential to contaminate local watersheds. Over 1 million gallons of chemicals are injected on average per hydraulically fracked well depending on the number of chemicals injected.142 Several billions of gallons of wastewater are produced by oil and gas production per year.143 Onshore oil and gas operations in the United States create about 56 million barrels of produced water per day.144 California wells, for instance, produced roughly 3 billion barrels of wastewater in 2013, which is about 15 times the amount of oil the state produced.145 This waste can reach fresh water aquifers and drinking water.146

Fluids must be transported to and/or from the well, which presents opportunities for spills.147 Unconventional well stimulation relies on numerous trucks to transport chemicals to the site as well as collect and carry disposal fluid from the site to processing facilities. A U.S. GAO study found that up to 1,365 truckloads can be required just for the drilling and fracturing of a single well pad148 while the New York Department of Conservation estimated the number of [ldquo]heavy truck[rdquo] trips to be about 3,950 per horizontal well (including unloaded and loaded trucks).149 Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters. Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.150

Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.151 If spilled, the effects of produced water or brine can be more severe and longer- lasting than oil spills, because salts do not biodegrade or break down over time. The only way to

142 EPA 2016 at ES-22.

143 California Division of Oil, Gas, and Geothermal Resources, 2014 Preliminary Report of California Oil and Gas

Production Statistics at 3 (July 2015); California Department of Conservation Division of Oil, Gas, and Geothermal Resources, Producing Wells and Production of Oil, Gas, and Water by County - 2011, Final Report of 2011 California Oil and Gas Production Statistics (2012).

144 U.S. Government Accountability Office, Energy-Water Nexus: Information on the Quantity, Quality, and

Management of Water Produced during Oil and Gas Production, Report to the Ranking Member, Committee on Science, Space and Technology, House of Representatives at 13 (January 2012).

145 California Division of Oil, Gas, and Geothermal Resources July 2015; California Department of Conservation Division of Oil, Gas, and Geothermal Resources 2012.

146 NRDC Petition for Rulemaking at 17.

147 Warco, Kathy, Fracking truck runs off road; contents spill, Observer Reporter, Oct 21, 2010.

148 U.S. Government Accountability Office, Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks, Report to Congressional Requesters (2012) at 33.

149 New York Department of Environmental Conservation, Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Ch. 6 Potential Environmental Impacts (2015) at 6-306

150 Kusnetz North Dakota; E&E Publishing, LLC, Ohio man pleads not guilty to brine dumping, E&E News Greenwire, Feb. 15, 2013.

151 Brittingham, Margaret C. et al., Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic

Resources and their Habitats, 48 Environmental Science Technology (2014), p. 11039.

deal with them is to remove them.152 Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.153 Given the massive volumes of chemicals and wastewater produced and their potentially harmful constituents, and their persistence in the environment, the potential for environmental disaster is real.

The EA should evaluate how often accidents can be expected to occur, and the effect of chemical and fluid spills. Such analysis should also include identification of the particular harms faced by communities near oil and gas fields. The EA must include specific mitigation measures and alternatives based on a cumulative impacts assessment, and the particular vulnerabilities of environmental justice communities in both urban and rural settings.

On-site storage of chemicals is also an issue warranting analysis. Thousands of gallons of chemicals can be potentially stored on-site and used during hydraulic fracturing and other unconventional well stimulation activities.154 These chemicals can be susceptible to accidental spills and leaks. Natural occurrences such as storms and earthquakes may cause accidents, as can negligent operator practices.

Some sites may also use on-site wastewater treatment facilities. Improper use or maintenance of the processing equipment used for these facilities may result in discharges of contaminants. Other spill causes include equipment failure (most commonly, blowout preventer failure, corrosion and failed valves) and failure of container integrity.155 Spills can result from accidents, negligence, or intentional dumping.156

The EA should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices. Again, such analysis must also include an analysis of potential impacts faced by environmental justice communities in both rural and urban settings.

3. Water Quantity

Nevada[rsquo]s most precious resource is its groundwater. Abundant relative to the aridity of the climate, Nevada[rsquo]s groundwater supports hundreds of thousands of Nevadans for domestic use, the majority of Nevada[rsquo]s agricultural output and almost the entirety of Nevada[rsquo]s biodiversity. As a result of the critical importance of this resource, any federal action which may cause impacts to groundwater quantity must include a rigorous analysis of the possibility of those impacts, and the potential effects should impacts to groundwater quantity occur.

152 King, Pamela, Hydraulic Fracturing: Limited study supports findings on bigger brine spill risks, E&E News, Nov. 4, 2015.

153 Id.

154 EPA 2016 at ES-22.

155 EPA 2015 at 5-31 to 5-46.

156 See, e.g., Fontenot, Brian, et al., An evaluation of water quality in private drinking water wells near natural gas

extraction sites in the Barnett Shale Formation, Environmental Science Technology(2013), doi: 10.1021/es4011724 (2013); Jackson, Robert B., et al., Increased stray gas abundance in a subset of drinking water wells near Marcellus shale gas extraction, 110 PNAS 28 (2013).

An EPA study found that the volumes of water needed to successfully fracture rock to open up oil and gas resources vary widely: statewide median quantities utilized fell between 76,818 gallons (0.23 acre-feet) per well in California to 5,259,965 gallons (15.9 acre-feet) per well.157

Given the variability in both estimates of water consumption per well and in the number of anticipated wells typically put forth in oil and gas NEPA documents, there is great uncertainty in attempting to evaluate the impacts of the proposed lease sale on quantities of water. However, this does not relieve USFS from their legal obligation to evaluate such impacts. 40 CFR

[sect]1502.22 is known as the [ldquo]uncertainty rule,[rdquo] and indicates that agencies must include information on uncertain impacts if such information [ldquo]is essential to a reasoned choice among alternatives, and the overall costs of obtaining it are not exorbitant.[rdquo] And indeed, these requirements are important for [ldquo]impacts which have catastrophic consequences, even if their probability of occurrence is low.[rdquo]

The potential impacts to water quantity clearly meet this threshold. If hundreds or thousands of wells were developed, something that is not outside the realm of possibility should oil prices go back above $100 per barrel, and if those wells each required the high-end estimate of 10,000,000 gallons (30.3 acre-feet) to fracture, total water withdrawals for fractured wells from this lease sale could reach into the billions of gallons (tens of thousands of acre-feet).

Withdrawals on the level of tens of thousands of acre-feet have the potential to radically alter the hydrologic regime in the areas where such withdrawals are made. If the withdrawals are made from shallow alluvial aquifers, adjacent springs, wetlands, and other water features may dry up.158 If the withdrawals are made from the deeper regional aquifer, effects may be far

reaching and drying could occur tens of miles away. Additionally, due to connections between local and regional aquifers, intensive pumping of alluvial aquifers may eventually impact regional aquifers.159

Further, this analysis is important because USFS cannot rely on the state of Nevada to safeguard groundwater resources. First, the state[rsquo]s concept of [ldquo]perennial yield[rdquo] allows for the unmitigated destruction of all unallocated surface water resources. Perennial yield is notably not defined in statute, but a working definition is [ldquo][hellip]the maximum amount of groundwater that can be salvaged each year over the long term without depleting the groundwater reservoir. The perennial yield cannot be more than the natural recharge of the groundwater reservoir and is

usually limited to the maximum amount of natural discharge.[rdquo]160 What this functionally means is

that the state of Nevada makes available for appropriation an amount of water equivalent to that which is discharged within a basin through surface discharge and evapotranspiration through phreatophytic vegetation. As such, if a basin is fully appropriated and all of those water rights are being exercised, the long-term effect will be to cease all surface discharge and eliminate all phreatophytes.

