



September 3, 2014

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Sent via email to fsm2500@fs.fed.us

Re: Comments on U.S. Forest Service Proposed Groundwater Directive

Dear Ms. Berger:

Please accept these comments on the U.S. Forest Service's proposed Groundwater Directive, published in the Federal Register on May 6, 2014 at 79 Fed. Reg. 25,815. These comments are submitted by the Natural Resources Defense Council on behalf of the following organizations:

American Canoe Association, American Rivers, Arkansas Public Policy Panel, Arkansas Wildlife Federation, Association for Beaver Lake Environment, Breast Cancer Action, Center for Biological Diversity, Center for Environmental Law & Policy, Chattooga Conservancy, Clean Water Action, Conservation Congress, Defenders of Wildlife, Endangered Habitats League, Epic-Environmental Protection Information Center, FLOW, Forests Forever, Friends of the Bitterroot, Friends of Blackwater, Friends of the Mulberry Watershed, Grassroots Coalition, Heartwood, Hells Canyon Preservation Council, International Federation of Fly Fishers, Kentucky Heartwood, Kettle Range Conservation Group, Klamath Forest Alliance, Kootenai Environmental Alliance, The Lands Council, The League of Women Voters of Arkansas, Los Padres ForestWatch, Lower Columbia Canoe Club, Missouri Coalition for the Environment, Mount Shasta Bioregional Ecology Center, Ohio Environmental Council, Okanogan Highlands Alliance, OMNI Center for Peace, Justice & Ecology, Ouachita Watch League, Peoples Oil & Gas Collaborative- Ohio, RESTORE: The North Woods onto this letter, River Network, Sequoia ForestKeeper, Shale Test, Shenandoah Valley Network, Sierra Club, Southern Environmental Law Center, Tennessee Chapter Sierra Club, Tennessee Clean Water Network, Vermont Natural Resources Council, Waterkeeper Alliance, Western North Carolina Alliance, Western Watersheds Project, Wild South, Wild Virginia, Wilderness Workshop, Wyoming Outdoor Council, and Yellowstone to Uintas Connection.

The Organizations submitting these comments are described in Section 5.

Sincerely,

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1. Introduction

Thank you for your consideration of these comments. We are very pleased that the US Forest Service has proposed this directive. More than 66 million people depend on National Forests for clean drinking water from surface and groundwater resources,¹ including half of the population in the western U.S.² The proposed Groundwater Directive could help protect these drinking water sources, as well as healthy rivers and fisheries that support local economies, and more than 6 million acres of wetlands for waterfowl and other wildlife.³ The Directive could help ensure a drought and climate resilient source of water by encouraging sustainable management of groundwater and groundwater dependent ecosystems.

While the proposed Directive is a good start, the Forest Service should improve the Directive to address certain shortfalls and ensure that the purposes of the Directive are fulfilled. The Directive should be amended to: establish strong principles for the protection of groundwater dependent ecosystems, promote groundwater protection zones, increase safeguards to prevent unnecessary reductions in the quality and quantity of groundwater, encourage accountability, and implement scientifically justified monitoring and mitigation strategies. We urge you to implement a strong Directive that will keep sufficient water in streams and wetlands, protect surface and groundwater quality, provide water downstream for water users who need it, and ensure no net depletion of groundwater resources on National Forest lands.

We particularly applaud the Forest Service’s recognition and declaration of the inherent connection between surface and groundwater resources. These resources are often managed separately, creating a problematic dichotomy. Managing surface and groundwater resources as a unified whole is particularly important in National Forests, where the headwaters of many rivers are found. Declining groundwater levels on these lands would decimate their flows and the value to visitors, ecosystems, and downstream users. Including groundwater in planning efforts for National Forests will also benefit fishing and recreation on and around important rivers and springs throughout the country.

Important within the implementation of this Directive is the need to allocate adequate funding to the development of appropriate assessment, monitoring, and mitigation tools and to the actual enforcement of the review process and substantive standards provided in the Directive. The

¹ <http://www.fs.fed.us/geology/groundwater%20handout%20v3%205%202.pdf>

² Sedell, J., M. Sharpe, D. Apple, M. Copenhagen, and M. Furniss. 2000. Water and the Forest Service. <http://www.fs.fed.us/publications/policy-analysis/water.pdf>

³ Pringle, C.M. 2000. Threats to U.S. public lands from cumulative hydrologic alterations outside of their boundaries. *Ecological Applications*, 10: 971-989.

Forest Service must ensure both that policies are enforceable but also enforced. In other contexts, a lack of enforcement has undermined important groundwater protections. For example, little evidence exists that the groundwater mitigation components of Surface Mining Control and Reclamation Act of 1977 (SMCRA) are enforced⁴ and given that many coal bearing aquifers are capable of storing and transmitting significant water quantities, enforcement and mitigation is critical to adequate groundwater management strategies. We ask the Forest Service to provide sufficient funding to support scientifically sound protection, monitoring, and mitigation strategies for public groundwater resources on and connected to National Forest lands.

2. Background

There is ample overwhelming evidence for the need to protect groundwater resources in the United States. Declines in groundwater quantity and quality affect drinking water supplies and pull water from the surface, reducing availability for fisheries, forests, and other resources that depend on groundwater inputs. The Forest Service should lead the way in the development of a model for sustainably managing these resources at a national scale.

2.1. Groundwater dependent systems on National Forest lands provide an important public good

Forests, and in particular National Forests, provide valuable public resources – among them being clean and abundant water. They act as natural water infrastructure systems, storing and filtering water and effectively creating the largest water utility in the United States, providing drinking water for 40 percent of municipalities.⁵ Forest conservation is a critical element of plans to protect drinking water for a number of urban areas across the country, including Denver, New York, Seattle, Portland, San Francisco, Washington, D.C., and Boston. Adequate, long-term groundwater protection serves the public interest and downstream water users – including the ecosystems that depend on this water.

Groundwater is the earth's largest accessible store of fresh water and constitutes about 94% of all fresh water (excluding ice sheets and glaciers).⁶ Services provided by groundwater include water storage, natural water purification of potentially harmful metals, nutrients, and pathogens, climate resilience, and erosion regulation and flood control (via groundwater dependent surface ecosystems).⁷ Shallow aquifers maintain direct hydraulic connection to surface ecosystems, which is crucial to sustaining river flows, springs, and wetland viability.^{8,9} Further, healthy groundwater levels provide a stable, consistent water resource compared to surface water supplies, and thus sustain streamflow and water demands during dry seasons and droughts.¹⁰ In the U.S., more than 95% of rural populations depend on aquifers to provide their drinking

⁴ Epstein, H., J. Wald, and J. Smillie. 2007. Undermined Promise: Reclamation and Enforcement of the Surface Mining Control and Reclamation Act 1977-2007. 30 pp.

⁵ Environmental Protection Agency, Office of Water. 2007. Factoids: Drinking Water and Ground Water Statistics. www.epa.gov/safewater/data/pdfs/data_factoids_2007.pdf

⁶ Ward, R.C. and M. Robinson. 1990. Principles of Hydrology. McGraw Hill Book Company: London.

⁷ Groundwater dependent ecosystems include 1) terrestrial vegetation and fauna that have seasonal dependence on groundwater (e.g. riparian areas); 2) ecosystems dependent on rivers and streams that are eventually fed by groundwater; 3) aquifer and cave ecosystems; 4) wetlands and lakes that are mainly fed by groundwater; 5) estuarine and coastal lagoons that depend on the discharge of groundwater floods. Groundwater dependent ecosystems also specifically include fens, seeps, and swamps. See Foster S., P. Koundouri, A. Tuinhof, K. Kemper, M. Nanni and H. Garduño. 2006. Groundwater-dependent ecosystems: The challenge of balanced assessment and adequate conservation. Sustainable Groundwater Management, Concepts and Tools. Briefing Note Series, Note 15. The World Bank.

⁸ Morris, B.L., Lawrence, A.R.L., Chilton, P.J.C., Adams, B., Calow, R.C., and Klinck, B.A. 2003. Groundwater and its Susceptibility to Degradation: A Global Assessment of the Problem of Options for Management. Early Warning and Assessment Report series, RS. 03-3. United Nations Environment Programme, Nairobi, Kenya; Shaw, E.M. 1994. Hydrology in Practice. Chapman and Hall, London.

⁹ Falkenmark, M. and J. Rockström. 2004. Balancing Water for Humans and Nature. London: Earthscan

¹⁰ Ward, R.C. and M. Robinson. 1990. Principles of Hydrology. McGraw Hill Book Company: London.

water.¹¹ In many parts of the country, surface water supplies are inadequate or unavailable, and ground water is the only practical source of water supply.

2.2. Inadequate accounting for groundwater resources has contributed to diminished water quantity and quality

A dearth of information on groundwater resources, combined with a failure to manage groundwater sustainably, has led to severe groundwater level declines in many parts of the U.S. This trend has impacts on all who depend on water – even those dependent on surface waters.¹² From 1900 – 2008, approximately 810 million acre feet of groundwater volume has been depleted in the United States.¹³ In perspective, that volume of water would cover the entire state of Pennsylvania in approximately 27 feet of water. In a survey by the National Ground Water Association, nearly all state agency water managers and groundwater experts anticipate ground water supply shortages at a statewide or local level in the next 20 years.¹³ Given that the Forest Service manages a large public supply of water across the U.S., the agency should take any necessary steps to ensure sustainable use of such water.

Rapid declines in groundwater levels and quality are already being experienced nationally. For example:

- The High Plains aquifer (which includes the Ogallala aquifer) in the Midwest has declined more than 100 feet.
- Water levels in the Columbia River Basalt aquifer, surrounded by four National Forests in Washington and Oregon, have declined by 100 to 300 feet due to groundwater pumping.
- Saltwater intrusion is occurring along the entire east coast from New York to Miami, requiring Tampa, Florida to construct a desalination plant and increasing the risk of sinkholes.¹⁴

Such declines in groundwater levels and availability have and will continue to result in a number of substantial impacts:

Rising Costs to the Public: As the depth to water increases, the water must be lifted higher to reach the land surface. If pumps are used to lift the water, more energy is required to drive the pump, which increases the cost of water extraction. In many cases, the water drawn from deeper wells has more salts and minerals, becoming more expensive to treat.

Less water in streams and lakes: Groundwater's contribution to stream flow is substantial. For small and medium sized streams, estimates are that between 40% and 50% of stream baseflow is from groundwater discharge.¹⁵ Groundwater pumping can intercept flow that would normally end up in surface waters, increase the rate of loss from surface waters, and lower groundwater levels below the depth that streamside or wetland vegetation needs to survive.¹⁶ It is not

¹¹ Morris, B.L., A.R.L. Lawrence, P. Chilton, B. Adams, R.C. Calow, and B.A. Klinck. 2003. Groundwater and its Susceptibility to Degradation: A Global Assessment of the Problem of Options for Management. Early Warning and Assessment Report series, RS. 03-3. United Nations Environment Programme, Nairobi, Kenya

¹² Konikow, L.F., 2013, Groundwater depletion in the United States (1900–2008): U.S. Geological Survey Scientific Investigations Report 2013–5079, 63 p., <http://pubs.usgs.gov/sir/2013/5079>.

¹³ National Groundwater Association. 2003. NGWA member perspective: Information needs related to groundwater supplies; National Groundwater Association.

¹⁴ Konikow, L.F., 2013, Groundwater depletion in the United States (1900–2008): U.S. Geological Survey Scientific Investigations Report 2013–5079, 63 p., <http://pubs.usgs.gov/sir/2013/5079>.

¹⁵ Alley, W.M., T.E. Reilly, and O.L. Frank. 1999. Sustainability of groundwater resources. USGS Circular 1186.

