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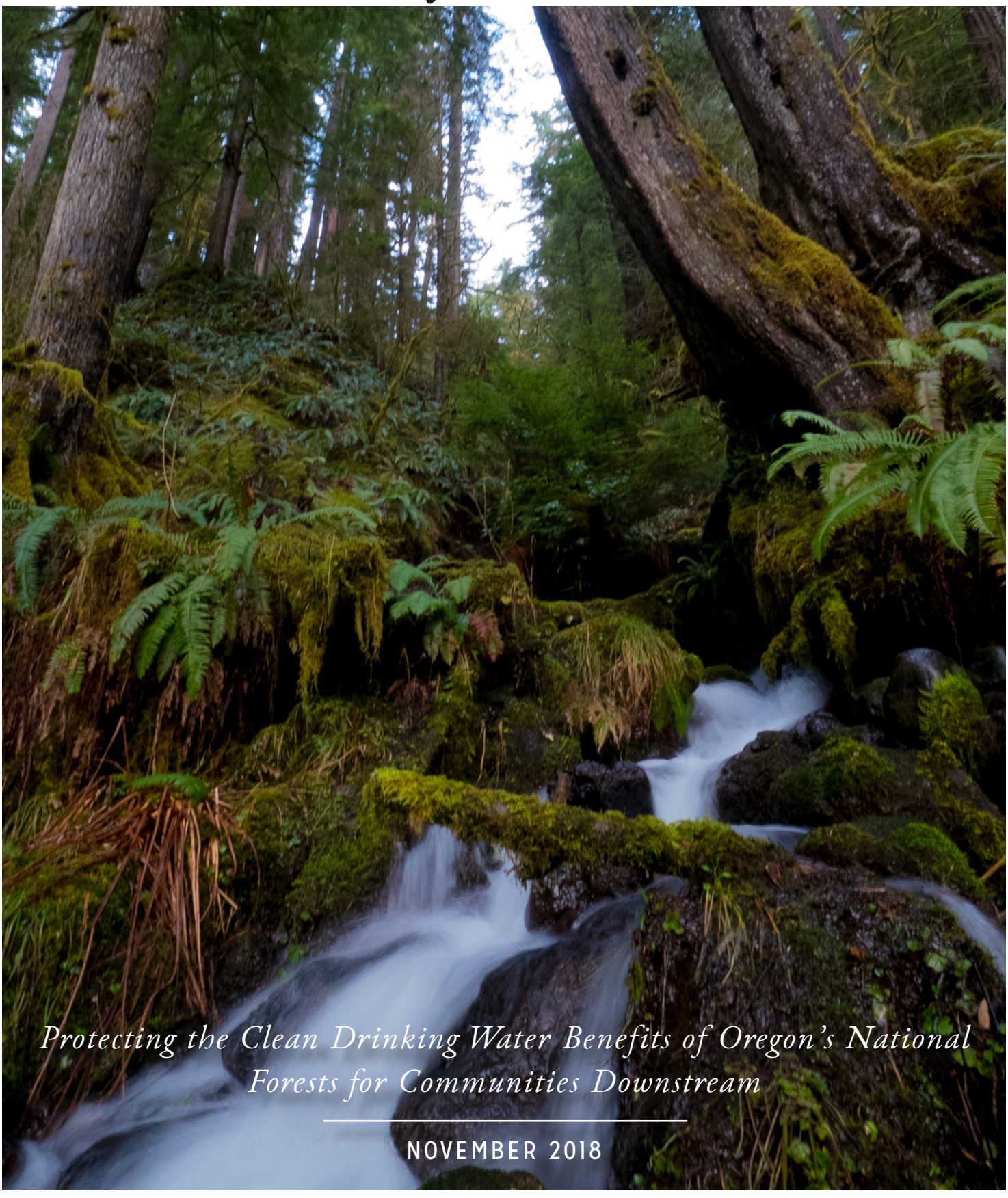
FORESTS

to faucets



Protecting the Clean Drinking Water Benefits of Oregon's National Forests for Communities Downstream

NOVEMBER 2018


FORESTS
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ABOUT AMERICAN RIVERS:

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. Headquartered in Washington, DC, American Rivers has offices across the country including in Oregon and more than 275,000 members, supporters and volunteers. Visit www.americanrivers.org

ABOUT PACIFIC RIVERS:

Founded in 1987, Pacific Rivers has protected thousands of miles of rivers and aquatic ecosystems on public lands across Oregon, Washington, and Northern California. Pacific Rivers advocates for state and federal land and water policies that are supported by science, equitable in impact, and resilient to the effects of climate change. Pacific Rivers is headquartered in Portland, Oregon

Visit www.pacific rivers.org

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INTRODUCTION

Forests in the United States cover roughly 651 million acres and supply abundant, clean drinking water for some 180 million people. Despite providing water for more than half of all Americans and 40% of all municipalities,[1] many people are unaware of where their drinking water comes from. Even fewer understand how healthy forests help provide low-cost, clean drinking water to their communities. This report aims to address these two issues.

Healthy forests perform many of the functions of traditional water treatment facilities and water infrastructure. They store water, filter pollutants, and transport clean water to downstream communities, all while operating naturally and essentially for free. In addition to providing these water delivery and filtration services, riparian forests are also considered to be among the most ecologically important.

The cities of New York, Boston, and Denver are among the many communities across the country investing billions of dollars in land protection in order to save billions more in clean drinking water supply and treatment costs.

By providing clean drinking water to over 66 million people in 3,400 communities in 33 states, the National Forest system could be considered the largest and most important water provider in the nation. In Oregon, Washington, and Northern California the cities of Seattle, Portland, and San Francisco receive their drinking water from National Forests. The U.S. Forest Service values the water that flows off of our National Forests alone at over $7.2 billion annually. Forests provide clean water at a very low cost for millions of residents of the Pacific Northwest.

In western Oregon, over 2 million residents benefit from efforts to protect their drinking water on National Forests. Within the Bull Run River watershed, Portland ratepayers have saved tens of millions of dollars in avoided secondary treatment costs. The cities of Medford, Eugene and Tualatin have all adopted innovative strategies to take advantage of healthy forests to provide clean water. Oregon's renowned craft breweries, distilleries and wineries rely on, and benefit from, the clean water benefits provided by National Forests.

Increasingly, municipalities, water providers and water users are supporting upstream forest protection and restoration as a low cost alternative to fixing aging infrastructure, and as a way to help meet growing demand. There is no better and more economical way to preserve rivers as a source of clean, plentiful water than to protect their flow and quality on National Forests upstream. By committing ourselves to continuing sensible forest management and protection of key watersheds we can preserve our most valuable asset on our National Forest lands: sustainable flows of clean water.

Currently, National Forests in western Oregon are managed under the Northwest Forest Plan and its Aquatic Conservation Strategy, which prioritizes restoration and conservation of fish and wildlife habitat and water quality. By pledging to keep this strategy in place, we can help communities across western Oregon preserve clean drinking water into 21st century.

THIS REPORT:

• Provides an introduction for community leaders, water providers and forest managers about the connection between healthy forests and clean drinking water as they seek to protect, manage and maintain the clean water benefits of upstream forests.

• Outlines the economic and environmental benefits of well-managed forests for drinking water protection.

• Describes the value of current management practices on National Forests in western Oregon to optimize water quality benefits to downstream communities.

• Highlights case studies of communities that use unique strategies for upstream forest protection, management and restoration.

FORESTS AND CLEAN DRINKING WATER

Forests are a critical link in local and regional water cycles, absorbing, filtering, and slowly releasing precipitation into streams and rivers. They act as natural water infrastructure systems, effectively creating the largest water utility in the United States, covering 750 million acres and providing drinking water for 40 percent of municipalities.[2] Collectively, forests provide drinking water for 180 million Americans across the country.[3] Forests also play a vital role in protecting water quality, controlling nutrients and sediment, reducing erosion, and mitigating flooding.