157 U.S. EPA 2016

158 Deacon, James .E. et al., Fueling population growth in Las Vegas: How Large-scale Groundwater Withdrawal Could Burn Regional Biodiversity, 57 Bioscience 8 (2007).

159 U.S. Geological Survey Circular 1139, Ground Water and Surface Water: A Single Resource (1998).

160 Nevada Department of Conservation and Natural Resources, Nevada Water Law 101 (accessed Sept. 15, 2017)

Nevada state water law does nothing to protect wildlife and other natural values present on public land [ndash] indeed, the law is structured to encourage full development of water resources, so it can be argued that Nevada state water law is actively detrimental to public land water-dependent resources. As such, USFS cannot rely on Nevada[rsquo]s water law as an indicator of the potential for groundwater impacts and overappropriation. An independent analysis must be made by USFS of any groundwater withdrawals associated with development of these leases, to examine the impacts of such withdrawals and how they may affect the environment.

It is unacceptable to simply state that water could be obtained offsite as a way of minimizing impacts to groundwater resources. The simple fact that the water is piped in from elsewhere does not exempt the action from rigorous environmental review. For example, in an APD filed for a proposed well in the Railroad Valley in 2016, the project proponent proposed utilizing surface flow from the adjacent Butterfield Spring for their drilling operations. This spring is home to the Railroad Valley tui chub, a BLM sensitive species. The proponent was to utilize up to 12,600 gallons of water every 24 hours, or some 8.75 gallons per minute, a substantial flow. The fish was protected by sealing the intake hose with [frac14][rdquo] grating. This is clearly an unacceptable set of circumstances for an endemic and sensitive species. Obtaining water offsite can have substantial environmental impacts, and USFS needs to develop very specific stipulations on where and how the water would be obtained as a part of the environmental review process.

C. Human Health

Oil and gas leasing and foreseeably-resulting fracking entail significant public health risks that should compel USFS to consider alternatives banning these practices. USFS must consider the potential threats that oil and gas leasing pose to human health and safety, such as carcinogenic, developmental, reproductive, and endocrine disruption effects.

Ample scientific evidence indicates that well development and well stimulation activities have been linked to an array of adverse human health effects, including carcinogenic, developmental, reproductive, and endocrine disruption effects. Just as troubling is how much is unknown about the chemicals used in well stimulation activities.161

While all phases of oil and gas production put people at risk, in recent years, attention has focused on the new dangers of fracking and other forms of well stimulation which use hundreds of chemicals, the majority of which are known to have adverse human health effects. A study of gas production in Colorado yielded 632 chemicals used in 944 different products that were known to have been used.162 Of these chemicals, 75 percent have been shown to cause harm to

the skin, eyes, and other sensory organs; approximately 40[ndash]50 percent could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.163 These

161 See, e.g. EPA 2016.

162 Colborn 2011 at 1045.

163 Id. at 1046.

chemicals must be transported, mixed, stored, injected, captured, and disposed of. Each step creates a risk for communities near the well site, transportation route, or disposal site. Chemicals used during the drilling process showed many of the same dangers.164 Chemicals identified in evaporation pits were also linked to the same array of harms.165

Due to the heavy and frequent use of chemicals, proximity to fracked wells is associated with higher rates of cancer, birth defects, poor infant health, and acute health effects for nearby residents who must endure long-term exposure. For example:

[middot] In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.166

[middot] Another study found that pregnant women living within 10 miles of a fracked well were more likely to bear children with congenital heart defects and possibly neural tube defects.167 A separate study independently found the same pattern; infants born near fracked gas wells had more health problems than infants born near sites that had not yet conducted fracking.168,169 Further studies have raised substantial questions regarding air pollution from Uinta Basin drilling, for example, and its public health effects on stillborns.170

[middot] A study analyzed Pennsylvania birth records from 2004 to 2011 to assess the health of infants born within a 2.5-kilometer radius of natural-gas fracking sites. They found that proximity to fracking increased the likelihood of low birth weight by more than half, from about 5.6 percent to more than nine percent.171 The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled to more than five percent.172 Another recent Pennsylvania study found a correlation between proximity to unconventional gas drilling and higher incidence of lower birth weight and small-for-gestational-age babies.173

[middot] A recent study found increased rates of cardiology-patient hospitalizations in zip codes with greater number of unconventional oil and gas wells and higher well

164 Id.

165 Id. at 1048.

166 McKenzie 2012.

167 McKenzie 2014.

168 Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).

169 Whitehouse, M., Study Shows Fracking is Bad for Babies, Bloomberg View, Jan. 4, 2014.

170 See Siddika, N. et al., Prenatal ambient air pollution exposure and the risk of stillbirth: systematic review and meta-analysis of the empirical evidence, Occup Environ Med. (May 24, 2016) doi: 10.1136/oemed-2015-103086;

see also Knox, Annie, At Vernal forum, questions about air pollution, pregnancies, research, Salt Lake Tribune (April 19, 2015); Solotaroff, Paul, What[rsquo]s Killing the Babies of Vernal, Utah? Rolling Stone Magazine, June 22, 2015.

171 Id., citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.

172 Id.

173 Stacy 2015.

density in Pennsylvania.174 The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km2, the number of cardiology- patient hospitalizations per 100 people (or [ldquo]cardiology inpatient prevalence rate[rdquo]) in that zip code would increase by 27 percent. If a zip code went from having zero wells to a well density of 0.17 to 0.79 wells/km2, a 14 percent increase in cardiology inpatient prevalence rates was expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.

[middot]   Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation, and throat irritation.175

[middot]   In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.176 The family complained that they experienced migraines, rashes, dizziness, nausea, and chronic nosebleeds. Medical tests showed one of the plaintiffs had more than 20 toxic chemicals in her bloodstream.177 Air samples around their home also showed the presence of BTEX[mdash]benzene, toluene, ethylbenzene and xylene[mdash]colorless, but toxic chemicals typically found in petroleum products.178

Chemicals used for fracking also put nearby residents at risk of endocrine disruption effects. A study that sampled water near active wells and known spill sites in Garfield County, Colorado found alarming levels of estrogenic, antiestrogenic, androgenic, and antiandrogenic activities, indicating that endocrine system disrupting chemicals ([ldquo]EDC[rdquo]) threaten to contaminate surface and groundwater sources for nearby residents.179 The study concluded:

[M]ost water samples from sites with known drilling-related incidents in a drilling-dense region of Colorado exhibited more estrogenic, antiestrogenic, and/or antiandrogenic activities than the water samples collected from reference sites[,] and 12 chemicals used in drilling operations exhibited similar activities. Taken together, the following support an association between natural gas drilling operations and EDC activity in surface and ground water: [1] hormonal activities in Garfield County spill sites and the Colorado River are higher than those in reference sites in Garfield County and in Missouri[;] [2] selected drilling chemicals displayed activities similar to those measured in water samples

174 Jemielital 2015.

175 Rabinowitz, P.M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household

Survey in Washington County, Pennsylvania. Environmental Health Perspectives Advance Publication (2014); Bamberger, Michelle and R.E. Oswald, Impacts of Gas Drilling on Human and Animal Health, 22 New Solutions 51 (2012); Steinzor, N. et al., Gas Patch Roulette: How Shale Development Risks Public Health in Pennsylvania, Earthworks Gas & Oil Accountability Project (2012).

176 Parr v. Aruba Petroleum, Inc., Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).

177 Deam, J., Jury Awards Texas Family Nearly $3 million in Fracking Case, Los Angeles Times, Apr. 3, 2014.

178 Id.

179 Kassotis, C. D. et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region, 155 Endocrinology 3:897 (2014).

collected from a drilling-dense region[;] [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites[;] and [4] known spills of natural gas fluids occurred at these spill sites.

The study also noted a linkage between EDCs and [ldquo]negative health outcomes in laboratory animals, wildlife, and humans[rdquo]:

Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.

Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor

activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.180

Operational accidents also pose a significant threat to public health. For example, in August 2008, Newsweek reported that an employee of an energy-services company got caught in a fracking fluid spill and was taken to the emergency room, complaining of nausea and headaches.181 The fracking fluid was so toxic that it ended up harming not only the worker, but also the emergency room nurse who treated him. Several days later, after she began vomiting and retaining fluid, her skin turned yellow and she was diagnosed with chemical poisoning.182

Harmful chemicals are also found in the flowback fluid after well stimulation events.

Flowback fluid is a key component of oil-industry wastewater from stimulated wells. A survey of chemical analyses of flowback fluid dating back to April 2014 in California revealed that concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the

180 Id. at 905.

181 Wiseman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, 20 Fordham Envtl. Law Rev. 115 at 145 (2009).

182 Id.

federal limits for drinking water.183 Of the 329 available tests that measured for benzene, the chemical was detected at levels in excess of federal limits in 320 tests (97 percent).184 On average, benzene levels were around 700 times the federal limit for drinking water.185 Among

other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.186 These hazardous substances were detected in excess of federal limits for drinking water in over 100 tests. This dangerous fluid is commonly disposed of in injection wells, which often feed into aquifers, including some that could be used for drinking water and irrigation.

Acidizing presents similar alarming risks to public health and safety. In acidizing operations, large volumes of hydrochloric and hydrofluoric acids are transported to the site and injected underground. These chemicals are highly dangerous due to their corrosive properties and ability to trigger tissue corrosion and damage to sensory organs through contact.

While many risks are known, much more is unknown about the hundreds of chemicals used in fracking. The identity and effects of many of these additives is unknown, due to operators[rsquo] claims of confidential business information. But, as the EPA recognizes, chemical identities are [ldquo]necessary to understand their chemical, physical, and toxicological properties,

which determine how they might move through the environment to drinking water resources and any resulting effects.[rdquo]187 Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.188 The lack of this information also precludes effective remediation: [ldquo]Knowing their identities would also help inform what chemicals to test for in the event of suspected drinking water impacts and, in the case of wastewater, may help predict whether current treatment systems are effective at removing them.[rdquo]189

Even where chemical identities are known, chemical safety data may be limited. In the EPA[rsquo]s study of the hazards of fracking chemicals to drinking water, the EPA found that [ldquo][o]ral reference values and oral slope factors meeting the criteria used in this assessment were not available for the majority of chemicals used in hydraulic fracturing fluids [87 percent], representing a significant data gap for hazard identification.[rdquo]190 Without this data, the EPA could not adequately assess potential impacts on drinking water resources and human health.191

183 California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report. The highest concentration was 7,700 parts per billion ([ldquo]ppb[rdquo]) for a well with API number 03052587. The US EPA[rsquo]s maximum contaminant level for benzene is 5 ppb.

184 Id.

185 Id., see also Cart, J., High Levels of Benzene Found in Fracking Wastewater, Los Angeles Times, Feb. 11, 2015. 186 Id.; see also Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015), available at http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02- 11-2015.html.

187 EPA 2015 at 10-18.

188 Souther, Sara et al, Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, 12 Frontier Ecology Environmental 6: 334 (2014).

189 EPA 2015 at 10-18.

190 Id. at 10-7, 9-7.

191 Id. at 9-37-38.

Further, of the 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physiochemical properties reported in the EPA[rsquo]s toxics database; although this information is [ldquo]essential to predicting how and where it will travel in the environment.[rdquo]192 The data gaps are actually much larger, because the EPA excluded 35 percent of fracking chemicals reported to FracFocus from its analysis because it could not assign them standardized chemical names.193

In sum, there are a wide array of possible impacts from fossil fuel extraction and fracking to human health, both well-documented and those that remain unknown. USFS is obligated to disclose and analyze these impacts in the EA.

D. Wildlife

1. Lahontan Cutthroat Trout

Oil and gas developments and infrastructure further affect entire aquatic ecosystems. The overall health of an aquatic habitat derives from the condition of the entire watershed including the uplands, riparian corridor and the stream channel.194 The decline of native trout is caused primarily by habitat damage (much of it associated with roads, dust, and sedimentation), and the effects of introduced, non-native fish. Roads are a significant cause of trout habitat damage and

water quality degradation. In streams where cutthroat trout share habitat with other non-native salmonids, any habitat degradation is likely to shift the balance to dominance by non-native salmonids.195 Once non-native trout displace native trout, the situation is almost impossible to reverse.196

More specifically, recent research has specifically demonstrated that exposure to flowback and produced water resulting from hydraulic fracturing results in multiple adverse biological effects on freshwater fish, specifically rainbow trout.197 The study was one of the first to directly evaluate the effects of materials used in hydraulic fracturing on aquatic life:

The lack of available hazard assessment for HF-FPW spills in Canada and the United States hinders environmental impact and risk assessment of hydraulic fracturing activities. Mandatory disclosure of the chemical constituents of fracturing fluids for example, through the chemical disclosure registry, FracFocus, has somewhat improved our understanding but the toxicity data of many chemicals is often missing. The environmental fates of those chemicals are further complicated by potential down-hole reactions and generation of secondary

192 Id. at 5-73.

193 Id. at 9-38.

194 Wyoming Game and Fish Dept, Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats (Apr. 2010) at 11.

195 Western Native Trout Campaign, Imperiled Western Trout and the Importance of Roadless Areas (Nov. 2001) at 12.

196 Id.

197 He, Yuhe et al., Effects on Biotransformation, Oxidative Stress, and Endocrine Disruption in Rainbow Trout (Oncorhynchus mykiss) Exposed to Hydraulic Fracturing Flowback and Produced Water, 51 Environ. Sci. Technol.

940-947 (2017), doi: 10.1021/acs.est.6b04695.

products. Therefore, there exists an obvious need to investigate the toxicity on aquatic organisms. In this study, juvenile rainbow trout (Oncorhynchus mykiss), commonly used as a biologically relevant freshwater model for regulatory science, were used to determine responses to potential spills and leaks of HF- FPW in the aquatic environment. Acute exposures (48 h) were conducted followed by measurements of a variety of endpoints including hepatic and ranchial ethoxyresorufin-O-deethylase (EROD) activity, thiobarbituric acid reactive substance (TBARS) formation in various tissues, and mRNA abundance of a battery of genes related to biotransformation, oxidative stress, and endocrine disruption by quantitative real-time polymerase chain reaction (Q-RT-PCR). This is one of the first studies to investigate the physiological responses to HF-FPW

exposure in a whole organism.198

The results of exposure to flowback and produced water ([ldquo]HF-FPW[rdquo]) on rainbow trout revealed multiple pathways with potential for adverse effects, including endocrine disruption:

Adverse effects were observed at high dilutions in both SF and/or S fractions exposure groups, rather than AC fractions exposure groups. This indicates that the organic contaminants rather than the salts per se were the major contributor in acute exposure of diluted HF-FPW in fish. Analysis of multiple biomarkers and gene expression for key markers of adverse effects reveal HFFPW exposure in a biologically relevant fish elicits responses in a variety of pathways, including biotransformation, oxidative stress, and endocrine disruption. Our results further suggest that sediment found in HF-FPW is an important component in causing adverse effects related to biotransformation and oxidative stress pathways, in agreement with our earlier studies. An alternative hypothesis is that the exposure concentration of various contaminants present in HF-FPW was elevated by chemical desorption from sediment particles, thus enhancing the exposure rate.

Future study is needed to address the potential adverse effects derived from sediments of HF-FPW, and special attention should be paid to the sediment residues in spill response and the remediation process.199

We incorporate herein the comments provided by Trout Unlimited.