¹⁶ Konikow, L.F., 2013, Groundwater depletion in the United States (1900–2008): U.S. Geological Survey Scientific Investigations Report 2013–5079, 63 p., <http://pubs.usgs.gov/sir/2013/5079>.

uncommon for groundwater pumping to leave streams completely dry when water demand is high, causing significant negative impacts, including eliminating or interfering with fish migration and spawning, for instance.¹⁷

Deterioration of water quality: Surface water quality is threatened by losses in groundwater quantity and quality in three primary ways: 1) groundwater declines that reduce streamflows can concentrate pollutants; 2) polluted groundwater directly contributes to surface water supplies or is directly used for drinking water; 3) declining coastal groundwater levels enhance net salt water intrusion or cause significant mixing between variable saline aquifers that can increase salinity in aquifers with moderate salt content.¹⁸

Land subsidence: As water is pulled from aquifers, the land above it has little support and aquifer compression occurs, leading to a sinking of the land or the development of sinkholes in karst systems. During the 1960s and 1970s, parts of the Central Valley in California experienced a drop of more than 25 feet due to groundwater pumping, costing billions of dollars to the federal and state government, farmers, irrigation districts, and local agencies to repair infrastructure – a process that continues today.¹⁹

Declining forest productivity: Falling shallow groundwater levels increase the energy required by natural biota to extract groundwater,²⁰ reducing forest productivity and economic value.²¹ Thus, the Forest Service should be concerned that declining groundwater levels could impact many activities on National Forest lands in addition to forest health, including timber productivity.

2.3. The lack of a coordinated groundwater management policy on National Forests has negatively impacted public waters and leads to inconsistent and conflicting strategies

All of the impacts discussed above affect the National Forest System. Unfortunately, under current policies, groundwater resources are not protected consistently across our National Forests and Grasslands. The management of surface waters, which are connected to groundwater, provides an indication of the problems that have afflicted agency water resource management activities. According to an internal task force, the Forest Service rarely refuses to renew water use permits even if there are serious environmental problems.²² Instead, in a small number of cases, the Forest Service has issued permits that require owners of dams and other facilities to leave enough water in streams on National Forest lands to sustain fish life during times of low water flows.²³ National Forests must also contend with water uses outside of their boundaries including the cumulative effects of dams, regulated flows, wetland drainage, and groundwater extraction.²⁴ Because of such activities, major rivers are now dry or virtually dry during substantial portions of the year (e.g. the Salt River below Theodore Roosevelt Dam in the Tonto

¹⁷ Pringle, C.M. 2000. Threats to U.S. public lands from cumulative hydrologic alterations outside of their boundaries. *Ecological Applications*, 10: 971-989.

¹⁸ Gleick, P. H., 1996. Water resources. In *Encyclopedia of Climate and Weather*, ed. by S. H. Schneider, Oxford University Press, New York, vol. 2, pp.817-823

¹⁹ Borchers, J.W. and M. Carpenter. 2014. Land Subsidence from Groundwater Use in California. Lohdorff & Scalmanini Consulting Engineers. 193 pp.

²⁰ Dillon, P., A. Kumar, R. Kookana, R. Leijds, D. Reed, S. Parsons, and G. Ingleton. 2009. Managed Aquifer Recharge - Risks to Groundwater Dependent Ecosystems - A Review. 134 pp.

²¹ Konikow, L.F., 2013, Groundwater depletion in the United States (1900–2008): U.S. Geological Survey Scientific Investigations Report 2013–5079, 63 p., <http://pubs.usgs.gov/sir/2013/5079>.

²² In 1997, a Federal Water Rights Task Force created pursuant to Section 389(D)(3) of Public Law 104-127 issued its report. Report of the Federal Water Rights Task Force, available at <http://www.fs.fed.us/land/water/>.

²³ Pringle, C.M. 2000. Threats to U.S. public lands from cumulative hydrologic alterations outside of their boundaries. *Ecological Applications*, 10: 971-989.

²⁴ NPCA (National Parks and Conservation Association) 1993. *Park waters in peril*. Publication of the NPCA, 1776 Massachusetts Avenue, N. W., Washington, D.C., USA.; Stromberg, J. C., and D. T. Patten. 1992. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. *Madrone* 39:205-223.

National Forest).²⁵ Groundwater pumping and use has also played a role in declining cottonwood survival along the Little Missouri River in the Little Missouri National Grasslands.²⁶ Surface-disturbing activities, such as livestock grazing and timber harvest can also impact the health of groundwater dependent ecosystems and aquifer recharge, affecting flows into and out of shallow groundwater, particularly if soil compaction or direct disturbance to the resource occurs.²⁷

In addition to impacts to groundwater quantity, a wide range of surface-disturbing activities on and near national forests and grasslands pose risks to groundwater quality. If groundwater is contaminated, it can negatively impact drinking water sources and the health of groundwater dependent ecosystems. As discussed in sections 3.7.1 and 3.7.2, underground injection wells and mineral development pose known risks of groundwater contamination and are addressed specifically in the Service's proposed Directive. However, many other surface-disturbing activities on national forests and grasslands may also lead to groundwater contamination – these risks must be adequately understood and managed. Notably, the Forest Service currently allows grazing on 96 million acres of land, about half of all forests. Grazing activity can result in an increase in soil compaction and a decrease in groundcover, as well as posing risks of surface and groundwater contamination.²⁸ Runoff from pastures frequently exceeds EPA's fecal coliform standards for primary contact water²⁹ and, further, grazing places groundwater at risk of contamination from fecal coliform, nitrates, and E. coli.³⁰ In karst groundwater systems the risk of contamination and transport into drinking water systems increases.³¹ The Forest Service must ensure that the impacts of all surface-disturbing activities on groundwater are adequately analyzed and that Forest Service staff are directed to minimize adverse impacts from these activities to the maximum extent practical, as discussed further in Section 3.4.1.

While it is not too late to protect groundwater dependent ecosystems on National Forest lands, the Forest Service should move forward in a timely manner with a strong Directive that incorporates important improvements outlined in this document. Unfortunately, the lack of clear and consistent direction in the Service's groundwater management has led to detrimental but avoidable impacts on groundwater resources. In one example, Rosemont Copper Company has proposed a 3,670 acre copper mine on Coronado National Forest land to extract locatable minerals such as copper, molybdenum, and silver.³² The proposed mine would have substantial impacts on groundwater and groundwater dependent ecosystems. Proposed groundwater use would increase land subsidence (by 0.7-1.4"/year), decrease groundwater levels by 90-100 feet, reduce streamflows by 10%, negatively impact 63 springs and 1,364 acres of riparian habitat, and pose significant water quality issues related to cadmium, fluoride, nickel, and selenium leaching from overburden. Many of these changes would be permanent and significantly affect spawning, breeding, and survival of federally listed and endangered species such as the Gila chub and Gila topminnow.³³

²⁵ Gillilan, D.M. and T.C. Brown. 1997. Instream Flow Protection. Washington (DC): Island Press.

²⁶ Personal communication, Eleanor Griffin, USGS, June 26, 2014.

²⁷ Moore, D. and S. Wondzell. 2005. Physical hydrology and the effects of forest harvesting in the Pacific Northwest: A review. *Journal of the American Water Resources Association*, 41: 763-784; Bohn C.C. and Buckhouse J.C. 1985. Some responses of riparian soils to grazing management in northeastern Oregon. *Journal of Range Management* 38: 378-381.

²⁸ <http://www.fs.fed.us/rangelands/whoware/>

²⁹ Niemi, R.M. and J. S. Niem. 1991. Bacterial Pollution of Waters in Pristine and Agricultural Lands. *J. Environ. Qual.* 20:620-627

³⁰ Milne, C.A. 1976. Effect of a livestock wintering operation on a western mountain stream. *Transactions of the American Society of Agricultural Engineers*: 749-762

³¹ Howell, J. M., M.S. Coyne, and P.L. Cornelius. 1995. Fecal Bacteria in Agricultural Waters of the Bluegrass Region of Kentucky. *Plant and Soil Sciences Faculty Publications*. Paper 15. http://uknowledge.uky.edu/pss_facpub/15; Kloot, R.W. 2007. Locating *Escherichia coli* contamination in a rural South Carolina watershed. *Journal of Environmental Management*, 83: 4, pp. 402-408

³² U.S. Forest Service. 2013. Final Environmental Impact Statement for the Rosemont Copper Project A Proposed Mining Operation Coronado National Forest Pima County, Arizona Volume 1.

³³ Id.

While the final EIS included qualitative analysis of groundwater impacts, a number of statements demonstrated confusion regarding the ability of the Forest Service to analyze and impose conditions on groundwater use and impacts. The Forest Service states “A reduction in local aquifer recharge is possible but not quantifiable” and “An additional 59 springs within the analysis area may be indirectly impacted due to groundwater drawdown; however, their water source is unknown and therefore difficult to predict.”

Additionally, the final EIS puts false limits on the Forest Service’s ability to provide locational and additional mitigation stipulations on proposed activities. The document states: “It is important to note that the ADWR [Arizona Department of Water Resources] has the authority to permit groundwater pumping for mining purposes, and it is beyond the authority of the Forest Service to require that Rosemont Copper find an alternate source.”³⁴ Additionally, the proposed mitigation strategies lacked any attempt to restore the expected losses in springs, riparian areas, and streamflows. It is part of the Forest Service’s core mission to address these impacts³⁵ and the Service clearly has both the authority and the duty to do so, as discussed further in section 2.4.

A strong Groundwater Directive will provide clear guidance to Forest Service staff at all levels to improve sustainable management of groundwater resources and prevent unnecessary impacts. For instance, one positive example of the sustainable management of groundwater, using important data for adaptive management, comes from the Tonto National Forest (TNF). The TNF has seen declines in spring and stream water levels due to test pumping miles away, sometimes in a matter of days but sometimes lag times can be months, years, or even decades in large alluvial aquifers such as those at TNF, meaning that the effects of pumping are not seen immediately.³⁶ The TNF requires proposed developers of groundwater to perform both short-term and long-term groundwater monitoring on forest lands.³⁷ Without foresight by the TNF, springs and streams on the Forest would likely have been detrimentally impaired. Instead forest managers took the first step to sustainably managing the resource by implementing detailed monitoring protocols.

2.4. The Proposed Groundwater Directive is Supported by Legal Authority

The proposed Groundwater Directive is an important step towards fulfilling the congressional mandate in the Forest Service Organic Administration Act.³⁸ The Forest Service was directed to establish National Forests in part in order to “secur[e] favorable conditions of water flows.”³⁹ This mandate was affirmed in the Multiple-Use Sustained Yield Act (MUSYA), where watershed protection was recognized as one of the five co-equal purposes for establishing national forests.⁴⁰

³⁴ Id. at 184.

³⁵ Sustain the health, diversity, and productivity of the Nation’s forests and grasslands to meet the needs of present and future generations. <http://www.fs.fed.us/plan/>

³⁶ Fonseca, J. 2008. Aquifer monitoring for groundwater-dependent ecosystems, Pima County, Arizona. Pima County Natural Resources, Parks, and Recreation. 38 pp.

³⁷ Martin, R. and G. Loomis. 2007. Keeping our streams flowing—Tonto National Forest groundwater policy. In Furniss, M.; Clifton, C.; Ronnenberg, K. eds. 2007. Advancing the fundamental sciences: proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, 18-22 October 2004. Gen. Tech. Rep. PNW-GTR-689. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 577 p.

³⁸ See 16 U.S.C. § 475 et seq.

³⁹ 16 U.S.C. § 475.

⁴⁰ 16 U.S.C. § 528.