FOREST PROTECTION: A GOOD BUSINESS CASE

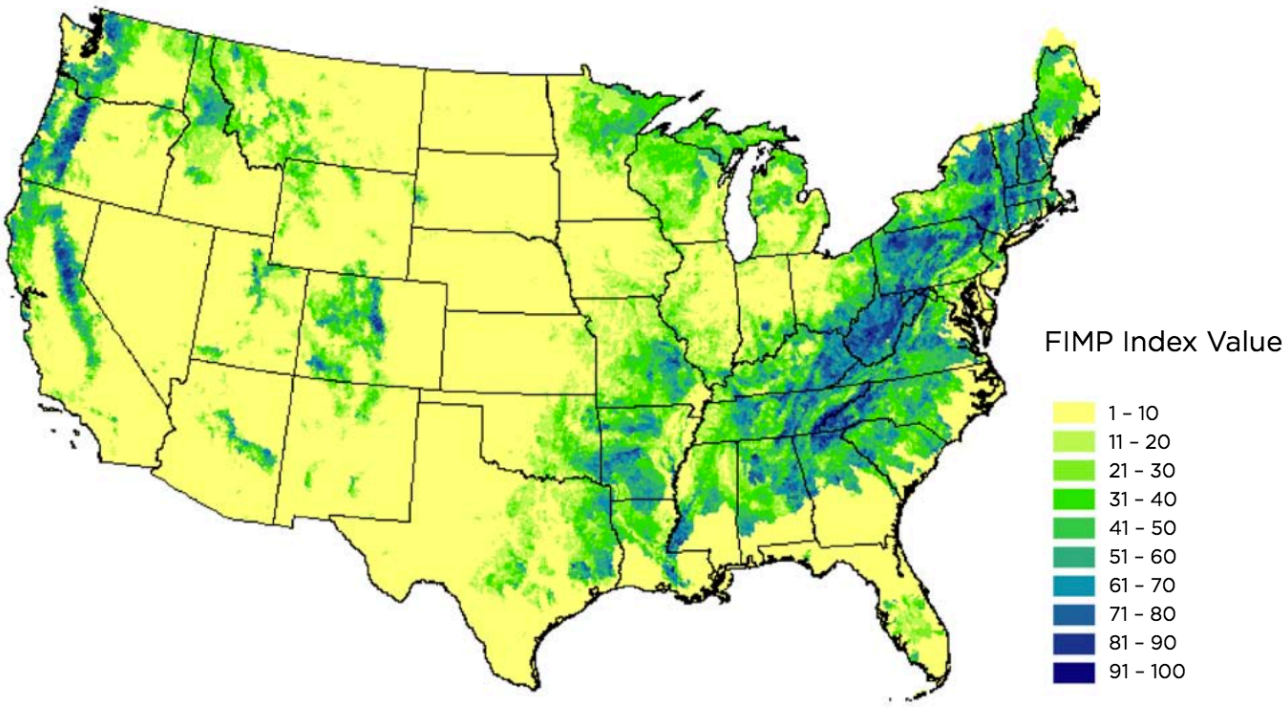
By protecting and restoring forests that supply drinking water, communities can save millions of dollars on water treatment and storage costs. There is an inverse relationship between forest cover and treatment costs: the more acreage in forest cover, the lower the treatment cost to make water potable. Municipalities are now spending tens of millions of dollars in water treatment, depending on their size and the complexity of system. There are more cost-effective and environmentally sustainable options, providing benefits to the public and maintaining high quality ecosystems. For every $1 invested in forest and watershed protection, water utilities save an average of 7 to 20 times their investment in treatment and filtration costs. Increasing forest cover can exponentially improve water quality, saving water utilities and their customers money. For example, it is estimated that a ten percent increase in forest cover in source watersheds would save the state of Nevada $2.2 million annually in treatment costs. Strategically placed forests can reduce nutrients, sediment, and bacteria – all harmful to the human health and aquatic species – by 80 to 99 percent. All of this means fewer long-term treatment costs.

QUICK FACTS:

• More than 3,400 communities get most of their water from supplies originating on National Forest Land, including Atlanta, Denver, Portland, San Francisco, and Washington, DC.

•The value of water flowing from federal lands has been estimated to be $7.2 billion annually. Over 2 million Oregonians receive their drinking water from National Forests.

Communities around the country support saving money and have embraced paying to conserve their drinking watersheds. Since 1996, New York City spent $1.5B on upstream land conservation and management to avoid an $8-10B treatment plant upgrade. After spending $25 million to address the impacts of forest fire on its drinking water, the municipal water provider for the city of Denver committed $16.5 million to forest management in their drinking watersheds. And in Oregon, the city of Portland pushed to have its drinking watersheds within the Bull Run and Little Sandy River watersheds legislatively protected in part to reduce potential sediment loads from unsustainable logging practices.



Forests Important for Surface Drinking Water

The index of forest importance to surface drinking water (FIMP) identifies those sub-watersheds where forest lands are most important in protecting surface drinking water.

United States Department of Agriculture Forest Service. *Forests to Faucets.* Retrieved from **http://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml**

ECONOMIC BENEFITS: ECOSYSTEM SERVICES AND AVOIDED COSTS

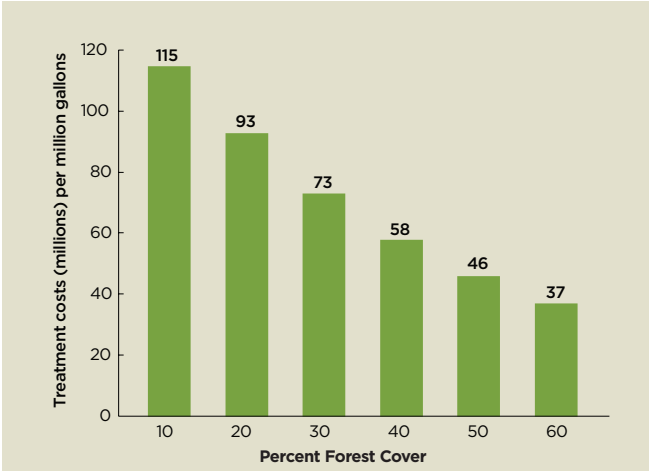
Healthy natural and well-managed forests provide a wide range of services and benefits for downstream communities. Forests filter pollutants, sediment, nutrients and harmful bacteria out of the water, absorb water into soils to be slowly released as base flows into streams and rivers, and provide protection to downstream communities by buffering floods. Critically, forests along streams, also known as riparian forests, provide abundant shade, keeping surface waters much cooler than they would be without adjacent tree cover.

Dissolved oxygen is an important indicator of water quality. Most forms of aquatic life, including fish and aquatic invertebrates, require dissolved oxygen to survive. As water temperature increases, the amount of dissolved oxygen[4] in water decreases. By shading rivers and streams, riparian forests moderate water temperatures, which benefits both natural and human communities.

The ecosystem services provided by healthy forests can be significant. Research demonstrates that water providers that receive water from mostly forested watersheds have cheaper annual treatment costs than providers in watersheds with less forest cover. Cities are finding that by properly managing upstream forests they can reduce expenditures on treatment and infrastructure; this investment in forest conservation is often referred to as "Payment for Watershed Services." A study found that for every $1 invested in forest and watershed protection, $7.50 to $200 is saved in treatment and filtration costs.[5] For example, in a study of 27 U.S. water supply systems, providers in less forested watersheds paid three times more in treatment costs than those with 60% forest cover.[6] Approximately one-third of the world's largest cities take advantage of protected areas and well-managed forests in acquiring their drinking water.[7]

In addition, with healthy intact riparian forests, communities can reduce capital expenditures on stormwater control infrastructure. The infiltration and storage capacity of forests, particularly forested floodplain wetlands, can reduce flooding by holding floodwaters and slowly releasing them over time. By reducing runoff during rainstorms, forests reduce the volume of water that municipal stormwater containment facilities and retention ponds might otherwise store.