2. Mule Deer

The southern Ruby Mountains are known to harbor one of the most significant mule deer herds in the state of Nevada, including tens of thousands of acres of crucial winter range. These ungulates provide vital services for the maintenance and thriving of the ecosystem, recreational opportunities for hunting and wildlife viewing, and are an essential facet of what makes the Ruby Mountains such an iconic and quintessentially Nevadan landscape.

198 Id. at 941.

199 Id. at 945-46.

Significant new research exists showing adverse effects to mule deer migrations and population from energy development. A full examination of this issue must include site-specific assessment of effects on particular deer subpopulations, winter use areas, and/or migration corridors. Merely describing the [ldquo]the category of impacts anticipated from oil and gas development[rdquo] fails to meet NEPA[rsquo]s hard look requirement when it is reasonable for the agency to do more. See New Mexico, 565 F.3d at 707 (emphasis original). [ldquo]NEPA does not permit an agency to remain oblivious to differing environmental impacts, or hide these from the public, simply because it understands the general type of impact likely to occur. Such a state of affairs would be anathema to NEPA's [lsquo]twin aims[rsquo] of informed agency decisionmaking and public access to information.[rdquo] Id.

Research shows that residential and energy development has reduced all ungulates across the West. The low-elevation valleys and mountain foothills, once important habitat for ungulates, are filled with cities and towns.200 The same is true particularly on winter ranges.201 For example, between 1980 and 2010, western Colorado saw a 37% increase in residential land-use in mule deer habitat, primarily on their winter range.202 The resulting lack of high-quality winter range is limiting robust mule deer population growth.203

An earlier dearth of high-quality, long-term, and controlled studies made it difficult to evaluate with precision the role of oil and gas development in mule deer habitat and population decline.204 Clearly, mule deer demonstrate avoidance of roads and oil and gas infrastructure, with as-yet inadequately-understood consequences for migration, energy budgets, adult and fawn survival, and population.205

Some of the best available long-term, controlled studies evaluate mule deer population density before and after oil and gas development in the Sublette mule deer herd.206 The Sublette mule deer study has compared mule deer density in control and development zones, and found mule deer densities declined 30% in the development area, as opposed to 10% in the control area.207 Sawyer and Strickland found that [ldquo]the observed decline of mule deer in the treatment

200 Polfus, J. L., and P. R. Krausman, Impacts of residential development on ungulates in the Rocky Mountain West, 36 Wildlife Society Bulletin 4 (2012) doi: 101002/wsb.185.

201 Johnson, H.E., et al., Increases in residential and energy development are associated with reductions in recruitment for a large ungulate. Global Change Biology (2016), doi: 10.1111/gcb.13385 ([ldquo]Johnson et al. 2016[rdquo]). 202 Johnson et al. 2016.

203 Bergman, E. J.,et al., Density dependence in mule deer: a review of evidence, 21 Wildlife Biology 18 (2015); Johnson et al. 2016.

204 Hebblewhite, Mark, Effects of Energy Development on Ungulates, Energy Development and Wildlife Conservation in Western North America, Island Press, Washington D.C. (2011)

205 Hebblewhite 2011; Sawyer, H., et al., A framework for understanding semi-permeable barrier effects on migratory ungulates, 50 Journal of Applied Ecology (2013), doi:10.1111/1365-2664.12013; Lendrum, P.E. et al.,

Habitat selection by mule deer during migration: effects of landscape structure and natural-gas development, 3 Ecosphere 9:82 (2012).

206 Sawyer, H. et al., Sublette Mule Deer Study (Phase II): Final Report 2007, Western Ecosystems Technology, Inc., Cheyenne, Wyoming, USA (2009).

207 Id.

area was likely due to gas development, rather than drought or other environmental factors that have affected the entire Sublette Herd unit.[rdquo]208

The Sublette example is particularly important when considering energy development[rsquo]s effects on mule deer populations, their winter range, and their migration patterns in sagebrush habitats of the west. For example, even in its relatively early stages compared to Wyoming, the most recent spatial analysis of already-occurring effects on mule deer in western Colorado finds energy development has the second-largest effect on deer recruitment, exceeded only by residential development.209

Most recently, Hall Sawyer and colleagues published their conclusions from seventeen years of telemetry data on mule deer exposed to energy development in Pinedale area, and found that, despite the using of timing stipulations and other, more aggressive, mitigation measures, development of oil and gas infrastructure within seasonal habitat and migration corridors has massive and long-term adverse effects on mule deer population levels:

Mule deer consistently avoided energy infrastructure through the 15-year period of development and used habitats that were an average of 913 m further from well pads compared with predevelopment patterns of habitat use. Even during the last 3 years of study, when most wells were in production and reclamation efforts underway, mule deer remained >1 km away from well pads. The magnitude of avoidance behavior, however, was mediated by winter severity, where aversion to well pads decreased as winter severity increased. Mule deer abundance declined by 36% during the development period, despite aggressive onsite mitigation efforts (e.g. directional drilling and liquid gathering systems) and a 45% reduction in deer harvest. Our results indicate behavioral effects of energy development on

mule deer are long term and may affect population abundance by displacing animals and thereby functionally reducing the amount of available habitat.210

It is demonstrated that oil and gas development affects mule deer habitat use and migration patterns by causing site avoidance, particularly in daytime,211 and creating [ldquo]semi- permeable[rdquo] barriers to migration routes.212 In addition, it is well-documented that human development causes direct habitat loss and fragmentation through the construction of infrastructure, and indirect habitat loss through deer avoidance of infrastructure and related activities; these consequences likely reduce the carrying capacity of the landscape.213 A recent study shows that oil and gas development causes significant habitat loss:

208 Id.

209 Johnson et al. 2016.

210 Sawyer, Hall et al., Mule Deer and Energy Development[mdash]Long-term trends of habituation and abundance, Global Change Biology (2017).

211 Lendrum 2012.

212 Sawyer et al 2013.

213 Johnson et al. 2016.

Energy development drove considerable alterations to deer habitat selection patterns, with the most substantial impacts manifested as avoidance of well pads with active drilling to a distance of at least 800 m. Deer displayed more nuanced responses to other infrastructure, avoiding pads with active production and roads to a greater degree during the day than night. In aggregate, these responses equate

to alteration of behavior by human development in over 50% of the critical winter range in our study area during the day and over 25% at night.214

Additionally, mule deer may suffer higher mortality rates in developed landscapes because of increased vehicle collisions and accidents (i.e., entrapment in fences); moreover, increased road densities expose mule deer to more hunters, poachers and predatory domestic pets.215

Mule deer also need migration corridors that are protected from human development. An ongoing mule deer study by members of the Wyoming Migration Initiative has found that mule deer migration patterns are altered by human development [ndash] herds will move faster, stop less to feed, and detour around developed portions of their route.216 Moreover, herds that can[rsquo]t migrate in search of the most nutritious grasses just end up smaller in number.

3. Greater Sage Grouse

In September 2015, the BLM and Forest Service completed a major effort to secure adequate regulatory mechanisms to prevent the listing of the greater sage-grouse ([ldquo]GRSG[rdquo]) under the Endangered Species Act. The effort culminated in amendments to the land management plans for the Idaho, Southwest Montana, Nevada, and Utah national forests, including the Humboldt and Toiyabe national forests ([ldquo]GRSG LMP Amendment[rdquo]),217 and Nevada and Northeastern California resource management plans ([ldquo]NV/NE CA RMPA[rdquo])218 and Record of Decision for the BLM amendments ([ldquo]Great Basin ROD[rdquo]).219 The amendments and prescribe management measures for BLM-permitted activities, including oil and gas leasing, within various categories Sagebrush Focal Areas ("SFAs"), Priority Habitat Management Areas ("PHMAs"), General Habitat Management Areas ("GHMAs") and Other Habitat Management Areas ("OHMAs") of sage-grouse habitat, and prescribed stipulations for all new fluid mineral

214 Northrup, J. M. et al. Quantifying spatial habitat loss from hydrocarbon development through assessing habitat selection patterns of mule deer, Global Change Biology, Aug. 2015.