To a great extent, the proposed Directive also ensures that the Forest Service will meet the mandates of the National Environmental Policy Act (NEPA).⁴¹ NEPA requires that federal agencies determine whether their actions will have a significant effect on the human environment.⁴² If so, agencies must prepare an analysis in which the agency considers the potential impacts of the proposed action on the environment and considers the impact of reasonable alternatives.⁴³ NEPA analysis must be performed prior to any irreversible or irretrievable commitment of resources in order to ensure that agencies and the public are informed about the “disruptive environmental effects that may flow from their decisions at a time when they “retain [] a maximum range of options.”⁴⁴ The Forest Service must therefore analyze the effects on forest resources, including groundwater, before taking action itself or authorizing private parties to conduct activities within National Forests and Grasslands. The Directive requires consideration of effects on groundwater for agency approvals and authorizations, but some cumulative effects are likely to be overlooked in project-level analyses, resulting in continued significant effects to water resources. If project-level analyses are carried out consistent with the protections we recommend below, however, this Directive should ensure that individual approvals and authorizations do not cumulatively cause significant degradation of water resources.

Congress recognized that managing natural resources in National Forests was “highly complex” and enacted the Forest and Rangeland Renewable Resources Planning Act (FRRRPA).⁴⁵ The Act requires that the Forest Service develop an inventory of “present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services.”⁴⁶ In addition the Act requires that all forest management activities to be preceded by a “comprehensive assessment” of environmental and economic impacts in order to create a management plan that is consistent with MUSYA and NEPA.⁴⁷ Congress emphasized the “fundamental need” for the management plans to “protect and, where appropriate, improve the quality of soil, air, and water resources.”⁴⁸ Developing an inventory of groundwater resources and an assessment of the environmental impacts on groundwater is an integral step in ensuring that a management plan protects the water quality in National Forests.

The National Forest Management Act (NFMA) requires that each National Forest and Rangeland develop and implement a land and resource management plan, revised periodically based on current, up-to-date information. 16 U.S.C. § 1604. Management plans must be ecologically sustainable, meaning that they must include standards or guidelines adequate to maintain or restore water resources, including groundwater. 36 C.F.R. § 219.8. These plans must also consider national forest resources in the context of surrounding land uses that could affect them—the “all lands” approach. This Directive must be consistent with the requirements for management plans, and it must therefore ensure that groundwater resources (and the surface water resources they nourish) are maintained or restored.

2.5. Support for Specific Forest Service Actions

⁴¹ See 42 U.S.C. §§ 4321 et seq.

⁴² 42 U.S.C. § 4332.

⁴³ See *Id.*

⁴⁴ *Conner v. Burford*, 848 F.2d 1441, 1446 (9th Cir. 1998) quoting *Sierra Club v. Peterson*, 717 F.2d 1409, 1414 (D.C.Cir.1983).

⁴⁵ 16 U.S.C. § 1600(1).

⁴⁶ 16 U.S.C. § 1601(a)(2).

⁴⁷ 16 U.S.C. §§ 1600(3), 1604(f).

⁴⁸ 16 U.S.C. § 1602.

We recognize the importance of the proposed Directive and the effort required to develop and gain support for an extensive policy such as this. One of the most promising aspects of the proposed policy is the assertion that our rivers and lakes are physically connected to the waters underground. This would be one of the first federal policies to recognize this scientific conclusion. Across the U.S., a majority of surface water and groundwater resources are managed separately and with varying degrees of protection.⁴⁹ It is this problematic dichotomy that both gives managers (and the public) a sense that more water exists than does and that drives depletion of this shared resource – water. In many cases we are double counting how much water we have, leaving streams dry at critical times for wildlife and recreation. However, the science shows that in many systems, groundwater and surface water interact to some degree, supporting subsurface and surficial aquatic ecosystems.⁵⁰ For instance, groundwater input to rivers and streams is an important determinant of spawning habitat for trout and other salmonids and regulates temperature and baseflow during the summer.⁵¹

We also strongly support the proposed Directive's focus on water conservation. Reducing water use should be the first step before accessing groundwater to maintain groundwater dependent ecosystems. We are pleased to see the focus on efficient use of water, particularly during droughts, the use of water conservation strategies for administrative and recreational uses,⁵² and the focus on water reuse and consideration of all other alternatives prior to the approval of groundwater use on National Forests.⁵³ This requirement will have substantial positive impacts on the future viability of groundwater dependent ecosystems. We recently showed that the state of California alone could save up to 14 million acre feet a year just through improved efficiency, stormwater capture, and water reuse.⁵⁴ We encourage the Forest Service to apply these conservation principles throughout the Directive and provide guidance for implementation across all sectors.

3. Recommendations

Below we provide recommendations for strengthening the Directive to comply with the Service's legal duties and ensure adequate protection and sustainable management of groundwater resources. Our recommendations stem from a need on the Forest Service's part to develop an adequate assessment framework for the protection of groundwater systems. We believe it is the responsibility of the Washington Office to establish a set of key principles that all National Forest units should abide by in order to increase the protection and sustainable use of groundwater resources. We recommend such a framework and set of principles below, which include a revised definition of sustainable use to include a no-net depletion policy and policies for managing high risk basins and fossil groundwater. We also recommend an overarching set of guidelines that would be associated with any designated groundwater protection zone to guide overall management of groundwater systems.

⁴⁹ Nelson, R. 2012. Instituting Integration: Findings of the Comparative Groundwater Law & Policy Program's Workshop 1. Water in the West Working Paper 3. Incorporating a Policy-Maker's Brief, pp. v-xi. 53 pp.; http://dnrc.mt.gov/wrd/water_rts/mt_basin_closures.asp

⁵⁰ Reviewed in Sophocleous, M. 2002. Interactions between groundwater and surface water: the state of the science. *Hydrogeology Journal* 10:52-67.; Pinder, G. F. and M.A. Celia. 2006. *Groundwater-Surface-Water Interaction*, in *Subsurface Hydrology*, John Wiley & Sons, Inc., Hoboken, NJ, USA.

⁵¹ E.g. Baxter, J. and J. McPhail. 1999. The influence of redd site selection, groundwater upwelling, and over-winter incubation temperature on survival of bull trout (*Salvelinus confluentus*) from egg to alevin. *Canadian Journal of Zoology*, 77(8): 1233-1239.

⁵² 2560.03 (7) Proposed Groundwater Management Directive (Forest Service Manual Chapter 2560 – Groundwater Resource Management) P.39 http://www.fs.fed.us/geology/FSM2560_02_17_12_final_doc.

⁵³ 2562.1 (1) Proposed Groundwater Management Directive (Forest Service Manual Chapter 2560 – Groundwater Resource Management) P.39 http://www.fs.fed.us/geology/FSM2560_02_17_12_final_doc.

⁵⁴ <http://www.nrdc.org/water/ca-water-supply-solutions.asp>

Beginning in Section 2.4 we outline specific enhancements that could be made in the language of the Directive and in specific sections of the Directive to better protect groundwater systems. These rely on improved accountability for managing groundwater resources and approaches to protect groundwater-dependent resources through monitoring and mitigation. Lastly, we are discouraged by the minimal standards for management of groundwater during mineral operations and recommend improvements to the Directive to better protect groundwater resources during mineral development.

3.1. The Forest Service should develop a comprehensive, national groundwater plan

The proposed Directive suggests that the Forest Service should address water at a scale larger than the individual National Forest or Grassland unit. Such an effort is already compelled by the Forest and Rangeland Renewable Resources Planning Act, which requires the Service to “develop and maintain on a continuing basis a comprehensive and appropriately detailed inventory of all National Forest System lands and renewable resources,” including water.⁵⁵ In the proposed Directive, the Forest Service states that managers should “Evaluate and manage the surface water–groundwater hydrological system on an appropriate spatial scale, taking into account surface water and groundwater watersheds, which may not be identical and relevant aquifer systems.”⁵⁶ and that managers should “Provide comments on proposed activities either on or off NFS lands that may adversely affect groundwater resources on NFS lands to the proponents and to State, Tribal, or other Federal entities that have the authority to regulate those activities.”⁵⁷

We recommend the Forest Service develop a comprehensive national groundwater management plan, rather than a piecemeal approach at the individual National Forest or Grassland Unit level or the triage approach proposed for forest supervisors focusing only on groundwater resources that “are now or are reasonably expected to be developed or adversely affected by development.”⁵⁸ Key components of such a plan include baseline groundwater data and sound principles and standards for sustainable groundwater management.

3.2. The Forest Service should develop a comprehensive baseline assessment of groundwater resources

The first and most critical step in developing a groundwater plan should be the development and implementation of a strategy to assess baseline groundwater levels, relevant aquifer characteristics, potentially threatened groundwater dependent ecosystems, and groundwater quality on all National Forests. We suggest the “appropriate spatial scale” is one that takes into account entire watersheds (e.g. HUC 8) and specifically groundwater dependent ecosystems. We also suggest that the Forest Service cannot assess “groundwater resources that are now or are reasonably expected to be developed”⁵⁹ without a baseline assessment of existing groundwater resources. We recommend this information be distributed to the public via a web portal and updated on an

⁵⁵ 16 U.S.C. § 1603. The Forest and Rangeland Renewable Resources Planning Act is set forth at 16 U.S.C. § 1600 et seq.

⁵⁶ Sec 2560.03, Proposed Groundwater Management Directive (Forest Service Manual Chapter 2560 – Groundwater Resource Management) P.39 http://www.fs.fed.us/geology/FSM2560_02_17_12_final_doc.

⁵⁷ Id. at Sec 2560.03(6)(c).

⁵⁸ Id. at Sec 2560.04h(1)

⁵⁹ Id. at Sec. 2560.04f(1).

annual basis, and that these data be included in any agency process that prioritizes National Forest lands for restoration, planning, and/or budgeting.⁶⁰

3.3. The Forest Service should develop key principles for sustainable groundwater management

Given that the proposed Directive will be the first comprehensive set of guidance from the Forest Service on groundwater resources, the Forest Service should develop a clear set of principles that would guide the management of groundwater on all National Forest lands. Section 2568 of the proposed Directive provides the initial basis for this by encouraging collaboration, consideration of conjunctive use and water supply strategies, and encouraging the use of alternative water supplies and the modification of timing and rate of withdrawals.

However, we urge the Forest Service to lead the way in efforts to protect the future of public water. Given the current state of groundwater supplies nationally, we recommend the Forest Service implement strategies that prevent depletion of groundwater and substantial environmental consequences to groundwater dependent ecosystems.

First, the Forest Service should redefine *sustainable use*, which currently reads in the Directive as “The rate of groundwater usage that can be maintained indefinitely without substantial adverse consequence to groundwater resources.”⁶¹ The definition of *sustainable use* that the Forest Service proposes would allow a rate of use that imposes substantial negative impacts on non-groundwater environmental or other values.

Instead, we recommend the Forest Service adopt the following definition for *sustainable use*, as recently summarized by the California Water Foundation:

The rate of groundwater use that provides for multiple long-term benefits without resulting in or aggravating conditions that cause significant economic, social, or environmental impacts such as long-term overdraft, land subsidence, ecosystem degradation, depletions from surface water bodies, or water quality degradation, and that protects the resource for present and future generations.^{62,63}

In addition to this definition, we believe that the Forest Service should adopt a **no-net depletion policy** for public groundwater originating from National Forests. Such a policy would require an understanding of recharge rates and natural discharges for shallow (unconfined) and deep (confined) aquifers as well as an assessment of potential climate impacts on recharge and discharge rates. There are at least two important advantages of a no-net depletion policy: First, it would ensure that individual decisions, in the aggregate, do not cumulatively cause significant impacts to water resources. Second, it would be consistent with the planning rule’s mandate to maintain water resources, including groundwater.

The Proposed Directive should include the following principles:

⁶⁰ Such a system includes the Watershed Condition Index, which currently uses the presence of dams as a surrogate for water quantity. U.S. Forest Service. 2011. Watershed Condition Framework. Forest Service FS-977. http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf

⁶¹ Id.; Sec 2560.04h

⁶² Id.