FIGURE 1: WATER TREATMENT COST V. PERCENT FOREST COVER



Adapted from Ernst, C. 2004. Protecting the Source. Land Conservation and the Future of America's Drinking Water. Report by The Trust for Public Land and the American Water Works Association. San Francisco, CA.

OTHER BENEFITS

The many economic, environmental, social, cultural, and aesthetic values of intact, healthy forests are well known. Forests provide habitat for an endless variety of native fish and wildlife species, including birds, mammals, reptiles and amphibians, and an astonishing diversity of invertebrate species. Leaf litter and other woody debris falling into streams becomes the organic material that makes up the base of the aquatic food web, especially in headwater streams.[8] Managed sustainably, forests provide a wide variety of culturally important and economically valuable products, such as salmon, game species for hunting, and other foods. Healthy forests are also used for numerous other important social and economically important activities, including recreation and environmental education. All of these additional benefits accrue when forests and forested watersheds are protected and sustainably managed to maintain water quality and quantity for human communities downstream.

TABLE 1: CITIES INVESTED IN SOURCE WATER FOREST PROTECTION

TABLE 1: Cities Invested in Source Water Forest Protection

City	Cost of protection	Avoided cost	Acres Protected
New York City	$1.5 billion spent on watershed protection over 10 years	Approx. $6 billion in capital costs and $300 million in annual operating costs.	96,000 acres[i]
Portland, Maine	$729,000 spent annually to protect watershed	$25 million in capital costs and $725,000 in operating costs	2,500 acres[ii]
Syracuse, New York	$10 million watershed plan	$70 million in capital costs and $7 million in annual operating costs[iii]	858 acres[iv]
Auburn, Maine	$570,000 spent to acquire watershed land	$30 million capital cost and $750,000 in annual operating cost	1,975 acres or 21% of the watershed[v]

Adapted from Postel and Thompson 2005[vi]

DENVER, COLORADO CASE STUDY: HOLDING THE DIRT BACK

Forested watersheds currently supply water to 1.3 million residents in Denver, Colorado. Insect infestation and other factors led to a high risk of wildfire in the watershed. Severe wildfires burned almost 200,000 acres in Denver's drinking water supply watershed during the Hayman and Buffalo Creek fires in 1996 and 2002, costing $237 million and shutting down drinking water supplies. Forests ravaged by wildfires are at a much greater risk of erosion, and significant amounts of sediment can wash out and reduce storage capacity in reservoirs. Denver Water, the municipal supplier, spent more than $10 million to restore the water supply, and yet sediment continues to erode into the reservoir during every storm.

Rather than continue to implement short-term solutions like spending $20 million to dredge the reservoir, the utility implemented a combination of water conservation and watershed protection strategies, such as tree thinning and clearing, as well as creating fire breaks to reduce wild fire intensity.[9] Denver Water collected fees from water users, charging every resident a $0.14 fee per bill to fund their conservation strategies. In 2010 they entered into an agreement with the Forest Service to invest $33 million, half from resident fees, to restore 33,000 acres of forests to ensure clean water into the future.[10] Notably, Santa Fe, New Mexico, adopted this same strategy after discovering the practice would save $21 million through the avoidance of costs associated with wildfires. [11]

NATIONAL FORESTS SUPPLY CLEAN WATER IN THE NORTHWEST

Abundant forested watersheds on federal lands in the Pacific Northwest help provide clean, dependable water supplies to millions of residents in downstream cities and towns. In the past, unsustainable logging of old growth forests and riparian areas significantly degraded fish and wildlife habitat and drinking water supplies.

The Northwest Forest Plan (NWFP) and its Aquatic Conservation Strategy (ACS) was adopted in 1994 in response to the environmental degradation and the decline of the Northern Spotted Owl and salmon populations caused by unsustainable logging. Administered by the Bureau of Land Management (BLM) and United States Department of Agriculture Forest Service (USFS), the NWFP covers 24 million acres of forestland in western Oregon, Washington, and northern California. The USFS manages the vast majority of the forests and watersheds covered under the NWFP.

The ACS seeks to prevent further degradation of aquatic ecosystems from the impacts of forest management activities and to restore and maintain fish and wildlife habitat and water quality. The ACS has five components to meet its goals and objectives: (1) watershed analysis, (2) riparian reserves, (3) key watersheds, (4) watershed restoration, and (5) standards and guidelines. Key watersheds and riparian reserves are particularly important for preserving water quality. Key watersheds are areas that provide, or are expected to provide, the best water quality for salmon habitat. There are 164 key watersheds across the NWFP area, covering 4,300,000 acres. Riparian reserves are protective areas adjacent to streams or other bodies of water that are managed with special considerations to protect water quality and support ecosystem function by maintaining buffers of trees along streams. On fish bearing streams, the buffers are equal to the height of two site-potential trees, which is roughly 300 feet, on each side of the stream. On non-fish bearing streams, buffers are equal to the height of one-site potential tree, or 150 feet, on each side of the stream. These buffers provide shade and keep streams cool, slow runoff and catch sediment. When the trees eventually die, they fall into the stream and create fish habitat, trap and store sediment and

slow runoff, serving an important flood management function. Forest management activities are limited in key watersheds and riparian reserves, and must focus on maintaining and protecting water quality and fish and wildlife habitat. The riparian reserve network within the NWFP area totals 2,602,014 acres.

Since its inception, the ACS has been successful in stabilizing or improving once imperiled salmon runs and maintaining water quality and watershed function.[14] Much like the protective management in Portland's Bull Run drinking watershed has provided reduced-cost, clean drinking water, so too the ACS provides benefits to downstream communities.

MANAGING NATIONAL FORESTS FOR WATERSHED HEALTH UNDER THE 2012 FOREST PLANNING RULE

According the U.S. Forest Service, National Forests contain 400,000 miles of streams, lakes and many aquifer systems that together serve as the source of drinking water for more residents of the United States than any other source, alone providing 18 percent of the Nation's supply of drinking water and over half the water in the West.[15] In 2012 the U.S. Forest Service updated guidance on how all National Forest lands should be managed to preserve and restore watershed health.

Known as the 2012 Planning Rule, this guidance is used by individual National Forests when they update their Resource Management Plans every 15-20 years. The Forest Service is currently revising the Northwest Forest Plan under the Planning Rule and will be revising management plans for many of the National Forests across the country.

The Planning Rule includes a strong set of requirements associated with "maintaining and restoring watersheds and aquatic ecosystems, water resources, and riparian areas in the plan area".[16] The agency is now required to "maintain or restore the structure, function, composition, and connectivity of aquatic ecosystems and watersheds in the plan area, taking into account potential stressors..." and seek ways "to maintain and restore the ecological integrity of riparian areas and prevents practices that have serious or adverse impacts."[17]

CATSKILLS, NEW YORK CASE STUDY: AVOIDED COSTS

New York City is an example of downstream water users paying for upstream forest protection, also known as "Payment for Watershed Services." For many decades, New York City has obtained 90 percent of its drinking water from watersheds within the Catskill Mountains. However, by the 1990s, growing housing developments, septic systems, dairy farms and agriculture significantly degraded water quality in the watershed.[12] New York City managers were faced with the decision to either build a $6 billion water filtration plant that would cost $300 million a year to operate, or spend $1.5 billion to protect the source watershed. City managers chose to conserve 80,000 acres of forested land in the Catskill Mountains and secure a clean water supply for far less money. In 1997, the City formed the Land Acquisition Program, which acquires land and conservation easements.[13] These decisions set the stage for the purchase of development rights and payments to landowners for the protection of water quality through a nine percent increase on water bills. These expenses were a fraction of what it would have cost to build a new water filtration plant. The 96,000 acres of watershed the city now owns provide a reliable supply of clean drinking water to nine million residents from a natural source that is more cost-effective than built infrastructure.