215 Johnson et al. 2016.

216 Sawyer 2013.

217 U.S. Bureau of Land Management, Record of Decision and Approved RMP Amendments for the Great Basin Region, Including the Greater Sage-grouse Sub-Regions of Idaho and Southwest Montana, Nevada and NE California, Utah, Oregon, (September 2015).

218 U.S. Bureau of Land Management, Nevada and Northeastern California Greater Sage-grouse Approved RMP Amendment (September 2015).

219 U.S. Bureau of Land Management, Record of Decision September 2015.

leases within those designated habitats. The leasing proposal includes parcels that contain PHMAs, GHMAs, OHMAs, winter habitat, brood rearing habitat.

The proposed leasing is contrary to the intent of the BLM and Forest Service[rsquo]s GRSG conservation effort and has a high potential for resulting the extinction of the local GRSG population. Oil and gas development and associated infrastructure has numerous well- documented adverse effects on GRSG survival, breeding, and behavior. According to the Conservation Objectives Team (COT) report that the GRSG LMP Amendment and

NV/NE RMPA were, in part, based, [ldquo][s]age-grouse populations can be significantly reduced, and in

some cases locally extirpated, by non-renewable energy development activities, even when mitigative measures are implemented.[rdquo]220

According to an analysis undertaken by the Nevada Department of Wildlife,221 30,169 acres of PHMA and 15,875 acres of GHMA is being considered for leasing. At least 80 parcels contain GRSG winter range and 137 parcels contain brood rearing habitat. A known active lek, with 40 breeding pairs based on last count, occurs within the intended leasing area. At least eight active and one pending lek are within four miles of the proposed area. At least 127 parcels are within 4 miles of a known lek.

The conservation measures in the Great Basin ROD, NV/NE CA RMPA, and GRSG LMP Amendment are key parts of the federal government[rsquo]s strategy to preserve the GRSG, which the BLM has stated [ldquo]offers the highest level of protection for GRSG in the most important habitat areas.[rdquo]222 Furthermore, [ldquo][t]he cumulative effect of these measures is to conserve, enhance, and restore GRSG habitat across the species[rsquo] remaining range in the Great Basin Region and to provide greater certainty that BLM management plan decisions in GRSG habitat in the Great Basin Region can lead to conservation of the GRSG and other sagebrush-steppe associated species in the region.[rdquo]223 Ultimately, [ldquo][t]he goal is to achieve the COT Report objective of [lsquo]conserv[ing] the sage-grouse so that it is no longer in danger of extinction or likely to become in danger of extinction in the forseeable future.[rsquo][rdquo]224

Regarding the leasing of fluid minerals, the intent is to prioritize leasing outside of PHMAs and GHMAs in non-habitat areas and only then in the least suitable GRSG habitat. The Great Basin ROD225 explains why prioritization is necessary (emphasis added):

In addition to allocations that limit disturbance in PHMAs and GHMAs, the ARMPAs prioritize oil and gas leasing and development outside of identified PHMAs and GHMAs to further limit future surface disturbance and to encourage new development in areas

220 U.S. Fish and Wildlife Service, Conservation Objectives Team (COT). Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. (February 2013) at 10.

221 Nevada Department of Wildlife. Comment Letter to Susan Elliott, Program Manager: Mountain City, Ruby Mountains, and Jarbridge Ranger Districts, Humbolt-Toiyabe National Forest, RE: Ruby Oil and Gas (October 19, 2017).

222 Great Basin ROD at S-1 223 Great Basin ROD at S-2. 224 Great Basin ROD at S-2.

225 Great Basin ROD at 1-23, emphasis added.

that would not conflict with GRSG. This objective is intended to guide development to lower conflict areas and, as such, protect important habitat and reduce the time and cost associated with oil and gas leasing development. It would do this by avoiding sensitive areas, reducing the complexity of environmental review and analysis of potential impacts on sensitive species, and decreasing the need for compensatory mitigation.

The stipulations set forth in the NV/NE CA RMPA226 should be implemented and interpreted as plan standards with an important caveat. The N/NE CA RMPA stipulations are inadequate to protect winter habitat and are not consistent with COT Report or the 2011 Sage- grouse National Technical Team227 report, considered best available science.

Once disturbed, winter habitat is difficult to restore. GRSG winter habitat must provide sufficient sagebrush cover and food to support the birds throughout the season, especially during periods with above average snow cover.228 Wintering areas are often on windswept ridges, south- facing slopes or in protected draws.229 These landscape features may be limited in some areas.230 GRSG typically show high fidelity to winter habitat areas, and a single area may support several different breeding populations.231 They are also known to move great distances between habitats. Connelly et. al. (2004) noted that females migrate an average of 6 miles between summer and winter habitat.232 Fedy (2012) reported average summer-to-winter migration of 13.5 miles and average nest-to-winter migration of 7.8 miles.233 Manier et al. (2013) summarized that a majority of sage-grouse move 6.2 miles from summer to winter locations with movements of up to 90 miles documented.234 Consequently, the loss or fragmentation of wintering areas can have a

226 NV/NE CA RMPA, Appendix G.

227 Sage-grouse National Technical Team. A Report on National Greater Sage-Grouse Conservation Measures. (December 21, 2011).

228 Braun et al., Seasonal habitat requirements for sagegrouse: spring, summer, fall and winter. Pages 38-42 in Shaw

et al., (compilers). Sage-grouse Habitat Restoration Symposium Proceedings; U.S. Dept. Agriculture, Sage-Grouse Habitat Restoration Symposium Proceedings (Nov. 2005); Connelly et al., Characteristics of Greater Sage-grouse habitats: a landscape species at micro and macro scales. Pages 69-83 in S. T. Knick and J. W. Connelly (eds).

Greater Sage-grouse: Ecology and Conservation of a Landscape Species and its Habitats. Studies in Avian Biol.

Series, vol. 38. Cooper Ornithological Society. Univ. Calif. Press. Berkeley, CA (2011).

229 Braun et al., Seasonal habitat requirements for sagegrouse: spring, summer, fall and winter. Pages 38-42 in Shaw et al., (compilers). Sage-grouse Habitat Restoration Symposium Proceedings; June 4-7, 2001; U.S. Dept.

Agriculture, Sage-Grouse Habitat Restoration Symposium Proceedings 2005.

230 Beck, T.D.I., Sage grouse flock characteristics and habitat selection in winter. 41 Journal of Wildlife Management 1 (1977) available at https://www.jstor.org/stable/3800086?seq=1#page_scan_tab_contents.

231 Sage-grouse National Technical Team. A Report on National Greater Sage-Grouse Conservation Measures.

(December 21 2011) at 51.

232 Connelly et al., Conservation assessment of greater sage-grouse and sagebrush habitats, Western Association of Fish and Wildlife Agencies (2004) at 4-19.

233 Fedy, Bradley et al., 2012, Interseasonal Movements of Greater Sage-Grouse, Migratory Behavior, and an

Assessment of the Core Regions Concept in Wyoming. 76 Journal of Wildlife Management (2012) at 1066 available at http://onlinelibrary.wiley.com/doi/10.1002/jwmg.337/abstract.