⁶³ Walton, W. C. and C.F. McLane. 2013. Aspects of groundwater supply sustainable yield. *Ground Water*, 51: 158–60.

3.3.1. Identify and reserve high priority groundwater rights

In the western U.S., reserving water rights is a key tool in maintaining flows for fish and wildlife and downstream communities. The Directive identifies a key strategy for protecting groundwater dependent ecosystems include reserving groundwater rights⁶⁴ for these systems. However, the Directive does not give any office responsibility for setting priorities regarding the establishment of groundwater and/or surface water rights where groundwater impacts surface ecosystems.⁶⁵ We recommend the Service establish a system for the identification and reservation of high priority groundwater rights and pursue these rights for the protection of aquifers and groundwater dependent ecosystems.

3.3.2. Encourage the use of temporary or permanent closed basins when necessary.

In areas where all the available surface water has been allocated, a common response to the adverse impacts of pumping groundwater on holders of surface water rights, or ecosystems, is to impose a “cap” on further groundwater development, creating “closed basins.” This has occurred, for example, in some Nebraska natural resource districts, Kansas intensive groundwater use control areas, Montana’s closed basins and controlled groundwater areas, and areas of Washington state.⁶⁶ A similar policy requiring capping of further groundwater development when water use is expected to impact the health of aquifers and groundwater dependent ecosystems should be stated in the Directive. In addition, high-risk basins should be identified in a timely manner following approval of the Directive. We define high-risk basins as those that are characterized by aquifers or groundwater dependent ecosystems which are sensitive to small changes in water quality or quantity or basins in which water quality or quantity changes threaten the function of groundwater systems.

3.3.3. Consider the lag times for any groundwater depletion and prevent withdrawals of “fossil” (nonrenewable) groundwater.

On a global basis, surface water recycles every 9 to 16 days with an average of 11 days.⁶⁷ Unlike surface water, groundwater does not recycle readily. Depending on the specific aquifer characteristics and various climate and geological factors affecting recharge, rates of groundwater turnover may be as short as days or as long as years. Proposed management and monitoring strategies should account for local recharge requirements whether recharge takes days or decades.

Shorter renewal times are usually associated with shallow groundwater, while longer renewal times are associated with deeper confined groundwater – some “fossil” groundwater is older than 30,000 years.⁶⁸ In other words, certain deep groundwater supplies will never substantially recharge water volumes within human lifespans, essentially making them non-renewal resources, analogous to fossil fuels. Some states, such as New Mexico use fossil groundwater to offset

⁶⁴ Proposed Groundwater Directive at Sec. 2560.03 (6)(e).

⁶⁵ Id. at Sec. 2560.04.

⁶⁶ Nelson, R. 2012. Instituting Integration: Findings of the Comparative Groundwater Law & Policy Program’s Workshop 1. Water in the West Working Paper 3. Incorporating a Policy-Maker’s Brief, pp. v-xi. 53 pp.; http://dnrc.mt.gov/wrd/water_rts/mt_basinlosures.asp

⁶⁷ World Water Balance and Water Resources of the Earth. 1978. U.S.S.R. Committee for the International Hydrological Decade, UNESCO, Paris, France.

⁶⁸ Jones, A. A. 1997. Global hydrology: Processes, resources, and environmental management. Longman, England.

surface water depletions,⁶⁹ and irrigators are drawing from fossil water in the High Plains and likely in the Central Valley of California.⁷⁰ Because this water cannot be returned in a timely manner, we urge the Forest Service to prevent such a process on and adjacent to National Forest lands through the implementation of the Directive.

3.3.4. The Forest Service should include groundwater management in the forest planning process and identify and implement specific standards for groundwater resource protection

During the development of Forest Plans, the Forest Service should develop specific desired conditions for groundwater at the forest-wide and basin and sub-basin level. In addition, the Service should delineate protected groundwater zones and develop specific standards and stipulations that will apply to permitted uses of groundwater on the forest.⁷¹ Subsequently, during any proposed activity, the Forest Service should be required to propose relocation of activities which negatively affect groundwater dependent ecosystems.

These protected groundwater zones should be identified for groundwater dependent ecosystems and accordingly incorporated into Forest Plans following approval of the Directive. Within these zones, the Forest Service has the ability to and should establish specific standards and stipulations regarding activities and the use of specific resources and “has the ultimate responsibility for ensuring protection of surface resources on National Forest System lands.”⁷² These stipulations should include timing limitations regarding groundwater impacts to protect other forest resources and uses. For example, groundwater dependent ecosystems may need to support flows at certain times of the year for the provision of habitat for fish spawning. Each zone should develop a baseline Groundwater Management Plan that describes how the Forest Service will achieve sustainable groundwater management.

We recommend any Groundwater Management Plan for designated zones contain at least the following components:

- Sub-basin water budget, model, water supply, and demand forecast;
- A plan for long-term basin sustainability that addresses long term overdraft, water quality, subsidence, surface water flows, and groundwater dependent ecosystems;
- Specific goals and objectives with measurable thresholds that demonstrate progress toward achieving sustainable groundwater management and restoration of previously impacted systems;
- Description of water management strategies for achieving sustainability of groundwater including an integrated approach that includes surface water, conservation, reuse, and other water management strategies.⁷³
- Protocol and plans for monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, land surface subsidence, changes in

⁶⁹ Nelson, R. 2012. Instituting Integration: Findings of the Comparative Groundwater Law & Policy Program’s Workshop 1. Water in the West Working Paper 3. Incorporating a Policy-Maker’s Brief, pp. v-xi. 53 pp.; http://dnrc.mt.gov/wrd/water_rts/mt_basinlosures.asp

⁷⁰ Scanlon, B. R., C. C. Faunt, L. Longuevergne, R. C. Reedy, W. M. Alley, V. L. McGuire, and P. B. McMahon. 2012. Groundwater Depletion and Sustainability of Irrigation in the US High Plains and Central Valley. *Proc. Natl. Acad. Sci.* 109(24): 9320-9325

⁷¹ In the mineral context, this should involve the designation of areas of the forest as “No Surface Occupancy” or “Controlled Surface Occupancy” zones. See FSM 2800 - MINERALS AND GEOLOGY: R2 Supplement No. 2800-94-1.

⁷² FSM 2800 - MINERALS AND GEOLOGY. <http://www.wttest.fs.fed.us/im/directives/fsm/2800/2820.txt> Sec 2822.32c

⁷³ California Water Foundation. 2014. Recommendations for Sustainable Groundwater Management: Developed Through a Stakeholder Dialogue. 43 pp.

surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater use, and a description of how recharge areas identified in the plan substantially contribute to the replenishment of the groundwater basin.⁷⁴

- Description of how groundwater activities in adjacent groundwater protection zones interact and impact groundwater or surface ecosystems. In other words, while groundwater zones represent arbitrarily delineated systems, nature does not follow such rules. Therefore, a comprehensive understanding of the cumulative groundwater interactions between individual zones must be understood.

3.3.5. Key principles and policies should be based on robust science.

Investing in science at the outset of a management planning process leads to better management solutions. Water managers can avoid “paralysis by analysis” by ensuring that the pursuit of better data is tied to the benefits yielded by more information, rather than gathering information for its own sake. For instance, the Forest Service should develop a transparent, iterative process for developing groundwater protection zones and determining the needs of groundwater dependent ecosystems, as seasonal conditions continually change. Such an approach should include:

- Providing publicly available internal and external peer-reviews of the science supporting groundwater protection zone standards.
- Developing a list of standardized data for key groundwater parameters and accepted methods for collection of this data. A potential (non-exhaustive) list of such data could include: the hydraulic properties of aquifers, groundwater levels, accurate groundwater use and consumptive use data, aquifer water quality, groundwater recharge rates (and intrinsic climate and geological factors which impact groundwater recharge rates), and aquifer isopach maps.

3.4. Specific Comments

3.4.1. The Forest Service should define language and establish standards to increase accountability

Define “adverse impacts” on groundwater resources: The Directive places the responsibility on the forest manager to determine whether there is an “adverse impact” on water resources without further guidance.⁷⁵ However, the term is ambiguous and susceptible to different interpretations and therefore requires definition. We recommend the Forest Service establish a principle that the Service will first take every step possible to avoid adverse impacts. Further, we recommend the Forest Service define “adverse impact” as has been done by other management agencies.⁷⁶ The Forest Service should define “adverse impacts” to include violations of state groundwater standards and the Safe Drinking Water Act, as well as alteration of groundwater dependent ecosystems.

At a minimum, factors likely to be adversely impacted by groundwater use should be identified such as 1) expected changes in surface or groundwater quality and quantity; 2) expected impacts

⁷⁴ CAL. WAT. CODE § 10753.7 : California Code - Section 10753.7 codes.lp.findlaw.com/cacode/WAT/1/d6/2.75/3/s10753.7#sthash.pC0dhFrv.dpuf

⁷⁵ Proposed Groundwater Directive at 2560.03(1), 2560.03(4)(d), 2560.03(5), etc. The document appears to use the terms “adverse impact” and “adverse effect” interchangeably.

⁷⁶ Association of State Floodplain Managers. 2008. No Adverse Impact White Paper http://www.floods.org/NoAdverseImpact/NAL_White_Paper.pdf

on groundwater dependent ecosystems and riparian vegetation; 3) expected impacts on downstream water uses (e.g. recreation and drinking water supply) and ecosystems. (including habitat important to recovery of threatened and endangered species); and effects to state-assigned classifications and uses for connected surface waters.

Within each category of impacts, the Forest Service should establish thresholds at which adverse impacts occur. Such an effort is supported by Section 2561: “Prior to implementation or approval, assess the potential for proposed Forest Service projects, approvals, and authorizations to affect the groundwater resources of NFS lands. If there is a high probability for substantial impact to NFS groundwater resources, including its quality, quantity, and timing, evaluating those potential impacts in a manner appropriate to the scope and scale of the proposal and consistent with this chapter.”⁷⁷

Define and change terms from “extent practical” or “extent practicable” to “maximum extent practicable.” The Forest Service uses the terms “extent practical” and “extent practicable”⁷⁸ without providing any such definition. To remedy this confusion these terms should be modified to “maximum extent practicable.” In other sections, the Directive provides clear guidance that indicates Forest Service staff should make every effort to protect public waters on National Forest lands. For instance, as stated in FSM 2500, Chapter 2540, the Forest Service should be prepared to protest proposed activities that affect reserved water rights if those activities would make water rights “ineffectual [because] associated water sources are diverted, polluted, impounded, or otherwise made unavailable or unusable.”⁷⁹ Weak language such as directing Forest Service staff to minimize adverse impacts from Forest Service actions on groundwater resources only “to the extent practical” minimizes the importance of these resources and indicates to staff that other considerations will frequently take precedence over groundwater management concerns.

At a minimum, the Forest Service should ensure that acute and cumulative changes resulting from proposed and existing activities do not affect groundwater or groundwater dependent ecosystems on Forest Service lands. In particular, the recommended criteria for “maximum extent practicable” should include, at a minimum, planning and mitigation efforts which shall not:

- Contribute to acute or cumulative changes in long-term surface or groundwater hydrology beyond the median 100 year conditions;
- Contribute to degradation of habitat or water availability for state or federal threatened or endangered species, designated Forest Service “sensitive species,” or groundwater dependent species or ecosystems;
- Degrade existing or future state water quality standards, drinking water standards, or designated uses via changes in streamflows or surface water quality.

This is by no means an exhaustive list. Further, “maximum extent practicable” should be broadly defined to track the limits of available technology, and the technical abilities of the entity proposing to use or impact groundwater quality or quantity, consistent with other federal and

⁷⁷ Proposed Groundwater Directive at 2561(2).