Specifically, the Forest Service is required to: identify "watershed(s) that are [or should be] a priority for maintenance or restoration,"[18] help maintain or protect soils, water quality, and water resources,[19] protect riparian areas,[20] and to "ensure implementation of [best management] practices" to protect water quality.[21] Given their high value, the Forest Service may manage source water areas as a special "designated area" under the Planning Rule, "[a]n area or feature identified and managed to maintain its unique special character or purpose.[22]

National Forests are now required to identify high value areas and maintain water quality and public water supplies. These guidelines provide municipalities and downstream communities a ready-made opportunity to work with the Forest Service during the revision of management plans to protect their water supplies on National Forest lands for the foreseeable future.

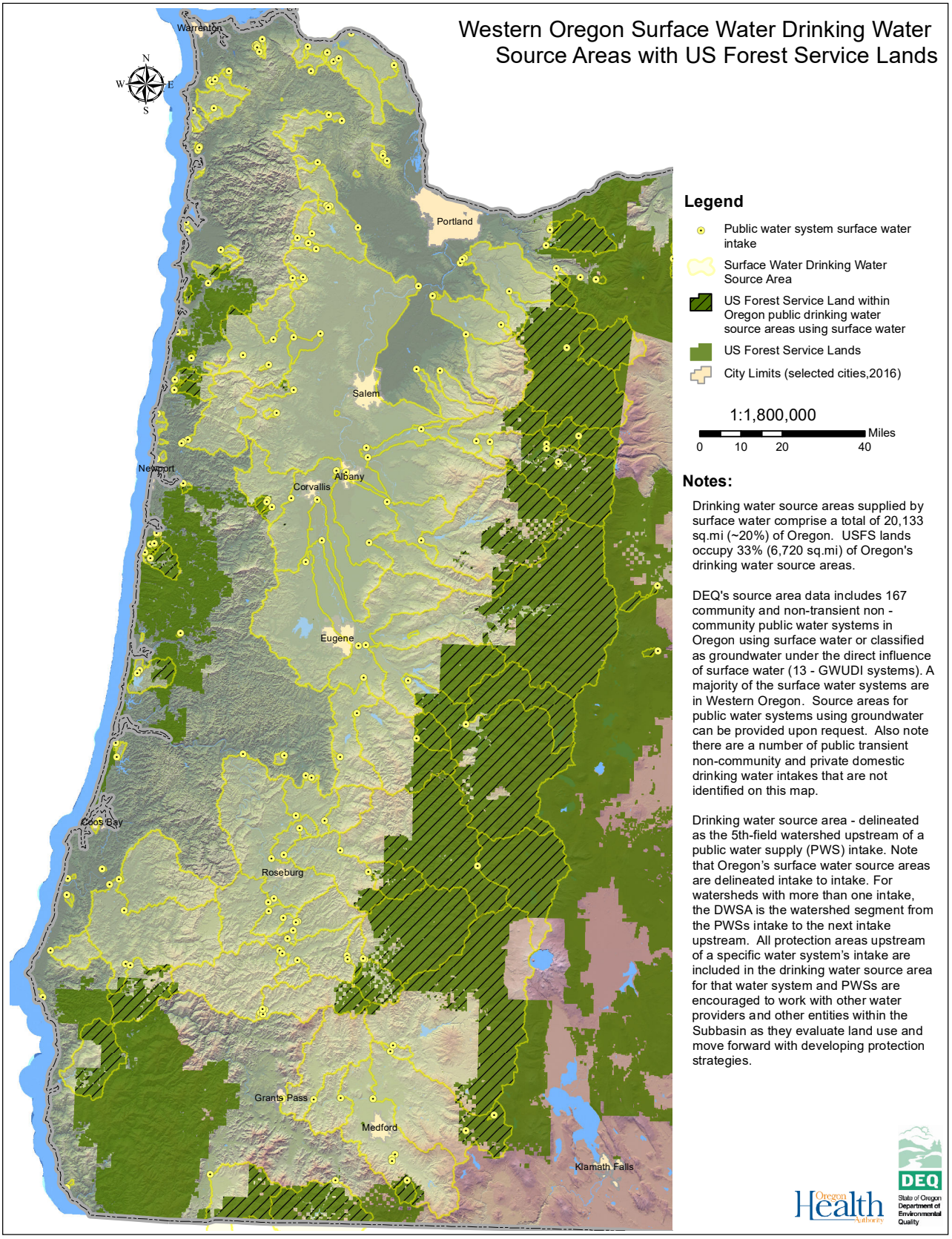
KEY COMPONENTS OF THE AQUATIC CONSERVATION STRATEGY

RIPARIAN RESERVES – Buffers of trees along streams intended to keep stream temperatures cool and to restore aquatic ecosystem function. Within the Nortwest Forest Plan area, there are 2,602,014 acres of riparian reserves.

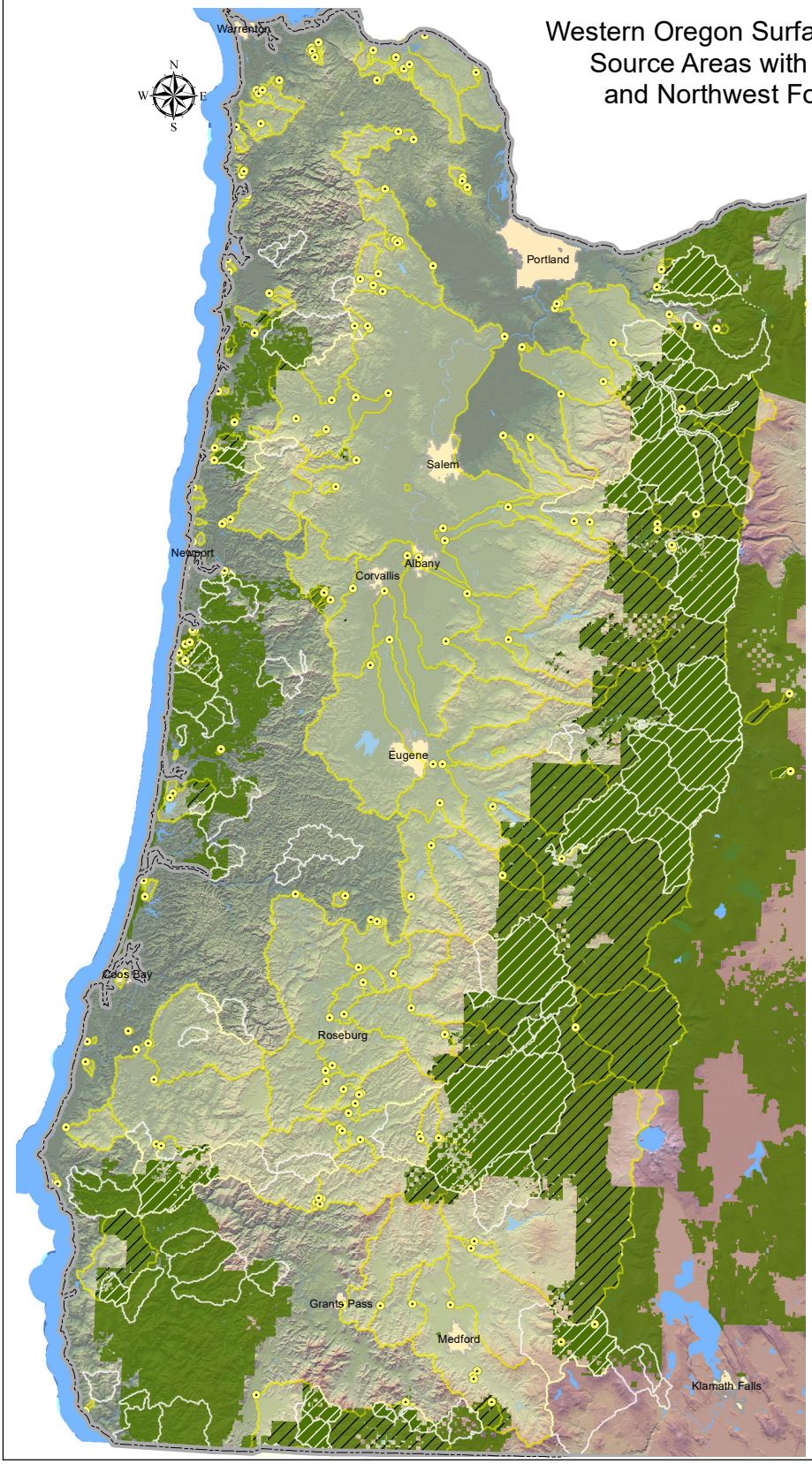
KEY WATERSHEDS – Areas identified as providing the best salmon habitat and water quality.