234 Manier et al., Summary of science, activities, programs, and policies that influence the rangewide conservation of Greater SageGrouse (Centrocercus urophasianus), U.S. Geological Survey Open[ndash]File Report (2013) at 26.

disproportionate impact on GRSG population size.235 Moynahan et al. (2007) also observed that the quality of winter habitat appears to influence the abundance and condition of female sage- grouse and their nesting effort and clutch sizes in spring.236

It makes little sense to restrict disturbance in winter habitat during the season of use, only to allow the same development at other times of the year, since sage-grouse will eventually return to find the habitat degraded and potentially unavailable the following winter. Surface occupancy should be prohibited in winter habitat as supported by the best available science.237

On September 1, 2016, BLM[rsquo]s Washington, D.C. office issued Instruction Memorandum 2016-143, Implementation of Greater Sage-Grouse Resource Management Plan Revisions or Amendments - Oil & Gas Leasing and Development Sequential Prioritization (September 1, 2016) ([ldquo]IM 2016-143[rdquo]), to the BLM[rsquo]s State Directors, providing [ldquo]guidance on prioritizing implementation decisions for . . . BLM oil and gas leasing and development[rdquo] to be consistent with the GRSG plan amendments.

IM 2016-143 instructs BLM that [ldquo][a]t the time the leasing priority is determined, when leasing within GHMA or PHMA is considered, BLM should consider, first, areas determined to be non-sage-grouse habitat and then consider areas of lower value habitat.[rdquo] Id.

IM 2016-143 mandates that [ldquo]BLM State Offices will use the following prioritization sequence for considering leasing in or near GRSG habitat, while also considering the [lsquo]Factors to Consider While Evaluating EOIs in

Each Category.[rsquo][rdquo] The IM then sets out the methods by which BLM will prioritize leasing in and around GRSG habitat. The IM directs the agency to prioritize leasing in the following order:

1. Lands outside of GHMAs and PHMAs: BLM State Offices will first consider leasing EOIs for lands outside of PHMAs and GHMAs. These lands should be the first priority for leasing in any given lease sale.

2. Lands within GHMAs: BLM State Offices will consider EOIs for lands within the GHMAs, after considering lands outside of both GHMAs and PHMAs. When considering the GHMA lands for leasing, the BLM State Office will ensure that a

235 Caudill et al., Winter habitat use by juvenile greater sage-grouse on Parker Mountain, Utah: implications for sagebrush management 72 Human Wildlife Interactions 2 (2013).

236 Moynahan, Brendan et al., Factors affecting nest survival of Greater Sage-grouse in northcentral Montana, 71 Journal of Wildlife Management 6 (2007) available at https://www.jstor.org/stable/4496268?seq=1#page_scan_tab_contents.

237 Braun et al, Seasonal habitat requirements for sagegrouse: spring, summer, fall and winter. Pages 38-42 in N. L.

Shaw, M. Pellant, S. B. Monsen (compilers). Sage-grouse Habitat Restoration Symposium Proceedings; U.S. Dept. Agriculture, Sage-Grouse Habitat Restoration Symposium Proceedings (Nov. 2005); U.S. Forest Service, Rocky Mountain Research Station. Fort Collins, CO (2005); Connelly et al., Guidelines to manage sage grouse populations and their habitats. 28 Wildlife Society Bulletin 4 (2000); Moynahan, Brendan et al., Factors affecting nest survival of Greater Sage-grouse in northcentral Montana. 71 J. Wildlife Management 6 (2007; Sage-grouse National Technical Team. A Report on National Greater Sage-Grouse Conservation Measures (December 21, 2011) at 21; Doherty et al., Greater Sage-grouse winter habitat selection and energy development, 72 Journal of Wildlife Management 1 (2008); Caudill et al., Winter habitat use by juvenile greater sage-grouse on Parker Mountain, Utah: implications for sagebrush management, 72 Human Wildlife Interactions, 72 (2013).

decision to lease those lands would conform to the conservation objectives and provisions in the GRSG Plans (e.g., Stipulations).

3. Lands within PHMAs: BLM state offices will consider EOIs for lands within PHMAs after lands outside of GHMAs and PHMAs have been considered, and EOIs for lands within GHMA have been considered. When considering the PHMA lands for leasing, the BLM State Offices will ensure that a decision to lease those lands would conform to the conservation objectives and provisions in the GRSG Plans (e.g., Stipulations) including special consideration of any identified SFAs.

IM 2016-143 also identifies additional prioritization factors that BLM must consider:

[middot] Parcels immediately adjacent or proximate to existing oil and gas leases and development operations or other land use development should be more appropriate for consideration before parcels that are not near existing operations. This is the most important factor to consider, as the objective is to minimize disturbance footprints and preserve the integrity of habitat for conservation.

[middot] Parcels that are within existing Federal oil and gas units should be more appropriate for consideration than parcels not within existing Federal oil and gas units.

[middot] Parcels in areas with higher potential for development (for example, considering the oil and gas potential maps developed by the BLM for the GRSG Plans) are more appropriate for consideration than parcels with lower potential for development. The Authorized Officer may conclude that an area has "higher potential" based on all pertinent information, and is not limited to the Reasonable Foreseeable Development (RFD) potential maps from Plans analysis.

[middot] Parcels in areas of lower-value sage-grouse habitat or further away from important life-history habitat features (for example, distance from any active sage-grouse leks) are more appropriate for consideration than parcels in higher-value habitat or closer to important life-history habitat features (i.e., lek, nesting, winter range areas). At the time the leasing priority is determined, when leasing within GHMA or PHMA is considered, BLM should consider, first, areas determined to be non-sage-grouse habitat and then consider areas of lower value habitat.

[middot] Parcels within areas having completed field-development Environmental Impact Statements or Master Leasing Plans that allow for adequate site-specific mitigation and are in conformance with the objectives and provisions in the GRSG Plans may be more appropriate for consideration than parcels that have not been evaluated by the BLM in this manner.

[middot] Parcels within areas where law or regulation indicates that offering the lands for leasing is in the government's interest (such as in instances where there is drainage of Federal minerals, 43 CFR [sect] 3162.2-2, or trespass drilling on unleased lands) will generally be considered more appropriate for leasing, but lease terms will include all appropriate conservation objectives and provisions from the GRSG Plans.

Leasing must follow IM 2016-143[rsquo]s guidance.

First, including the parcels with sage-grouse PHMA must conform to IM 2016-143[rsquo]s instruction about proximity to previous oil and gas development. The IM states, [ldquo]Parcels immediately adjacent or proximate to existing oil and gas leases and development operations or other land use development should be more appropriate for consideration before parcels that are not near existing operations. This is the most important factor to consider, as the objective is to minimize disturbance footprints and preserve the integrity of habitat for conservation.[rdquo] IM 2016-143, emphasis added.

Second, IM 2016-43 states, [ldquo][p]arcels that are within existing Federal oil and gas units should be more appropriate for consideration than parcels not within existing Federal oil and gas units.[rdquo]

Third, IM 2016-43 states, [ldquo][p]arcels in areas with higher potential for development (for example, considering the oil and gas potential maps developed by the BLM for the GRSG Plans) are more appropriate for consideration than parcels with lower potential for development.[rdquo]

Fourth, IM 2016-143 states, [ldquo][p]arcels in areas of lower-value sage-grouse habitat or further away from important life-history habitat features (for example, distance from any active sage-grouse leks) are more appropriate for consideration than parcels in higher-value habitat or closer to important life-history habitat features (i.e., lek, nesting, winter range areas).[rdquo]

Fifth, IM 2016-143 states, [ldquo][p]arcels within areas having completed field-development Environmental Impact Statements or Master Leasing Plans that allow for adequate site-specific mitigation and are in conformance with the objectives and provisions in the GRSG Plans may be more appropriate for consideration than parcels that have not been evaluated by the BLM in this manner.[rdquo]

Sixth, IM 2016-143 states, [ldquo][p]arcels within areas where law or regulation indicates that offering the lands for leasing is in the government's interest (such as in instances where there is drainage of Federal minerals, 43 CFR [sect] 3162.2-2, or trespass drilling on unleased lands) will generally be considered more appropriate for leasing, but lease terms will include all appropriate conservation objectives and provisions from the GRSG Plans.[rdquo]

4. Connectivity Corridors

The parcels proposed for leasing lie along a continental wildlife linkage extending from the greater Grand Canyon ecoregion northward along the Utah-Nevada border and into the Sawtooth-Bitteroot Ranges of Idaho. Initially defined by Fields et al (2010)238 and supported by the subsequent research of Carroll et al. (2013)239 and Belote (2016),240 the Grand Canyon-

238 Fields, Kenyon, et al., Modeling Potential Broadscale Wildlife Movement Pathways Within the Continental United States, Wildlands Network and Colorado State University, July 24, 2010.