⁷⁸ Id. at 2560.02(3), 2560.03(5), 2560.04a(2), 2563.4(4).

⁷⁹ FSM 2500 - WATERSHED AND AIR MANAGEMENT CHAPTER 2540 - WATER USES AND DEVELOPMENT. 2541.4.

state definitions of the term.⁸⁰ The Forest Service should be prepared to disallow or protest activities that do not meet such a minimum standard.

Develop an overarching set of groundwater standards. The Forest Service should establish a separate set of groundwater standards, rather than relying on the recommended standards for water rights in FSM 2541, as stated in Sec 2560.04f (3). The standards referenced therein do not include groundwater and thus provide little guidance to regional foresters. The most relevant standards reference reserved instream flows, however the reference here to groundwater is indirect. We recommend the Forest Service develop a set of groundwater standards that will outline relevant uses, best management practices, conservation, and protection policies for groundwater.⁸¹

Further, the aforementioned section⁸² should include potential impacts of groundwater use on surface water resources. The terms used in the Directive such as “high probability” and “substantial” are vague regarding decisions and trigger points required for additional monitoring and/or mitigation. The Forest Service should define and quantify such terms. Again, we emphasize the need for a scientifically defensible baseline of groundwater and surface water resources on National Forest lands. Without such an inventory, forest managers are left with insufficient information to begin to assess groundwater impacts.

The Forest Service should consider standards and indicators below (and others) to establish targets for sustainable use of groundwater resources:

- Sufficient groundwater should be discharged to perennial and ephemeral streams to maintain natural baseflow and adequate temperature regimes;⁸³
- The volume of groundwater withdrawals should not interfere with the maintenance of an adequate water supply for public and private needs;⁸⁴
- Land use disturbance should not affect the recharge rate of groundwater aquifers, thereby influencing the quantity or quality of this resource;⁸⁵
- In surface water systems that are dependent on groundwater discharge, plant and animal communities should not be impacted by the degradation of groundwater quality and quantity.

Revise Section 2561.1 to be consistent with the inherent assumption of surface-groundwater connectivity. Because the Directive inherently assumes a connection between all surface and groundwater resources, we recommend remaining consistent with this assumption, as amended in parentheses:

⁸⁰ For instance, the federal Pipeline and Hazardous Materials Safety Administration defines “maximum extent practical” as “the limits of available technology and the practical and technical limits on an owner or operator of an onshore facility in planning the response resources required to provide the on-water recovery capability and the shoreline protection and cleanup capability to conduct response activities for a worst-case discharge of oil in adverse weather.” 49 C.F.R. § 130.5. One useful state example is that provided by the California Water Resources Control Board. In discussing the meaning of “maximum extent practicable,” the Board stated “There must be a serious attempt to comply, and practical solutions may not be lightly rejected. If, from the list of BMPs, a permittee chooses only a few of the least expensive methods, it is likely that MEP has not been met. On the other hand, if a permittee employs all applicable BMPs except those where it can show that they are not technically feasible in the locality, or whose cost would exceed any benefit to be derived, it would have met the standard. MEP requires permittees to choose effective BMPs, and to reject applicable BMPs only where other effective BMPs will serve the same purpose, the BMPs would not be technically feasible, or the cost would be prohibitive.” Calif. Water Res. Control Bd., Order No. WQ 2000-11, at p.20, available at http://www.waterboards.ca.gov/water_issues/programs/stormwater/smallms4faq.shtml.

⁸¹ Best management practices are discussed further in the mitigation context in section 2.5

⁸² Proposed Groundwater Directive at Sec 2560.04f (3).

⁸³ Steinman, A. 2007. Report to the Michigan Legislature on: Recommended Criteria and Indicators of Groundwater Sustainability for the State of Michigan. 31 pp.

http://www.michigan.gov/documents/dnr/GW_Sustainability_Workshop_report5_ads_196985_7.pdf

⁸⁴ Id.

⁸⁵ Id.

Consider effects from the ~~combined~~ use of surface ~~and~~ (or) groundwater and the effects of one upon the other, including but not limited to quantity, quality, timing, and spatial distribution. ~~Where conjunctive uses are proposed,~~ (In any proposed project or activity) evaluate groundwater, surface water, and watershed issues, including potential effects on groundwater-dependent ecosystems, by conducting appropriate hydrological assessments of the geographic area.

3.5. Monitoring should be based on expected outcomes and potential long term impacts

As stated previously, the Forest Service should develop an inventory of baseline groundwater conditions at every National Forest and Grassland in a timely manner following the approval of the Directive. Groundwater monitoring required for any proposed project should be required to continue until any adverse impacts (as defined previously) have been fully and permanently mitigated. As discussed above, mitigation would be required until conditions have been restored to the conditions that existed prior to project development. In the Rosemont case, for instance, this would require monitoring for at least 100 years.

While, it is not the role of the Directive to define exact monitoring parameters, the Directive should reference specific targets and potential parameters. Such parameters should take into account:

- Groundwater dependent ecosystems (including their response to stress and thresholds that lead to the decline of such systems);
- Impacts of droughts on groundwater,⁸⁶ which influence long-term sustainability in light of proposed projects;
- Water quality measurements, including but not limited to: a complete cation/anion balance, nutrients, trace metals, and total dissolved solids which are crucial to identifying water quality characteristics and identifying any potential future groundwater contamination;
- Hydrological, as well as ecological,⁸⁷ monitoring to support the protection of ecosystems;
- Structural characteristics of the aquifer (or aquifer system) which may influence, either directly or indirectly, natural groundwater storage, recharge, and discharge;⁸⁸
- An appropriate temporal and spatial scale to detect potential impacts to groundwater dependent ecosystems. While the spatial scale will likely be locally specific, the temporal scale should require at a minimum, continuous monitoring based on ecosystem requirements of groundwater dependent ecosystems using the best, currently available technology.

The degree of effort placed on monitoring should depend on the spatial and temporal extent of the project and its likelihood of affecting groundwater resources. As is required in Montana for coal mining, the Forest Service should require a year of baseline data prior to project initiation⁸⁹ for any projects that are likely to adversely impact groundwater resources.

⁸⁶ Such as climatic influence on quality and quantity of groundwater dependent ecosystems and potential impacts of climate influenced changes in water usage

⁸⁷ For example minimum, maximum, and average discharge conditions which identify critical low flow and peak discharge rates of streams and springs

⁸⁸ For example the lithology, thickness, structural controls, hydraulic conductivity, transmissivity, recharge, storage and discharge characteristics, extent of aquifer, production data, water quality analyses and other relevant aquifer characteristics for each aquifer within the plan area and adjacent areas

⁸⁹ 17.24.304 BASELINE INFORMATION. ENVIRONMENTAL RESOURCES. <http://www.mtrules.org/gateway/ruleno.asp?RN=17.24.304>

3.6. Mitigation should reach beyond water volume and include the potential impacts of declining groundwater tables on riparian vegetation, surface water temperature, and water quality

In the western U.S., arguably the single largest groundwater policy gap is the missing link between regulating and managing groundwater pumping, on the one hand, and considering ecological requirements for groundwater, on the other hand.⁹⁰ Furthermore, in many places, policies fail to prevent streamflow depletions caused by increased groundwater pumping. Given that the Forest Service manages public waters and has an obligation to protect these resources in the public interest, the agency should **ensure that mitigation efforts to restore groundwater quantity results in no-net loss** of water levels in groundwater dependent systems.

Such an effort will require understanding both the seasonal impacts of a proposed activity on groundwater and the seasonal needs of any impacted system. The no-net loss policy we propose is consistent with other state laws. For example, the state of Washington applies the “one molecule rule,” under which **any** ascertainable groundwater impact, determined using up-to-date scientific measurement techniques, is sufficient to require mitigation.⁹¹

Mitigation should be considered carefully and at the aquifer-watershed level. Mitigation programs can be very complex, aiming to mitigate not just the impacts of groundwater pumping on the volume of surface water, but also impacts on the quality and temperature of water, and the timing of the depletion. Mitigation should also remain within the affected watershed (HUC 8), specifically as it relates to the groundwater dependent resources impacted. As such, the Forest Service should develop and annually update a compendium of Best Management and Mitigation practices for groundwater systems. Examples of mitigation approaches include:

- Purchasing and retiring, or leasing, a surface water right;
- Groundwater use restrictions that vary based on season and monthly water availability;
- Application of buffer zones between wells or groundwater intense activities and key groundwater dependent ecosystems;
- Allocation of a percentage of storage or recharge to groundwater dependent ecosystems;
- Constraining pumping to maintain groundwater at a level that enables groundwater dependent ecosystems to access the groundwater source.

Further, because of the lag time between excess groundwater extraction and recharge, we recommend a conservative mitigation ratio, requiring that at least the amount of water that was removed be replaced in a timely manner. **However, we recommend that the actual mitigation required be dependent on the amount of impact to the groundwater dependent ecosystem rather than the actual amount extracted.**

When mitigation efforts are unsuccessful, the Forest Service should require restoration of groundwater to meet state water quality standards or national primary and secondary drinking water standards. Natural attenuation should only be a viable restoration alternative for de minimis adverse impacts.

⁹⁰ Nelson, R. 2012. Instituting Integration: Findings of the Comparative Groundwater Law & Policy Program’s Workshop 1. Water in the West Working Paper 3. Incorporating a Policy-Maker’s Brief

⁹¹ Swinomish Indian Tribal Community v. Ecology, 178 Wn.2d 571, 311 P.3d 6 (2013)

3.7. Revise Section 2561.2 (Minerals and Energy Development) and 2561.4 to provide consistency with the Directive and existing authorities

In the proposed Directive, the Forest Service applies lesser protections to groundwater when mineral development is involved than when other surface-disturbing activities are contemplated. The Directive provides no reasoning for this differential treatment and such divergent treatment runs counter to the Service's legal duties to analyze potential effects on groundwater resources from all activities the Service permits and to protect the quantity and quality of ground and surface water resources. The proposed Directive should be revised to ensure that the risks to groundwater from mineral development activities are fully taken into account as they are with any other type of development. The same protections should certainly apply to leases of mineral rights on Forest Service lands. To the extent that the agency may feel that the extent of its' regulatory authority is in doubt with respect to reserved or outstanding rights, the Directive should provide simply that its provisions will apply to the maximum extent allowed by law.

Providing less protective standards for oil and gas development is inconsistent with the Service's statutory directives. The Multiple-Use Sustained Yield Act allows USFS lands to be developed for multiple uses as long as they are consistent with the five co-equal purposes for which forests are established.⁹² Any additional uses must be supplemental, but not in derogation, of those purposes.⁹³ Thus, for oil and gas exploration and development, for example, must be held to the same standards as other USFS activities to ensure that a primary purpose of the National Forests, the protection of water flow and water quality, is not impaired.

First, the Directive should be amended to remove the exemption for minerals and energy development in Section 2561.4. There is no reason why mineral and energy development activities should not be subject to the requirement that appropriate levels of analysis be completed and the range of potential impacts to groundwater resources be understood. In fact, NEPA requires that the Service do precisely that. The coordinated policy in this Directive recognizes that authorizations for mineral exploitation have the potential to cause substantial cumulative impacts on water resources, and its substance should be consistent with that recognition. The exemption also causes internal inconsistencies, for example, it seems inconsistent with the requirements of section 2561.24. The exemption in section 2561.4 is contrary to the Forest Service's obligations and sends a troubling signal to Service staff members that they should ignore risks to groundwater and associated resources and ecosystems simply because those risks are posed by mineral and energy development. Additionally, the proposed Section 2561.4 appears to exempt mineral and energy development from appropriate monitoring and mitigation measures. Again, there is no reason for the arbitrary distinction between energy and mineral development and all other activities and such differential treatment has no basis in law. In particular, given the known frequent risks to groundwater from mineral and energy development, and the known threats to forest health and ecosystems from impaired groundwater, it would be particularly negligent for the Forest Service to exempt any activities associated with these industries from any type of analysis, monitoring, mitigation, or any other agency standard, policy, or regulation.