QUICK FACTS

2,175,000 people – 77% of the population in western Oregon - get their drinking water from source areas with U.S. Forest Service lands.



Oregon DEQ\Water Quality Division Drinking Water Protection Program File:\\deqhq1\DWP\LandUse\2018Feb\Map1_WesternOregonUSFSLandUseinSWDWSAs_12FEB2018.mxd (jkh)



Western Oregon Surface Water Drinking Water Source Areas with US Forest Service Lands and Northwest Forest Plan Key Waterheds

Legend

- Public water system surface water intake
- Surface Water Drinking Water Source Area
- NWFP Key Watershed USFS Land within Oregon drinking water source area using surface water
- Northwest Forest Plan Key Watershed
- US Forest Service Land within Oregon public drinking water source areas using surface water
- US Forest Service Lands
- City Limits (selected cities, 2016)

1:1,800,000

0 10 20 40 Miles

Notes:

"Key Watersheds" are defined by the Forest Ecosystem Management Assessment effort (Northwest Forest Plan - Record of Decision 1994). GIS data downloaded from https://www.blm.gov/or/plans/rmpswesternoregon/prmpdata-details.php?id=15471.

Drinking water source areas supplied by surface water comprise a total of 20,133 sq.mi (~20%) of Oregon. USFS lands occupy 33% (6,720 sq.mi) of Oregon's drinking water source areas.

DEQ's source area data includes 167 community and non-transient non - community public water systems in Oregon using surface water or classified as groundwater under the direct influence of surface water (13 - GWUDI systems). A majority of the surface water systems are in Western Oregon. Source areas for public water systems using groundwater can be provided upon request. Also note there are a number of public transient non-community and private domestic drinking water intakes that are not identified on this map.

Drinking water source area - delineated as the 5th-field watershed upstream of a public water supply (PWS) intake. Note that Oregon's surface water source areas are delineated intake to intake. For watersheds with more than one intake, the DWSA is the watershed segment from the PWSs intake to the next intake upstream. All protection areas upstream of a specific water system's intake are included in the drinking water source area for that water system and PWSs are encouraged to work with other water providers and other entities within the Subbasin as they evaluate land use and move forward with developing protection strategies.

Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ/Water Quality Division Drinking Water Protection Program File:\\deqhq1\DWP\LandUse\2018Feb\Map2_WesternOregonUSFSKeyWatershedinSWDWSAs_12FEB2018.mxd (jkh)

RECOMMENDATIONS FOR RETAINING CLEAN WATER PROTECTIONS ON WESTERN OREGON NATIONAL FORESTS INCLUDE:

• Support existing Aquatic Conservation Strategy practices including riparian buffers and key watersheds.

• Conserve source drinking water areas by minimizing logging in areas with high erosion or runoff potential such as steep slopes and areas that have historic or existing landslides or that are close to drinking water supply intakes.

• Support cooperative public-private partnerships, such as the Drinking Water Providers Partnership, that are focused on restoration of key portions of drinking watersheds.

• Support the decommissioning of unnecessary and high risk forest roads through programs such as the Legacy Roads and Trails Remediation program

THREATS TO DRINKING WATER FROM FORESTS MANAGEMENT ACTIVITIES

In western Oregon, it's no secret that it rains a lot. A healthy, natural or well-managed forest can absorb the rainfall and slowly release it to streams and rivers with little to no impact. But when a forest is poorly managed, or fire scarred, the heavy rainfall can lead to sediment-choked streams that require more chemicals and treatment to make water potable. Examples of forest management activities that create excessive erosion and sediment include clearcut logging on steep slopes and road building. The use of herbicides and fertilizers on private forestlands is another potential source of contamination. Fortunately, the USFS and BLM have largely ceased the application of these chemicals. Under certain climate conditions, clearcuts may increase snow accumulation and the rate of melt, which can lead to increases in peak flows during storm events, particularly during rain-on-snow events. These events often overwhelm downstream treatment plants, making treatment difficult and more expensive.

The majority of land managed by the USDA Forest Service on the west side of the Cascade Mountains contains the highest density of the stream network. These headwater streams are generally well protected by the management protocols of the Northwest Forest Plan. Further downstream, and lower in the watershed, the situation is much different. Private industrial logging is managed under the Oregon Forest Practices Act (OFPA), which has very weak protections for streams and rivers. Under the OFPA, there no streamside buffer requirements on small headwater streams and landowners are allowed to log right through these streams. On larger streams, only minimal buffers are required. Further, clearcut logging is allowed on very steep slopes with thin, high erodible soils. Thousands of miles of roads crisscross the stream network, serving as constant source of sediment to the stream network. And harmful herbicides are applied by helicopter across the landscape, often ending up in drinking water. All of these practices, while lawful under the OFPA, are a major challenge for water providers in supplying safe and affordable drinking water to their customers.

In Oregon, over half of the eight million acres of private timberlands are owned by multinational corporations who manage tree plantations on short rotation in order to maximize profit. These tree plantations impact water supply and quality in several ways. When a natural forest is clearcut and replaced with a tree plantation, stream flow initially increases, but after five years, flows decrease as the dense Douglas Fir plantations begin to grow. Ultimately, base flows are lower flows, which is particularly problematic in low flow years for water suppliers. Stream temperature also increases because of the lower flow. Further, tree plantations are shown to burn more severely, and more often, than surrounding National Forests. The fire-scarred landscape is another major source of sediment. The extent of industrial tree plantations and the management of them under the OFPA, serves to highlight the critical importance of National Forests for providing clean drinking water.

ROADS AND TRAILS

The sheer number of forest roads and stream crossings, many of them poorly designed, represent the largest source of sediment to water bodies from forestry operations.[23] Truck traffic loosens and mobilizes the sediment, particularly during a rain event. Stream crossings with poorly located or maintained structures (culverts, bridges) can also degrade aquatic habitat and block the passage of salmon. Roads intercept, concentrate and divert water into ditches, accelerate runoff, which increases erosion. Depending on the location of the road, the diverted runoff may ultimately flow into a stream that supplies drinking water to a downstream community. Roads also increase the frequency and magnitude of landslides.

LANDSLIDES

Under predicted climate change scenarios for western Oregon, there will likely be an increase in landslides. A Weyerhauser study found higher rainfall levels led to an approximate two to three times increase in landslides in younger tree stands. Further an Oregon Department of Forestry study found that landslides in harvested areas contributed more sediment material and travelled farther than areas not harvested. Areas slated for increased intensity of harvest identified as having a higher susceptibility of landslides would lead to an increased risk to water quality.

Climate change will bring more intense precipitation, increasing the likelihood and magnitude of slope failure.