239 Carroll, Carlos, Richard J. Fredrickson, and Robert C. Lacy. 2013. Developing Metapopulation Connectivity Criteria from Genetic and Habitat Data to Recover the Endangered Mexican Wolf. Conservation Biology DOI:10.1111/cobi.12156.

240 Belote R. Travis, Matthew S. Dietz, Brad H. McRae, David M. Theobald, Meredith L. McClure, G. Hugh Irwin,

Peter S. McKinley, Josh A. Gage, Gregory H. Aplet. 2016. Identifying Corridors among Large Protected Areas in

Central Idaho wildlife corridor includes significant protected core areas from Arizona[rsquo]s Grand Canyon-Parashant National Monument in the south through Great Basin National Park and north to the Jarbidge Wilderness and Owyhee River watershed.

The Ruby Mountains form a critical link in this wildlife passage. Wildlife directly benefiting from an intact, connected landscape include mule deer, cougars, elk, bighorn sheep, and mountain goats. These ranges, along with the nearby Goshute Mountains, comprise one of Audubon[rsquo]s Important Bird Areas241, and lies along the annual north-south migration route of thousands of raptors, golden eagles, bald eagles, red-tailed hawks, goshawks, American kestrels,

peregrine falcons, and Cooper's hawks.

In October 2016, USDA indicated that revision of the Humboldt-Toiyabe Forest Plan is tentatively scheduled to begin in 2021242 and the 2012 Planning Rule will guide this effort.

Forest plans detail strategies to protect habitat and balance multiple uses to ensure the persistence of wildlife, including at-risk and federally protected species.243 With this impending process in mind, we submit that the Service should skeptically view projects with the potential to adversely impact for the long term the integrity of landscape-scale habitat and ecological functions such as wildlife connectivity. Indeed, as discussed above in detail, the Forest Service should not consent

to such the proposal here prior to revising the forest plan. Forest plans detail strategies to protect habitat and balance multiple uses to ensure the persistence of wildlife, including at-risk and federally protected species.244 In addition, the Forest will follow the Region 4 Wilderness Planning Process and identify and evaluate lands that may be suitable for inclusion in the National Wilderness Preservation System and determine whether to recommend any such lands to be designated as Wilderness.245

In April 2012, the Forest Service finalized regulations implementing the National Forest Management Act (NFMA). These regulations, commonly referred to as the [ldquo]2012 Planning Rule[rdquo] established a process for developing and updating forest plans and set conservation requirements that forest plans must meet to sustain and restore the diversity of ecosystems, plant and animal communities and at-risk species found on these public lands (36 C.F.R. [sect][sect] 219.1- 219).

The forest planning rule includes explicit requirements for managing for ecological connectivity on national forest lands and facilitating connectivity planning across land ownerships[mdash]the first such requirements in the history of U. S. public land management. The pending revisions of most forest plans provide a significant opportunity to protect and enhance the United States. PLoS ONE 11(4): e0154223. doi:10.1371/journal.pone.0154223

241 National Audubon Society, Important Bird Areas, Goshute Mountains, available at

http://www.audubon.org/important-bird-areas/goshute-mountains (accessed Oct. 24, 2017).

242 U. S. Dept. of Agriculture, Forest Plan Revision, Intermountain Region Newsletter (Oct. 2016).

243 Defenders of Wildlife, Planning for Connectivity: A Guide to Connect and Conserve America[rsquo]s Wildlife Within and Beyond the National Forest System (accessed Oct. 24, 2017)

244 Ibid.

245 U.S. Dept. of Agriculture, U.S. Forest Service Region 4 Wilderness Planning Progress (accessed June 27, 2017).

the diversity of habitat and wildlife on national forest lands by developing forest plans that promote the conservation and restoration of ecological connectivity.246

The 2012 Planning Rule defines connectivity as: Ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the exchange of flow, sediments, and nutrients; the daily and seasonal movements of animals within home ranges; the dispersal and genetic interchange between populations; and the long distance range shifts of species, such as in response to climate change (219.19).

The planning rule definition reflects both structural and functional aspects of connectivity. The rule[rsquo]s reference to spatial scales and [ldquo]landscape linkages[rdquo] suggests a structure of connected patches and ecosystems. Functional connectivity is also part of the definition: water flows, sediment exchange, nutrient cycling, animal movement/dispersal, species climate adaptation and genetic interchange are all ecological processes that are sustained by connectivity.

Connectivity plays a key role in the rule[rsquo]s conservation approach. As a key characteristic of ecosystems, connectivity may also be an [ldquo]ecological condition[rdquo] needed by individual species, and so forest plans may need to address connectivity at the species level. For example, a recent amendment to forest plans in Wyoming protects migration corridors between seasonal habitats for pronghorn.247

There is an additional requirement in NFMA that is particularly important to developing plan components for connectivity. It is a procedural requirement that the planning process be [ldquo]coordinated with the land and resource management planning processes of State and local governments and other Federal agencies[rdquo] (16 USC [sect] 1604(a)). One of the purposes of the planning rule was to [ldquo][e]nsure planning takes place in the context of the larger landscape by taking an [lsquo]all-lands approach[rsquo][rdquo] (77 Fed. Reg. 21164).248 To accomplish this, forest plans should consider how habitat is connected across ownership boundaries.

The planning rule accounts for this type of [ldquo]all lands[rdquo] connectivity by:

[middot] Requiring assessments to evaluate conditions, trends and sustainability [ldquo]in the context of the broader landscape[rdquo] (219.5(a)(1))

[middot] Recognizing that sustainability depends in part on how the plan area influences, and is influenced by, [ldquo]the broader landscape[rdquo] (219.8(a)(1)(ii), (iii)).

[middot] Requiring coordination with other land managers with authority over lands relevant to populations of species of conservation concern (219.9(b)(2)(ii)).

[middot] Requiring coordination with plans and land-use policies of other jurisdictions (219.4(b)).

246 Defenders 2017.

247 Ament, R., R. Callahan, M. McClure, M. Reuling, G. Tabor. 2014. Wildlife Connectivity: Fundamentals for Conservation Action. Center for Large Landscape Conservation. Bozeman, MT.

248 Compare with the NPS (2011) [ldquo]big-picture[rdquo] approach, replacing short-term, single species management with multi-species, long-term and large-scale approaches[hellip][to] ensure not only the survival of species and scenic vistas,

but also allow these systems to continuously evolve and change;[rdquo] and the first goal of the President[rsquo]s National Fish, Wildlife, and Plants Climate Adaptation Strategy: to [ldquo]build or maintain ecologically connected network of terrestrial, coastal, and marine conservation areas that are likely to be resilient to climate change and support a broad range of fish, wildlife, and plants under changing conditions[rdquo] (Council 2014:19-20).

[middot] Requiring consideration of opportunities to coordinate with neighboring landowners to link open spaces and take joint management objectives into account (219.10(a)(4)).

Achieving the broader scale [ldquo]all-lands[rdquo] goals of the planning rule requires partnerships and compatible management across landscapes among multiple landowners and jurisdictions. In particular, there is a need for a landscape-scale strategic approach to conserving connectivity.