⁹² Fossil fuel activities, including exploration, development, and wastewater disposal, may cause serious harm to national forests, forest health, water and related values. Accordingly, these technical comments do not constitute an endorsement of any fossil fuel activities on public lands. See 16 U.S.C. § 529.

⁹³ 16 U.S.C. § 528.

We also urge the Forest Service to explicitly provide that, as with other activities, minerals and energy development “Require that monitoring and mitigation appropriate to the scale and nature of potential effects is conducted, evaluated, and reported when authorizing a proposed use or Forest Service activity that has a significant potential to adversely affect NFS groundwater resources.”⁹⁴

As written, the language in the proposed Directive regarding different types of mineral development is diffuse and inconsistent. While, we recognize that different statutory authorities provide the Forest Service with varying abilities to influence mineral development, we encourage consistent direction wherever possible, based on such authorities. The Forest Service has broad authority to regulate surface-disturbing activity on land it manages and a legal duty to analyze the impacts of any action that has a significant effect on the environment. For national forest lands with federal mineral ownership, the Forest Service has a clear right to determine whether and under what conditions to consent to oil and gas leasing and a responsibility to ensure that leasing does not interfere with the use of national forests for their primary purposes. The Directive must ensure that the acute and cumulative impacts of mineral and energy development activities on national forests and grasslands are understood before lands are made available for leasing or surface use is approved and minimize the impacts of these activities on groundwater and associated resources and ecosystems.

Specific resource-related recommendations are provided below:

3.7.1. Injection Wells

Produced water and any other wastewater from minerals development can contain toxic chemicals such as benzene and other volatile organic compounds, heavy metals, radioactive materials, salts, and other contaminants.⁹⁵ The Forest Service should not support the potential contamination of groundwater via wastewater injection by “evaluating the capability of local geological formations to accept produced water from oil and gas operations introduced using groundwater injection wells.”⁹⁶ The Forest Service should first avoid the development of waste water injection wells due to inadequate federal regulations for these activities. If there are legal reasons which prevent the Service from doing so, it should place limitations on such wells to protect groundwater dependent ecosystems for potential failures. Rather than injection, the Forest Service should ask operators to recycle their waste water in the spirit of the Directive’s focus on water reuse and efficiency. Additionally, the Forest Service should require the measurement and reporting of **all** active injection wells, rather than only those injected into formations with total dissolved solids less than 10,000 ppm.⁹⁷ In many cases, measurement and reporting to other agencies is already conducted under requirements of the Safe Drinking Water Act and state or federal Underground Injection Control programs. There is no reason that the

⁹⁴ FSM 2560.03 (4)(d)

⁹⁵ Veil, J. A., Puder, M. G., Elcock, D., and Redweik Jr, R. J. 2004. A white paper describing produced water from production of crude oil, natural gas, and coal bed methane. Prepared by Argonne National Laboratory for the US Department of Energy, National Energy Technology Laboratory, January. Available at http://www.ead.anl.gov/pub/dsp_detail.cfm; Alley, B., Beebe, A., Rodgers Jr, J., & Castle, J. W. 2011. Chemical and physical characterization of produced waters from conventional and unconventional fossil fuel resources. *Chemosphere*, 85(1), 74-82.; Zielinski, R. A., & Otton, J. K. 1999. Naturally Occurring Radioactive Materials (NORM) in Produced Water and Oil-field Equipment: An Issue for Energy Industry. US Department of the Interior, US Geological Survey.

⁹⁶ Proposed Groundwater Directive at Sec 2561.24 (7)

⁹⁷ Proposed Groundwater Directive at Sec 2560.03 (8)c

Forest Service should not require reporting of information for underground injection wells on USFS-managed lands when that information is already measured and provided to other agencies.

3.7.2. Leasable Mineral Mining

As set forth in Forest Service Manual 2820, Forest Service consent is generally required for the leasing of federal mineral resources beneath national forests and grasslands. Prior to granting consent, the Forest Service may require that stipulations be included in leases or impose conditions in surface operations to protect resources on National Forest lands. The Service should use its authority to ensure the protection of groundwater, connected surface waters, and groundwater-dependent ecosystems.

Groundwater monitoring is an essential part of the management of mineral development. While the proposed directive indicates that monitoring should be included in any required plan of operations or special use authorization associated with locatable minerals, monitoring is not discussed in the leasable mineral section. Groundwater monitoring should be explicitly recommended as a lease term or approval condition under 2561.22, 2561.23, 2561.24, and 2561.25.

3.7.2.1. Coal

Coal is currently produced from six national forest units in five states from both surface and underground mines. Coal production for National Forest system lands accounts for over 25% of the coal produced in the U.S.⁹⁸ Coal mining poses a serious threat to groundwater resources through a number of avenues. In many cases coal seams are aquifers themselves, which are often dewatered to access the coal; this dewatering draws in water from nearby aquifers as far as 3 miles away, having a domino-like effect. In the Appalachians, coal mining has created permanent groundwater drains, meaning we lose access to this water forever. In many cases, particularly mountaintop removal mining, entire streams are lost as are their shallow aquifers, with little chance of full recovery. Groundwater and surface water quality decline due to coal mining, leading to acid mine drainage in the eastern U.S. and high sulfates in the western U.S. However, these impacts may not be seen for decades after mines have closed.⁹⁹

Accessing coal has come with unacceptable costs to water resources. For instance, along the New River Gorge National River in West Virginia, coal mine tunnels act as a sieve and have drained numerous springs and wetlands.¹⁰⁰ Because of coal mining, streams in this area maintain acidic pH and elevated concentrations of other chemicals such as polyaromatic hydrocarbons (PAHs), affecting recovery of aquatic ecosystems.¹⁰¹ For instance, in Wolf Creek, a tributary of the New River, water has become so acidic that fish kills are common and West Virginia can no longer stock trout.¹⁰² Given the current understanding of coal-related impacts, the Forest Service should design efforts to prevent such widespread water quality and quantity impacts.

⁹⁸ <http://www.fs.fed.us/geology/energyCoal.html>

⁹⁹ National Research Council (U.S.). Committee on Ground-Water Resources in Relation to Coal Mining. 1981. Coal mining and ground-water resources in the United States. 197 pp.

¹⁰⁰ National Park Service. 1996. New River Gorge National River, Gauley River National Recreation Area, and Bluestone National Scenic River, West Virginia Water Resources Scoping Report. Technical Report NPS/NRWRS/NRTR-96/76

¹⁰¹ Paybins, K.S., Messinger, Terence, Eychaner, J.H., Chambers, D.B., and Kozar, M.D., 2000. Water Quality in the Kanawha–New River Basin West Virginia, Virginia, and North Carolina, 1996–98: U.S. Geological Survey Circular 1204, 32 p., on-line at <http://pubs.water.usgs.gov/circ1204/>

¹⁰² National Park Service. 1996. New River Gorge National River, Gauley River National Recreation Area, and Bluestone National Scenic River, West Virginia Water Resources Scoping Report. Technical Report NPS/NRWRS/NRTR-96/76

Managing coal activity requires the Forest Service to interact with the Interior Department's Office of Surface Mining and individual State agencies under the terms of SMCRA.¹⁰³ SMCRA places prohibitions on surface coal mining in National Forests, except for valid existing rights that existed before its enactment and on lands where "the Secretary finds that there are no significant recreational, timber, economic, or **other values** which may be incompatible with such surface mining operations."¹⁰⁴

We recommend the Forest Service, where coal extraction would impact groundwater dependent ecosystems, **define such groundwater dependent ecosystems as "other values"** which are incompatible with surface coal mining operations.

Within SMCRA Congress also mandated that the "recharge capacity" of the surface-mined lands be restored to approximately pre-mining conditions.¹⁰⁵ In large coal fields of the West, the coal seams themselves may be the major aquifers. Removing the coal seams, then, also removes the aquifers and replaces them with mine spoil.¹⁰⁶ Thus, the Forest Service has authority to and should require strong conditions and mitigation requirements for coal mining and should use this authority to protect and mitigate groundwater recharge capacity and future water quality in groundwater dependent ecosystems. When strong mitigation is in place, some functions can be restored, such as the surface-groundwater connection so important for groundwater dependent ecosystems.¹⁰⁷

3.7.2.2. Oil and Gas

Oil and gas development may lead to significant impacts to water resources. For instance, coalbed methane extraction in the Powder River Basin has led to groundwater drawdowns of 25 to 375 feet, some of which spread out under more than 20 townships in Wyoming, placing communities and ecosystems at risk.¹⁰⁸ The BLM may not proceed with oil and gas leasing beneath Forest Service managed lands without the Services' consent to lease. In the process of granting its consent, the Forest Service may require the addition of stipulations in leases. It may also place limitations on surface use in oil and gas Surface Use Plan of Operations (SUPOs).¹⁰⁹ Thus the Forest Service not only regulates surface use, but determines surface reclamation activities¹¹⁰ and additional bonding requirements.¹¹¹

Because of this relatively broad responsibility given to the Forest Service for managing oil and gas development, we recommend the agency implement the following strategies to protect groundwater dependent ecosystems and aquifers:

¹⁰³ Surface Mining Control and Reclamation Act of August 3, 1977, (91 Stat. 445; 30 U.S.C. 1201-1328)

¹⁰⁴ FSM 2800 <http://wwwtest.fs.fed.us/im/directives/fsm/2800/2820.txt>

¹⁰⁵ Committee on Ground Water Recharge in Surface-mined Areas, Water Science and Technology Board, Commission on Engineering and Technical Systems, and National Research Council, 1990, Surface coal mining effects on ground water recharge: Washington, D.C., National Academy Press, p. 70-80, <http://fermat.nap.edu/catalog/1527.html>

¹⁰⁶ National Research Council. 1990. Surface Coal Mining Effects on Ground Water Recharge, Committee on Ground Water Recharge in Surface-Mined Areas, Water Science and Technology Board. 170 pp.

¹⁰⁷ Martin, Jeffrey D., R. Duwelius, and C. Crawford. 1990. Effects of surface coal mining and reclamation on the geohydrology of six small watersheds in West-Central Indiana. USGS Water Supply Paper: 2368-B

¹⁰⁸ http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/energy/coal/prb/coalreview/task_1b_rev__11_2009.Par.45075.File.dat/exsum.pdf

¹⁰⁹ 30 U.S.C. § 226(g) ("The Secretary of the Interior, or for National Forest lands, the Secretary of Agriculture, shall regulate all surface-disturbing activities conducted pursuant to any lease issued under this chapter, and shall determine reclamation and other actions as required in the interest of conservation of surface resources.")

¹¹⁰ Id.

¹¹¹ 36 C.F.R. § 228.109.

- Resource management plans prepared by the Forest Service pursuant to the National Forest Management Act serve as a legally enforceable, administratively promulgated standard. These plans are typically accompanied by a leasing availability decision which designates lands that are closed to oil and gas leasing and those areas which are open to leasing with standard lease terms and with various protective stipulations and conditions.¹¹² We strongly encourage the Forest Service to develop standard stipulations for the protection of groundwater dependent ecosystems and aquifers and incorporate these into each resource management plan that makes land available for leasing.¹¹³
- BLM's Gold Book¹¹⁴ outlines strategies operators should take to develop and operate oil and gas wells. The Forest Service should work with BLM to ensure the Gold Book for oil and gas operations is updated to reflect groundwater protection in a timely manner following approval of the Directive.