A better understanding of high erosion potential on National Forests in western Oregon, including the presence of concave or convex geologic features, permeability of soils, high runoff potential and landslide proneness would help planners and downstream communities better assess the risk to in these areas by limiting the type and intensity of harvest. Knowing where we might see a higher risk of landslides would allow forester to apply corresponding management prescriptions to reduce risk to clean water and watershed health.

Road network on private land in the Siletz River watershed. Roads are a significant source of sediment in streams that provide drinking water.

FIRE AND WATER

Fire has always been a natural part of forested landscapes, particularly in the western United States. Each forest type has its own fire regime. On the west side of the Cascades, where wet forests predominate, fires occur less frequently, but they tend to be of high severity due to several factors. In contrast, forests east of the Cascades where rainfall is lower, burn more frequently but are generally low to moderate in severity. When, where, and how severally these forests burn is dependent on numerous factors but climate change is a leading driver of fire frequency. Water providers on either side of the Cascades are dependent on land management practices- be they good or bad, that are protective of source waters.

Forest fire is an essential part of a healthy forest ecosystem. However, a century of forest fire suppression on National Forests, large tree plantations on private lands and changing climatic conditions have created more combustible conditions. While forest fires can provide ecological benefits, a large rainstorm on a fire-scarred landscape can lead to large sediment pulses into nearby streams and rivers. This creates challenges for water providers.

The science on the effects of logging on the fragile post-fire landscape clearly shows dramatic increases in the amount and duration of harmful sediment in streams and rivers compared to watersheds that are left alone to recover. Some simple rules can help reduce harm to water quality and salmon habitat.[24] This includes minimizing or ceasing logging on streamside areas and steep slopes prone to soil erosion and landslides. It is vitally important to avoid building new roads and instead, begin decommission any temporary roads, which are often the largest contributor of stream sediment.

When confronted with decisions about post-fire landscapes, the Forest Service is often pressured to log any merchantable timber. Known as “salvage logging” this practice can have serious impacts on water quality for downstream water providers. Salvage logging impacts soils; productivity is reduced making it more difficulty for trees to regenerate naturally, and erosion is accelerated affecting stream habitat and water quality. With climate change increasing the frequency of fire, the need to avoid harmful practices such as salvage logging increase to protect clean water, soils, and fish and wildlife habitat.[25]

In Oregon, there are examples of sensible forest management actions that reduce the risk of wildfire and protect water quality, older forests, wildlife, people, property and quality of life. The City of Ashland, the U.S. Forest Service and a group of non-profit groups have partnered to create the Ashland Forest Resiliency, a 10-year project to reduce fuel loads while protecting the city’s water supply. The project also prioritizes improving forest health, preserving streamside habitat and protecting unstable slopes and erodible soils, thereby ensuring water quality.

TREATING DRINKING WATER

When rain hits the ground or snow begins to melt in a forest, the condition of the landscape, the type of forest management and the number of roads, trails and ditches will effect sediment delivery to streams and dictate how much treatment will be required downstream. Generally, treating drinking water at the treatment plant is a four-step process consisting of coagulation, flocculation, sedimentation, and filtration. First, aluminum sulphate (alum) is added to raw (untreated) water to force impurities to coagulate to form larger particles called floc. Water then flows into a sedimentation basin where the floc settles out. Settled floc is removed from the sedimentation basins as a sludge and disposed. In the third step, clarified water passes through a filter of layered media, including carbon, sand and garnet. The filters trap and remaining small particles in the water and the carbon adsorbs many chemical contaminates. Chlorine is added to disinfect the water and keep it safe as it travels through the distribution system.

In coastal Oregon, many small communities rely on simple sand filters and sodium hypochlorite (liquid chlorine) for disinfection. These systems can be easily overwhelmed by high, turbid streamflows entering the treatment plant and some communities must switch to groundwater wells as a back-up under certain conditions. Highly turbid water requires more coagulants to remove the particulate matter, increasing costs. Dirty source water also requires using more chlorine to kill harmful bacteria; however, this creates a potential health issue. Turbid and sediment laden source water contains more organic matter, which requires more chlorine to adequately disinfect the water. When chlorine comes in contact with organic matter, disinfectant by-products such as trihalomethanes and haloacetic acids are formed. Trihalomethanes are known carcinogens and the Environmental Protection Agency sets maximum contaminate levels of these chemical compounds in drinking water to protect human health.

IN CONCLUSION

With our forests, and in particular our National Forests, providing natural filtration for two-thirds of the nation's water supply, we should take steps to preserve the low-cost clean water services that they provide. In Oregon, as elsewhere, these forests provide the best and lowest-cost water infrastructure. Healthy, intact, forested watersheds have been proven to maintain the highest water quality, conserve water supplies through increased groundwater recharge, and reduce flood damage by absorbing storm run-off.

By applying the common sense policies of the Northwest Forest Plan on National Forests in Oregon, including the continued use of wide riparian buffers, protecting source drinking water areas, supporting investments in restoration of drinking watersheds, and addressing outdated forest roads, we will continue to reap the clean water benefits our National Forests provide well into the future.

WATERSHED CASE STUDIES

The following case studies of watersheds and communities in Oregon illustrate the connection between forest management and drinking water. They highlight areas within the watershed that should demand special management consideration when the Northwest Forest Plan is revised.