NFMA has established that the way to communicate a long-term and reliable management commitment for National Forest System lands is through forest plan decisions for specific areas.

E. Vegetation

The EA must include an analysis of impacts to vegetative communities, including riparian, woodland, and scrub communities present on the parcels in question.

F. Wilderness Qualities of Nearby Wilderness Areas

USFS must assess the impacts of leasing and development on the parcels in question on the wilderness qualities of the adjacent Ruby Mountains Wilderness Area. Many of the parcels are adjacent to the Ruby Mountains Wilderness Area boundary, and areal affects such as air pollution, groundwater contamination, visual resources, and others would likely cause impacts to the wilderness qualities of the designated wilderness area.

G. Wilderness Qualities of Proposed And Suitable Wilderness Areas

As described above, the Humboldt-Toiyabe must conduct a comprehensive revision of its 1986 forest plan prior to consenting to oil and gas leasing in the Ruby Mountains. Under the 2012 planning rule governing the revision process, the forest will be required to [ldquo][i]dentify and evaluate lands that may be suitable for inclusion in the National Wilderness Preservation System and determine whether to recommend any such lands for wilderness designation.[rdquo] 36 C.F.R. [sect] 219.7(c)(2)(v). The agency[rsquo]s directives governing the wilderness inventory and evaluation process (Chapter 70 of Forest Service Handbook (FSH) 1909.12), require the forest to first conduct a comprehensive inventory of all roadless lands that may be suitable for wilderness designation and then evaluate the wilderness characteristics of those lands pursuant to the criteria in section 2(c) of The Wilderness Act of 1964, 16 U.S.C. [sect] 1131(c). FSH 1909.12, ch. 70, [sect][sect] 71-

72. Based on the results of the evaluation and public input, the forest then must analyze in the EIS for the plan revision potential recommended wilderness areas, and ultimately decide whether to recommend any of those areas for wilderness designation. FSH 1909.12, ch. 70, [sect][sect] 73-74. Forest plans must [ldquo]provide for . . . management of areas recommended for wilderness designation to protect and maintain the ecological and social characteristics that provide the basis for their suitability for wilderness designation.[rdquo] 36 C.F.R. [sect] 219.10(b)(iv).

The current proposal would undercut the necessary forest plan revision and wilderness inventory process by consenting to leasing of some of the forest[rsquo]s most ecologically significant and iconic roadless and wildlands. The area includes citizen proposed wilderness areas, which are likely to be key candidates for potential recommended wilderness or other conservation- oriented designations or management strategies in the revised forest plan. Friends of Nevada Wilderness has conducted assessments of both Inventoried and uninventoried Roadless Areas. Their assessment is attached to this letter as Appendix B, and their recommendation for Pearl Peak Wilderness, the largest roadless area potentially compromised by oil and gas leasing, is attached as Appendix C.

By consenting to lease these areas, the current proposal would short-circuit and prejudice the necessary comprehensive planning process and mandatory wilderness recommendation process. Oil and gas leasing and development undoubtedly diminish an area[rsquo]s wilderness potential and, once leased, the USFS and Congress will be discouraged or even precluded from undermining the lessee[rsquo]s expectations by recommending or designating the area as wilderness. A comprehensive plan revision is the appropriate place to make any decisions about the availability of these important wilderness-quality lands for leasing or development, as opposed to conservation through recommended wilderness or other protective designation or management.

H. The Roadless Characteristics of Inventoried Roadless Areas

As described in section 9 above, the USFS must thoroughly analyze and disclose impacts of any consent to lease on the roadless characteristics of the affected IRAs.

I. Visual Resources

Development of oil and gas resources by necessity entails impacts to visual resources. Examples include surface infrastructure such as roads and power lines, equipment such as drill rigs, pump jacks, alterations of surface characteristics including grading and leveling, and other disturbances to the visual environment. A full visual resources inventory must be conducted and an assessment of the impacts of leasing and developing 54,000 acres must be made based on the results of that inventory, should any recommendation to proceed with leasing be made.

J. Cultural Resources

The Ruby Mountains are an important traditional cultural and spiritual resource for the Western Shoshone who have lived in the areas surrounding them for millennia. Leasing and development of oil and gas resources have the distinct potential to impact both archaeological cultural resources and spiritual cultural resources. USFS must ensure that impacts to these resources are adequately disclosed and analyzed in the EA. A full round of cultural resources inventory must be conducted in the parcels in question. Consultation with the concerned tribes and bands must be comprehensive and include site-specific discussions of resource conflicts.

USFS also must acknowledge that it is likely that leasing and developing the proposed acreage will entail impacts to spiritual cultural resources which cannot be mitigated. Setbacks, buffers, or even NSO stipulations will not effectively mitigate impacts to the cultural landscape- they will simply move the impacts to a slightly different location. Impacts that are not able to mitigated must be taken into account as USFS determines the significance of said impacts.

K. Recreational opportunities and values

Leasing and development of oil and gas resources in the Ruby Mountains has the potential to impact recreational opportunities and values, including but not limited to: hunting, fishing, wildlife watching, hiking, backpacking, off-roading, geocaching, camping, botanizing, photography, and other activities.

L. Environmental Justice

USFS must consider the environmental justice implications of making the lands in question available for oil and gas leasing. Thus, USFS must consider all of the above impacts with regard to which communities will be most affected by the harms. For example, with regard to health risks from air pollution, methods of collecting and analyzing emissions data often underestimate health risks by failing to adequately measure the intensity, frequency, and duration of community exposure to toxic chemicals from fracking and drilling; failing to examine the

effects of chemical mixtures; and failing to consider vulnerable populations.249 Of high concern,

numerous studies highlight that health assessments drilling and fracking emissions often fail to consider impact on vulnerable populations including environmental justice communities250 and children.251

In particular, USFS should consider the proximity of the area to the South Fork Reservation. In analyzing impacts, USFS should consider how oil and gas development [ldquo]booms[rdquo] may increase local crime, particularly crime perpetrated against Native Americans.252

Before concluding that the lands in question should be available for oil and gas leasing, USFS must assess how the various impacts in particular affect Native American communities and other communities that historically have been exposed to unfair burdens from destructive

249 Brown, David et al., Understanding Exposure From Natural Gas Drilling Puts Current Air Standards to the Test. 29 Reviews on Environmental Health 277 (2014).

250 Clough, Emily & Derek Bell, Just Fracking: A Distributive Environmental Justice Analysis of Unconventional

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251 Webb, Ellen et al., Potential Hazards of Air Pollutant Emissions From Unconventional Oil and Natural Gas Operations on The Respiratory Health of Children And Infants, 31 Reviews on Environmental Health 225 (2016).

252 See, e.g., Murdoch-Crane, Sierra, On Indian Land, Criminals Can Get Away With Almost Anything, The

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(Feb. 22, 2013) (describing increased crime against Native Americans by non-Native American perpetrators in connection with oil and gas boom in North Dakota).

and polluting activities. Only then can USFS make an informed decision about whether making the lands available is consistent with proper management of those lands.

11. Conclusion

In sum, we urge the Forest Service to withhold consent. Allowing leasing to occur on the lands in question will irretrievably commit those lands to environmental harms. Impacts to water, wildlife, and cultural resources from leasing and developing the parcels in question are likely unmitigatable [ndash] that is, there are no mitigation measures, including NSO stipulations, which would prevent permanent and irreparable impacts to these resources. The Forest Service should exercise its authority to protect the resources of Ruby Mountains area by withholding consent.

Furthermore, the Forest Service cannot rationally consent to leasing here without conducting, at minimum, a new leasing analysis that comports with NEPA and USFS regulations. Given the age of the forest plan and the significant new information about impacts and resources that is relevant to the current decision, a forest plan revision is required here prior to consenting to leasing.

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