In addition to the above, we recommend the following changes to Section 2561.24 of the proposed Directive related to Oil and Gas Operations:

- The proposed directive calls for the assessment of geological and hydrogeological conditions in areas “proposed for coal-bed natural gas or other non-traditional shallow natural gas leasing or development.” However, all oil and gas operations have the potential to affect groundwater resources and this provision should not be limited to a subset of these activities, in this case only shallow development. Oil and gas exploration and production in the United States has left behind a legacy of pollution and environmental impacts, including from both conventional and newer, unconventional development. Among the most commonly cited environmental impacts of oil and gas production are degradation of soils and water caused by releases of hydrocarbons and co-produced brine, known as “produced water.”¹¹⁵ Two of the most likely pathways through which groundwater may be impacted – mechanical integrity failures of oil and gas wells or mismanagement/spills of produced water – are not unique to shallow development but rather are common to all types of oil and gas operations. Moreover, we note that federal oil and gas leases typically do not limit lessees to a specific formation or depth.
- Contrary to provisions in the proposed Directive, the Forest Service should prohibit produced water or any waste water discharges into surface drainages or land application as a matter of policy. Surface discharge of produced water is prohibited under the Clean Water Act except in very limited circumstances.¹¹⁶ Contamination caused by releases of produced water can be extremely technologically and financially difficult to remediate, if it is not impossible to do so. Hundreds of studies document the risks associated with produced water

¹¹² BLM Manual, Supplemental Program Guidance for Energy and Mineral Resources (SPG) ' 1624.21(A)(1). Within the National Forest System, these decisions may be made in separate oil and gas leasing analyses which tier to the forest plans. See 36 C.F.R. § 228.102.

¹¹³ 36 C.F.R. § 219.8.

¹¹⁴ United States Department of the Interior and United States Department of Agriculture. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado. 84 pp.

¹¹⁵ Kharaka, Y. K., & Dorsey, N. S. 2005. Environmental issues of petroleum exploration and production: Introduction. *Environmental Geosciences*, 12 (2), 61-63.

¹¹⁶ 40 C.F.R. § 435.32, 435.50.

releases.¹¹⁷ For example, a multi-year, interdisciplinary study of produced water releases at an oil production site in Oklahoma undertaken by the United States Geological Survey found that soil and groundwater at the site were still polluted after more than 60 years of natural attenuation.¹¹⁸ However, if the Forest Service decides to allow discharge of produced water to surface drainages, it must strictly apply the requirements of federal regulations and ensure that each element for invoking the “beneficial use” exception is met. In this case, the Forest Service must ensure that the discharges (1) are composed solely of produced water, and do not include well treatment fluids or hydraulic fracturing flowback, (2) are of good enough quality to be used for wildlife or livestock watering,¹¹⁹ (3) will not cause exceedances of any water quality standards and will protect designated uses of any receiving waters, and (4) will not negatively impact forest service managed lands, resources¹²⁰, or groundwater dependent ecosystems.

- The proposed Directive should be amended to remove the language “when necessary” from subsection 4. The inclusion of this phrase may imply to staff that there is a high burden of proof for the inclusion of such conditions and that they may not include conditions of approval if negative impacts to groundwater are merely likely. This language should be removed in order to maintain consistency with the proposed Directive’s policy of limiting impacts on groundwater resources.

4. Conclusion

In closing we urge you to support and implement a strong Groundwater Directive that will protect instream flows and wetlands, provide water downstream for water users who need it, preserve water quality, and ensure no net depletion of groundwater resources on National Forest lands. Without such action, the future benefit of water from forests – a core mission of the U.S. Forest Service – may be lost. Thank you for consideration of our views. Please contact us at your convenience if you have any questions about these comments or would like to discuss them further.

5. Descriptions of Organizations Submitting These Comments

The **Natural Resources Defense Council** (NRDC) is a non-profit environmental membership organization with more than 1.4 million members and activists throughout the United States. NRDC members and activists use and enjoy National Forests and Grasslands across the country for a variety of purposes, including: recreation, solitude, scientific study, conservation of natural resources, and sources of clean drinking water. NRDC has had a longstanding and active interest in the protection of public lands and national forests, the responsible development of our nation’s resources, and the protection of public health from environmental threats.

¹¹⁷ Otton, J. K. 2006. Environmental aspects of produced-water salt releases in onshore and estuarine petroleum producing areas of the United States - a bibliography. U.S. Geological Survey Open-file report 2006-1154

Retrieved from http://pubs.usgs.gov/of/2006/1154/pdf/of06-1154_508.pdf

¹¹⁸ Kharaka, Y. K., & Otton, J. K., eds. 2003. Environmental impacts of petroleum production - Initial results from the Osage-Skiatook Petroleum Environmental Research Sites, Osage County, Oklahoma. U.S. Geological Survey Water-Resources Investigations Report 03-4260.

¹¹⁹ 40 C.F.R. § 435.51.

¹²⁰ See, e.g., Mary Beth Adams, et. al. 2011. Effects of Development of a Natural Gas Well and Associated Pipeline on the Natural and Scientific Resources of the Fernow Experimental Forest. U.S. Forest Service, Northern Research Station, GTR-NRS-76.

Founded in 1880, The **American Canoe Association** (ACA) is a national nonprofit organization serving the broader paddling public by providing education related to all aspects of paddling; stewardship support to help protect paddling environments; and sanctioning of programs and events to promote paddlesport competition, exploration and recreation.

American Rivers protects wild rivers, restores damaged rivers, and conserves clean water for people and nature. Since 1973, American Rivers has protected and restored more than 150,000 miles of rivers through advocacy efforts, on-the-ground projects, and an annual America's Most Endangered Rivers campaign.

The **Arkansas Public Policy Panel** is a statewide organization dedicated to achieving environmental, social and economic justice by organizing citizen groups around the state, educating and supporting them to be more effective and powerful, and linking them with one another in coalitions and networks. The Panel seeks to bring balance to the public policy process in Arkansas.

The **Arkansas Wildlife Federation** (AWF) is the oldest conservation organization in Arkansas. It was established in 1936 to protect what wildlife we had left after market hunters had hunted native wildlife species such as the buffalo and elk to extinction and other species to near extinction. Today, the AWF mission is to advocate for the sustainable use of Arkansas' wildlife habitats and natural resources for future generations.

Association for Beaver Lake Environment (ABLE) is a grassroots citizens' group founded in 1980 with a mission of protecting Beaver Lake in Arkansas especially since it the drinking water source for the whole Northwest Arkansas region. The U.S. Forest Service Groundwater Directive could have an impact especially knowing that Northwest Arkansas has a karst geology. In general, ABLE supports protecting groundwater no matter where it is because it is vital finite resource.

Breast Cancer Action's mission is to achieve health justice for all women at risk of and living with breast cancer. We focus on systemic interventions that will address the root causes of the disease and produce broad public health benefits. These benefits will ensure that fewer women develop breast cancer and die from breast cancer and so that no community bears a disproportionate burden of diagnosis or death from this disease. As the watchdog of the breast cancer movement, we educate, organize and take action for systemic change. We opposes hydraulic fracturing, or "fracking" because the practice exposes people to endocrine disruptors and carcinogenic chemicals that are linked to breast cancer, as well as a host of other health harms.

The **Center for Biological Diversity** believes that the welfare of human beings is deeply linked to nature — to the existence in our world of a vast diversity of wild animals and plants. Because diversity has intrinsic value, and because its loss impoverishes society, we work to secure a future for all species, great and small, hovering on the brink of extinction. We do so through science, law and creative media, with a focus on protecting the lands, waters and climate that species need to survive. We want those who come after us to inherit a world where the wild is still alive.

The **Center for Environmental Law & Policy** (CELP) is a nonprofit based in Seattle, WA, whose mission is to protect and restore Washington's rivers and aquifers through science-based management of our water resources. At the core of our work is the concept of the public trust doctrine – water held in trust by the state to ensure public access to waters for commerce, navigation, environmental protection and aesthetics. CELP works through public education, agency advocacy, policy reform, and public interest litigation to achieve this mission and is known as Washington's water watchdog.

The **Chattooga Conservancy** is a grassroots conservation organization that works to protect the natural landscape and ecological health of the National Wild & Scenic Chattooga River, and the 200,000-acre watershed surrounding this incredible river. Approximately 70% of the Chattooga River watershed is under control of the U. S. Forest Service, and is managed by the Nantahala National Forest in NC, the Sumter National Forest in SC, and the Chattahoochee National Forest in GA. Our organization strives to monitor and positively impact Forest Service initiatives in the Chattooga River watershed, with a strong record of successes. The Chattooga Conservancy's mission is to protect, promote and restore the natural ecological integrity of the Chattooga River watershed ecosystems; to ensure the viability of native species in harmony with the need for a healthy human environment; and, to educate and empower communities to practice good stewardship on public and private lands.

Clean Water Action is a national citizens' organization, founded in 1972, of over 1 million members and is active in over a dozen states. Clean Water Action works for strong public health and environmental protections with an emphasis on those that impact water resources.

Conservation Congress is a grassroots nonprofit organization working to protect National Forest lands and wildlife habitat in northern California and the Rocky Mountain West.

Defenders of Wildlife (Defenders) is a national non-profit conservation organization with more than 1.2 million members and supporters nationwide. Founded in 1947, Defenders focuses on conserving and restoring native species and the habitat upon which they depend, including habitat provided on National Forest System lands.

The **Endangered Habitats League** is Southern California's only regional conservation group. We are dedicated to ecosystem protection and sustainable land use for all the region's inhabitants. Since 1991, we have worked with public and private sector partners to adopt and assemble comprehensive habitat reserves in five counties. Our National Forests are integral parts of the reserve systems and our members and activists have a profound interest in the ecological integrity of National Forest lands.

The **Environmental Protection Information Center** (EPIC) is a community based, non-profit organization that works to protect and restore forests, watersheds, coastal estuaries, and native species in Northern California. EPIC was founded in 1977 and represents over 2,000 members and 10,000 activists and supporters who deeply value the spiritual and aesthetic wild nature of our public lands and Wild and Scenic Rivers. EPIC uses an integrated, science-based approach,

combining public education, citizen advocacy, and strategic litigation to protect public trust resources, including the vital carbon dense forests and clean waters on our national forests.

FLOW is a non-profit organization working to ensure the waters of the Great Lakes are protected now and for future generations by recognizing the Great Lakes as a Commons, building deep public awareness and engaging the public and decision-makers about the threats and abuses facing the Great Lakes, and advancing public trust solutions to protect the rights of the people and waters of the Great Lakes Basin.

Forests Forever is an environmental advocacy organization founded in 1989, based in San Francisco. Our mission is to defend and preserve California's wild forest ecosystems and forest wildlife through legislative and administrative advocacy, electoral activities, and public education organizing. We also have successfully undertaken litigation and book publishing in recent years. We have both a 501c4 and a c3 organization.

Friends of the Bitterroot is a 28 year old grassroots conservation group working to protect conservation interests in the Northern Rockies region. We are an all-volunteer 501(c)(3) organization of over 300 members.

Friends of Blackwater works to protect the unique ecology, spectacular landscapes, outdoor recreation and heritage of the High Allegheny Mountains of West Virginia through public outreach, advocacy and restoration.

Friends of the Mulberry Watershed is a grassroots network of individuals within the Mulberry Watershed in Northwest Arkansas. The Mulberry River is designated a Wild and Scenic River and our primary purpose is to protect our watershed and environment from contamination and harmful projects through communication, education, scientific monitoring, and alliance building.

Grassroots Coalition is a non-profit organization dedicated to science based investigation and evaluation for public and environmental health and safety protection and conservation of the natural environment. GC believes in the public's right to making informed decisions.