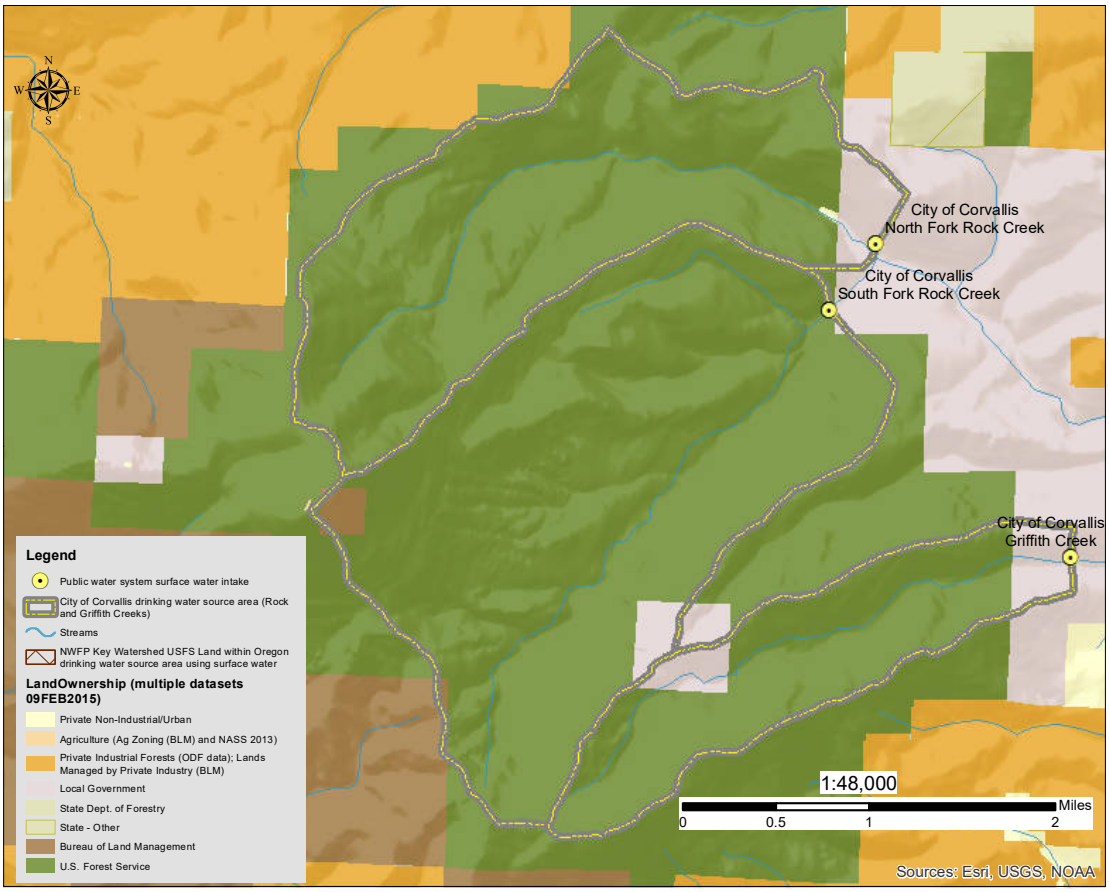
CORVALIS, OREGON

A CASE STUDY

CORVALLIS, OREGON

Some 56,000 residents of the City of Corvallis gets their drinking water from four sources: the Willamette River, Griffith Creek, North Fork Rock Creek and the South Fork Rock Creek. About half of the city's water supply comes from Griffith and the two forks of Rock Creek. Nearly 95% of the Drinking Water Source Area (DWSA) for Griffith and Rock Creek is within the Siuslaw National Forest. In its Source Water Assessment, the Department of Environmental Quality identified managed forestlands as a potential source of contamination to surface waters supplying the treatment plant, though it notes that minimal logging has occurred in the DWSA because Forest Service manages the land for the protection of municipal water supply.

City of Corvallis (PWS 00225) Rock and Griffith Creek Drinking Water Source Areas with Land Use/Ownership



Notes:

Land Ownership/Use - The dataset is a combination of multiple datasets that have been modified by grouping land owner categories in order to simplify data display on the map. See Notes for data sources, methods, and data limitations avaliable at http://www.oregon.gov/deq/wq/programs/Pages/DWP-Maps.aspx. Because of the nature of combining multiple datasets, minor discrepancies will be seen in some maps especially at larger scales. Users are encouraged to use tax lot data available from individual the counties or other datasets to further refine the analysis if higher accuracy is needed.

Key Watersheds - defined by the Forest Ecosystem Management Assessment effort (Northwest Forest Plan - Record of Decision 1994). GIS data downloaded from https://www.blm.gov/or/plans/rmpswesternoregon/prmpdata-details.php?id=15471.

Drinking water source area - delineated as the 5th-field watershed upstream of a public water supply (PWS) intake. Note that Oregon's surface water source areas are delineated intake to intake. For watersheds with more than one intake, the DWSA is the watershed segment from the PWSs intake to the next intake upstream. All protection areas upstream of a specific water system's intake are included in the drinking water source area for that water system and PWSs are encouraged to work with other water providers and other entities within the Subbasin as they evaluate land use and move forward with developing protection strategies.

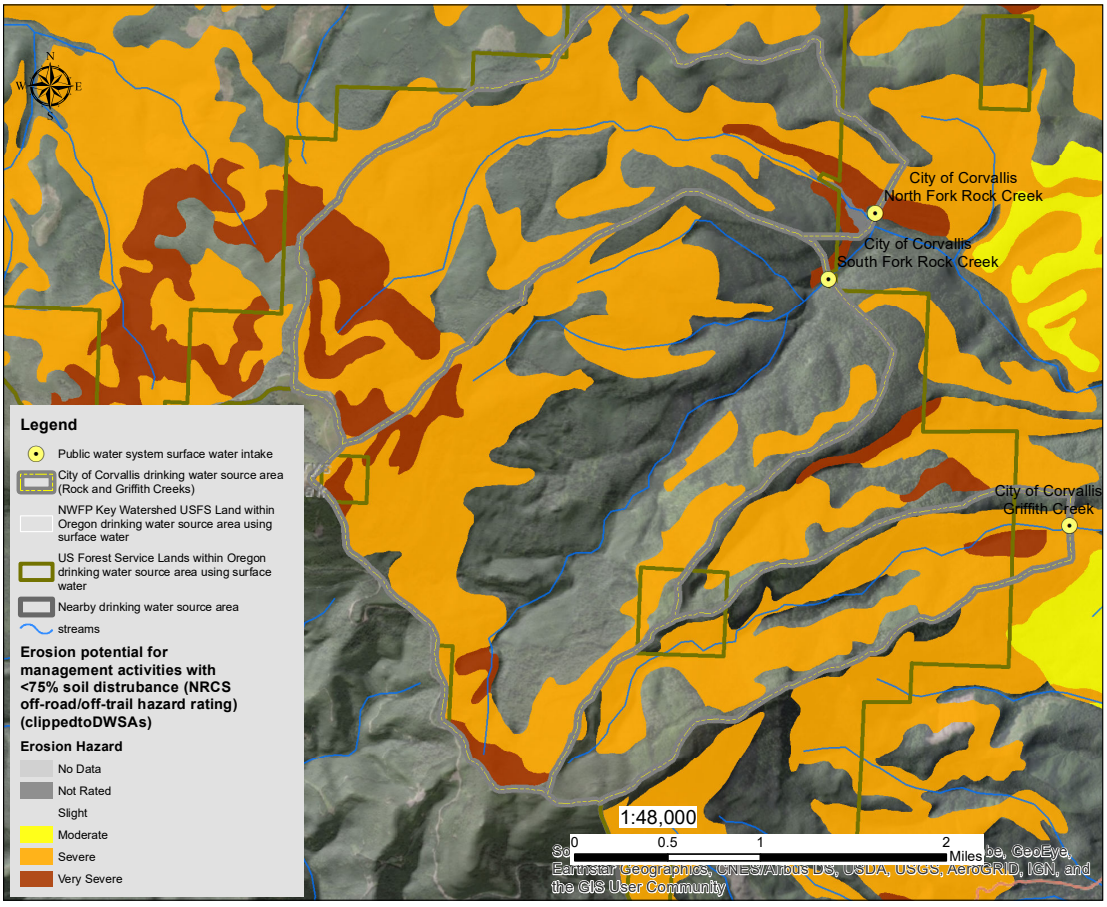
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapA_CprvallissUSFSLandUse.mxd (jkh)

Much of the DWSA contains lands with high to severe erosion potential from non-road and non-trail uses, including forest management activities. The presence erodible soils in the watershed illustrates that careful forest management by the Forest Service can prevent erosion and maintain good water quality. Note: Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.

City of Corvallis (PWS 00225) Rock and Griffith Creek Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



Notes:

High Soil Erosion Potential - This dataset provides surface erosion hazard ratings for areas where up to 75% of the soil surface is disturbed by non-road and non-trail uses (such as uncontrolled grazing, forestry, heavy equipment use, fire control, and mining). The erosion hazard ratings are calculated by the Natural Resource Conservation Service using inherent soil properties for whole soil erodibility and slope. This method underestimates erosion hazard for Histosol soils and for gully erosion, plowing or other disturbances that "disturb up to nearly 100 percent of the area and change the character of the soil". In the Updated Source Water Assessments, DEQ maps only those locations where risk is moderate or higher AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible. Other assessment methods may be more appropriate for flatter terrains with 75-100% soil disturbance or in areas where NRCS soils data is not available (some National Forest Lands). Where NRCS soils data is not available (typically National Forest Lands) Soil Resource Inventory information from the US Forest Service can be used to evaluate erosion potential.