Heartwood is a cooperative network of grassroots groups, individuals, and businesses working to protect and sustain healthy forests and vital human communities in the nation's heartland and in the central and southern Appalachians.

Hells Canyon Preservation Council (HCPC) is a non-profit conservation organization based in La Grande, Oregon with over 1000 members and supporters. HCPC's mission is to protect and restore the inspiring wildlands, pure waters, unique habitats and biodiversity of the Hells Canyon-Wallowa and Blue Mountain Ecosystems through advocacy, education and collaboration, advancing science-based policy and protective land management. HCPC actively participates in decisions concerning the management of public lands in order to protect our members ability to use and enjoy the waters, public lands and natural resources in the Blue Mountains for recreational, scientific, spiritual, educational, aesthetic, and other purposes.

The **International Federation of Fly Fishers** is a 46 year old international non-profit organization dedicated to the betterment of the sport of fly fishing through Conservation, Restoration and Education. The Federation of Fly Fishers and its Councils are the only organized advocate for fly fishers on a regional, national and international level.

Kentucky Heartwood is a non-profit environmental organization that seeks to protect and restore the integrity, stability, and beauty of Kentucky's native forests and biotic communities through research, education, advocacy, and non-violent intervention. Our primary efforts focus on monitoring forest management and engaging citizen action toward the preservation of the Daniel Boone National Forest and other public lands in Kentucky.

Kettle Range Conservation Group is a rural-based, Republic, Washington grassroots conservation group formed in 1976 to preserve wilderness in the Kettle River Range of northeast Washington state and with a mission to defend wilderness, protect biodiversity and restore ecosystems of the upper Columbia River Basin.

The **Klamath Forest Alliance** (KFA) is a grassroots non-profit community organization centered in the Klamath-Siskiyou bioregion of Northern California. KFA's mission is to promote sustainable ecosystems and sustainable communities with the goal of defending and protecting the biodiversity, wildlife, waters and old growth forests of the wild and rugged watersheds within the national forests of Northern California and Klamath River Basin. Founded in 1989, KFA works in the public interest representing over 500 members who treasure our public lands and national forests.

The Lands Council (TLC) is a non-profit environmental membership organization with more than 1500 members and activists throughout the United States, but primarily in the Pacific Northwest. TLC members and activists use and enjoy National Forests and other public lands across the country for a variety of purposes, including: recreation, solitude, scientific study, conservation of natural resources, and sources of clean drinking water. TLC has been active for over 30 years, advocating for roadless area protection, protection of streams and rivers, and protection for the wildlife that depends on our forests.

The **League of Women Voters of Arkansas** (LWVAR) is a non-profit, non-partisan organization that promotes public policy education to create an informed and fully participating electorate. The LWVAR consists of 185 members.

Los Padres ForestWatch is a local nonprofit 501(c)(3) organization working to protect and restore wild places and wildlife in the Los Padres National Forest, the Carrizo Plain National Monument, and other public lands along California's Central Coast.

The **Lower Columbia Canoe Club** (LCCC) gives Pacific Northwest paddlers the opportunity to share in the excitement and adventure of single- and double- bladed paddling. Based in Portland, Oregon, the club features a year-round schedule of both whitewater and flat/moving water trips for canoeists and kayakers. As an organization, the club seeks to: promote river safety; help members improve paddling skills, protect and preserve Northwest watersheds, rivers and lakes; and foster a strong paddling and river conservation community within the club and in league

with other paddling organizations. The club's membership includes approximately 200 households in Oregon and Washington.

The **Missouri Coalition for the Environment** works to protect and restore the environment through education, public engagement, and legal action. The Coalition began its work in 1969 in St. Louis as the region's first independent citizens' group created to address a broad range of environmental policy issues. We are a trusted environmental advocacy agency, an informed educator, a passionate advocate, and a state-wide partner supporting allied organizations and initiatives around the state. We deliver vital information to thousands of Missourians on issues that affect our food, our water, our air, our health, and the environment. We promote a common sense approach to protecting and restoring the environment and upholding individuals' rights to make informed, independent decisions about environmental issues and policy.

The **Mount Shasta Bioregional Ecology Center** is a grassroots nonprofit dedicated since 1988 to protecting and restoring the outstanding environmental and cultural values of Mount Shasta and its surrounding bioregion: a major source of pure waters for California, forests and natural areas, rich biodiversity, and sacred areas of high significance to Native Americans and other cultures near and far. A primary focus is to preserve the pristine high-elevation recharge areas and source aquifers of our region. We bring our vision of a culture in harmony with nature into the forums where outcomes are decided.

The mission of the **Ohio Environmental Council** is to secure healthy air, land, and water for all who call Ohio home. We help individuals, communities, and businesses go green, save money, and live healthier. Our experts work daily to restore, protect and strengthen the quality of life for families and communities—from the air we breathe and the water we drink to the food we eat and natural resources we enjoy.

The **Okanogan Highlands Alliance** is a non-profit organization that works to educate the public about watershed issues, including the environmental threats of large-scale mining.

OMNI Center for Peace, Justice & Ecology actively educates, empowers and connects to build a nonviolent, sustainable, and just world.

The **Ouachita Watch League** (OWL) is a non-profit environmental coalition of about 60 organizations and 350 individuals which was formed in 1989 to bring about better management of the Ouachita National Forest with particular concern over intensive timber management and later involved over concerns with gas exploration and production. OWL members use the forest and streams on the Ouachita National Forest for recreation and enjoyment and many of its members are landowners within the forest area. OWL has been active in forest planning issues and has pursued, if necessary for resource protection, appeals and litigation on important issues.

People's Oil & Gas Collaborative- Ohio (POGCO) is an Ohio grassroots movement focused on oil and gas issues. We work with people affected by the impacts of oil and gas development in a nonpartisan effort for reform at local, state and federal levels. Our mission is to provide surface owners, oil and gas employees and citizens living near operations fair and equal treatment under the law with regard to health, safety and property rights.

RESTORE: The North Woods is dedicated to restoring, preserving, and defending the natural integrity of the North Woods of the United States and Canada through advocacy, public awareness, and citizen action.

River Network's mission is to empower and unite people and communities to protect and restore rivers and other waters. Since 1988, we have helped concerned citizens to take a stand against apathy, neglect, and abuse of our rivers and lakes and become effective caretakers of our waters. More than 15,000 of these local champions are part of our community. We help them connect to each other, empower them with training and exposure to new ideas, and expand their impact regionally and nationally. Together we support a future of clean and adequate water for people and nature.

Sequoia ForestKeeper is a non-profit conservation corporation whose mission is to protect and restore the ecosystems of the Southern Sierra Nevada including Sequoia National Forest through monitoring, enforcement, education, and litigation. Sequoia ForestKeeper and its nearly 800 members and supporters have vital interests in protection of wildlife and imperiled species that occur on the public lands in the Sequoia National Forest.

Shale Test was founded in October of 2010 by Tim Ruggerio and Dish, TX Mayor, Calvin Tillman. Having been negatively affected by oil and gas development, they both recognize the benefits of having quality environmental data when facing development. Shale Test is dedicated to collecting data and providing it to families and communities impacted by oil and gas development.

Shenandoah Valley Network supports citizens groups in six Virginia counties working to secure public policies that will protect the region's rural communities and rich natural and historic resources. The George Washington National Forest provides drinking water to 240,000 residents in our service area.

The **Sierra Club** is America's largest and most influential grassroots environmental organization, with more than 2.4 million members and supporters nationwide. In addition to creating opportunities for people of all ages, levels and locations to have meaningful outdoor experiences, the Sierra Club works to safeguard the health of our communities, protect wildlife, and preserve our remaining wild places through grassroots activism, public education, lobbying, and litigation.

The **Southern Environmental Law Center** is a regional non-profit organization working to conserve the environment and health of the Southeast, including the national forests and other public lands. The national forests in the Southern Appalachian Mountains, in particular, support globally significant levels of fish, wildlife, and plant diversity, shelter the headwaters of the South's major rivers, and supply drinking water to many cities.

Tennessee Chapter Sierra Club is a national nonprofit environmental organization dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to

protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Sierra Club has approximately 600,000 members, with over 6,500 members living in Tennessee, including members who would be affected by the proposed Directive.

Tennessee Clean Water Network empowers Tennesseans to exercise their right to clean water and healthy communities by fostering civic engagement, building partnerships and advancing and when necessary, enforcing water policy for a sustainable future.

The **Vermont Natural Resources Council** is a non-profit environmental education and advocacy group founded in 1963. Through research, education, collaboration and advocacy VNRC protects and enhances Vermont's natural environments, vibrant communities, working landscapes, rural character and unique sense of place, and prepares the state for future challenges and opportunities. Through partnerships with other organizations, individuals and businesses, we have been very successful and instrumental in enacting many of the landmark laws that have forged Vermont's national reputation as an environmental leader. We supported, and the Vermont Legislature passed in 2008, a law declaring groundwater to be a public trust resource in the state. We continue to work to assure state policy relating to groundwater includes provisions protecting groundwater as a public trust resource. We have also consistently supported the careful management of our public lands and national forests, including the Green Mountain National Forest.

Waterkeeper Alliance is the world's fastest growing environmental movement, uniting more than 220 Waterkeeper organizations around the world and focusing citizen action on issues that affect our waterways, from pollution to climate change. Our Waterkeeper organizations are on the frontlines of the global water crisis patrolling and protecting more than 1.5 million square miles of waterways on six continents. The Waterkeeper movement's mission is for swimmable, drinkable, fishable waterways worldwide. Our belief is that the best way to achieve this vision is through the Waterkeeper method of grassroots advocacy.

The **Western North Carolina Alliance** (WNCA) is a non-profit environmental organization serving more than 3,000 members who value Nantahala-Pisgah National Forest for its clean water, biodiversity, wildlife habitat, recreation, and scenery. The Western North Carolina Alliance empowers citizens to be advocates for livable communities and the natural environment of Western North Carolina.

Western Watersheds Project (WWP) is a non-profit conservation organization founded in 1993 with 2000 members and with field offices in Idaho, Montana, Oregon, Wyoming, Arizona and California. WWP works to protect and restore over 250 million acres of public lands throughout the West from harm to ecological, biological, cultural, historic, archeological, scenic, and wilderness values. WWP's primary focus is to identify, address, and end potential or existing private abuses of this public land due to livestock grazing, which is a primary cause of degraded ecosystems and species loss in the West.

Wild South is a regional conservation organization dedicated to inspiring people to enjoy, value, and protect the wild character and natural legacy of the South.

Wild Virginia is a not-for-profit membership organization devoted to preserving and protecting Virginia's forests, wild lands, unique habitats and endangered species.

Wilderness Workshop (WW) is a non-profit environmental membership organization. WW's mission is to protect and conserve the wilderness and natural resources of the Roaring Fork Watershed, the White River National Forest, and adjacent public lands. WW engages in research, education, legal advocacy and grassroots organizing to protect the ecological integrity of local landscapes and public lands. We focus on the monitoring and conservation of air and water quality, wildlife species and habitat, natural communities and lands of wilderness quality. WW has a longstanding and active interest in the protection of public lands.

Founded in 1967, the **Wyoming Outdoor Council** is the state's oldest independent conservation organization and represents over 1,500 members. The Outdoor Council's mission is to protect Wyoming's environment and quality of life for future generations. Their goal is to work collaboratively with stakeholders and decision makers to develop productive and lasting solutions for managing natural resources. The Wyoming Outdoor Council believes good environmental stewardship is crucial to safeguarding public health and Wyoming's quality of life.

Yellowstone to Uintas Connection is a non-member 501c3 organization addressing public lands issues in Idaho, Wyoming and Utah, in particular focused on watershed health and the major wildlife corridor connecting the Yellowstone Ecosystem and Northern Rockies to the High Uinta Wilderness and Southern Rockies.