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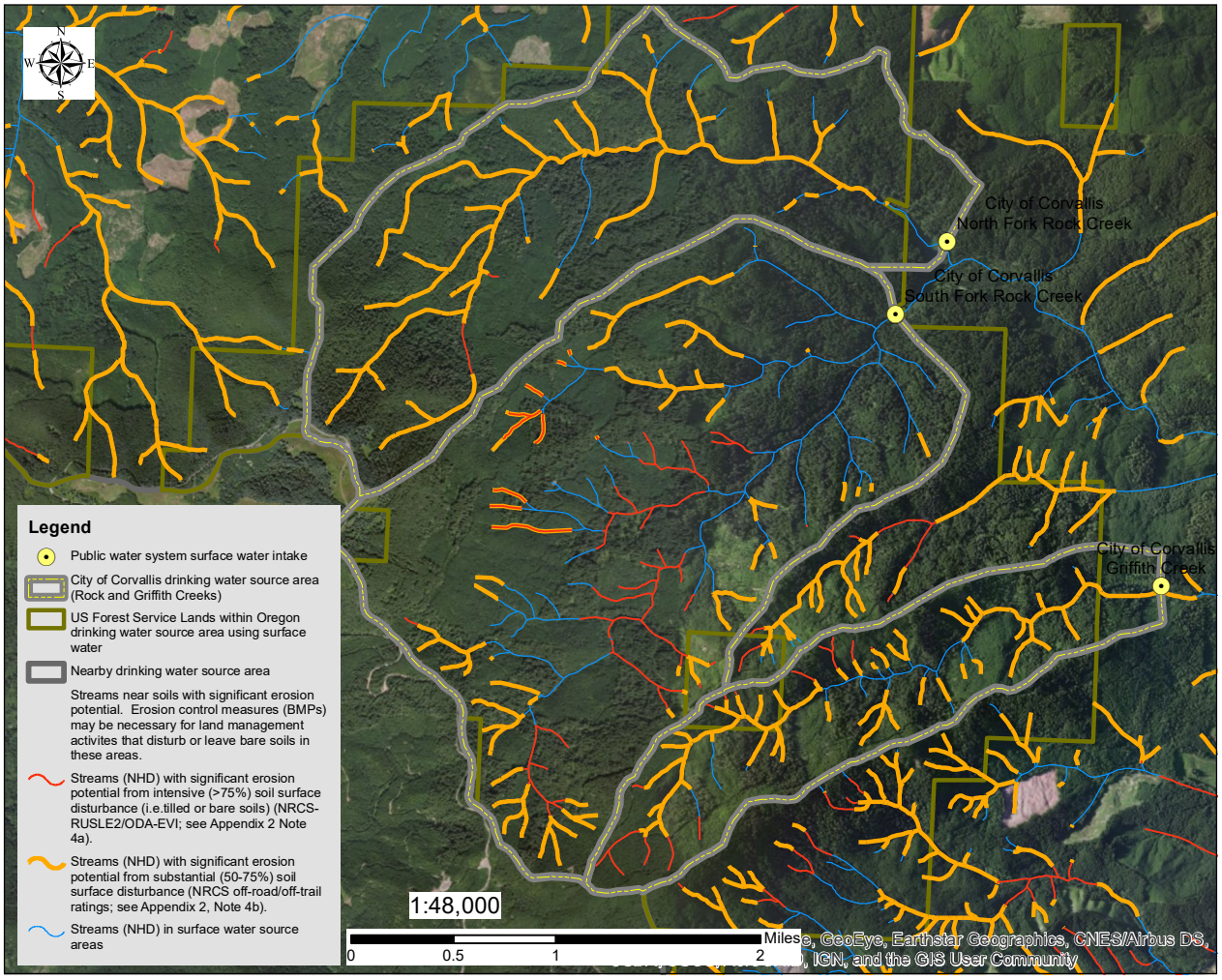
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapB_CorvallisUSFSandErosion.mxd (jkh)

City of Corvallis (PWS 00225) Rock and Griffith Creek Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



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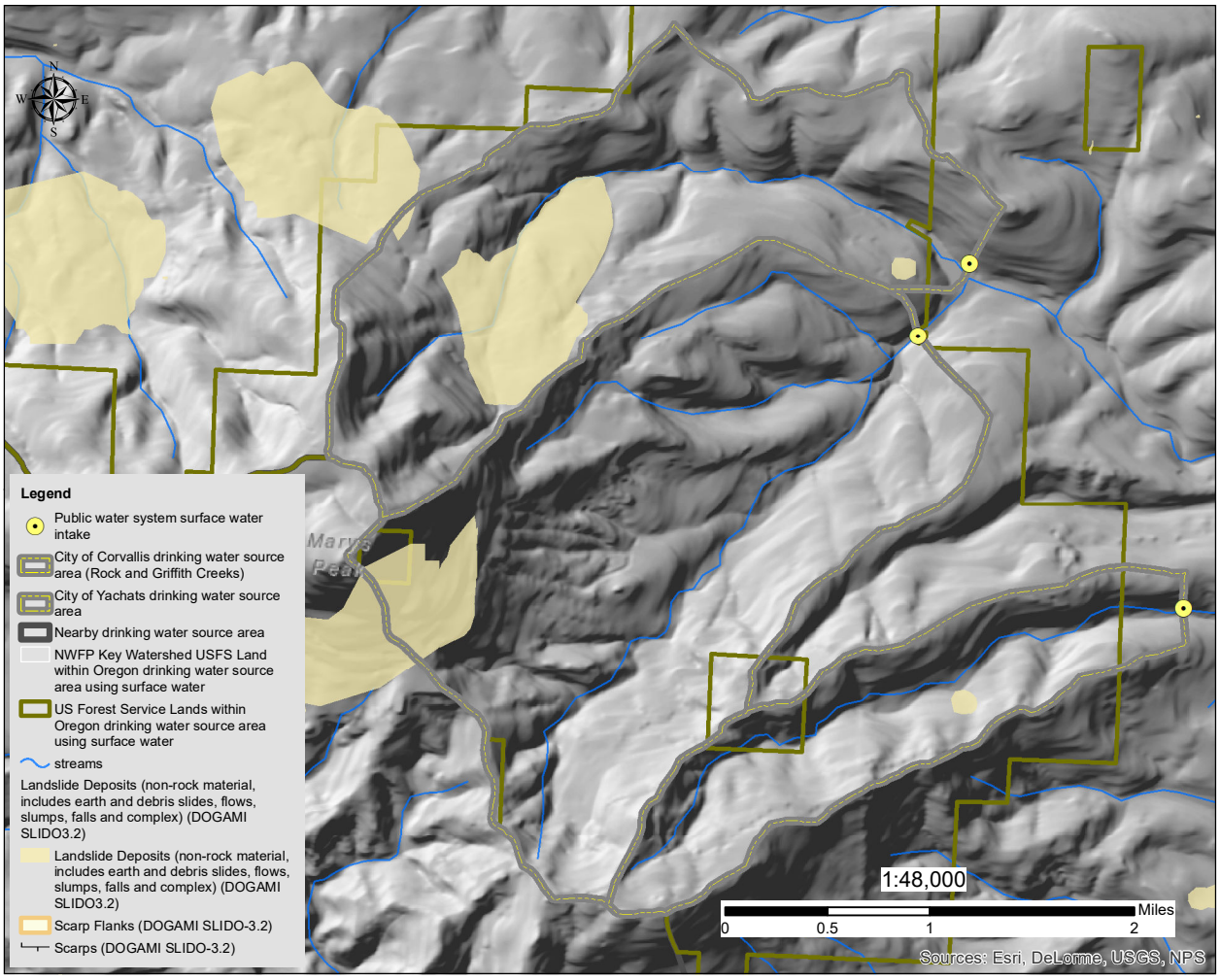
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapC_CorvallisUSFSnErosionStreams.mxd (jkh)

Landslides have been mapped in the Corvallis DWSA. The combination of steep slopes, erodible soils and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

City of Corvallis (PWS 00225) Rock and Griffith Creek Drinking Water Source Areas with US Forest Service Lands and Landslide Hazards Map



Notes:

Landslide Data - published by DOGAMI to improve the understanding of landslide hazards in Oregon and to provide a statewide base level of landslide data. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication. For more information see: http://www.oregongeology.org/sub/slido/

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Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapD_CorvallisUSFSandLandslides.mxd (jkh)

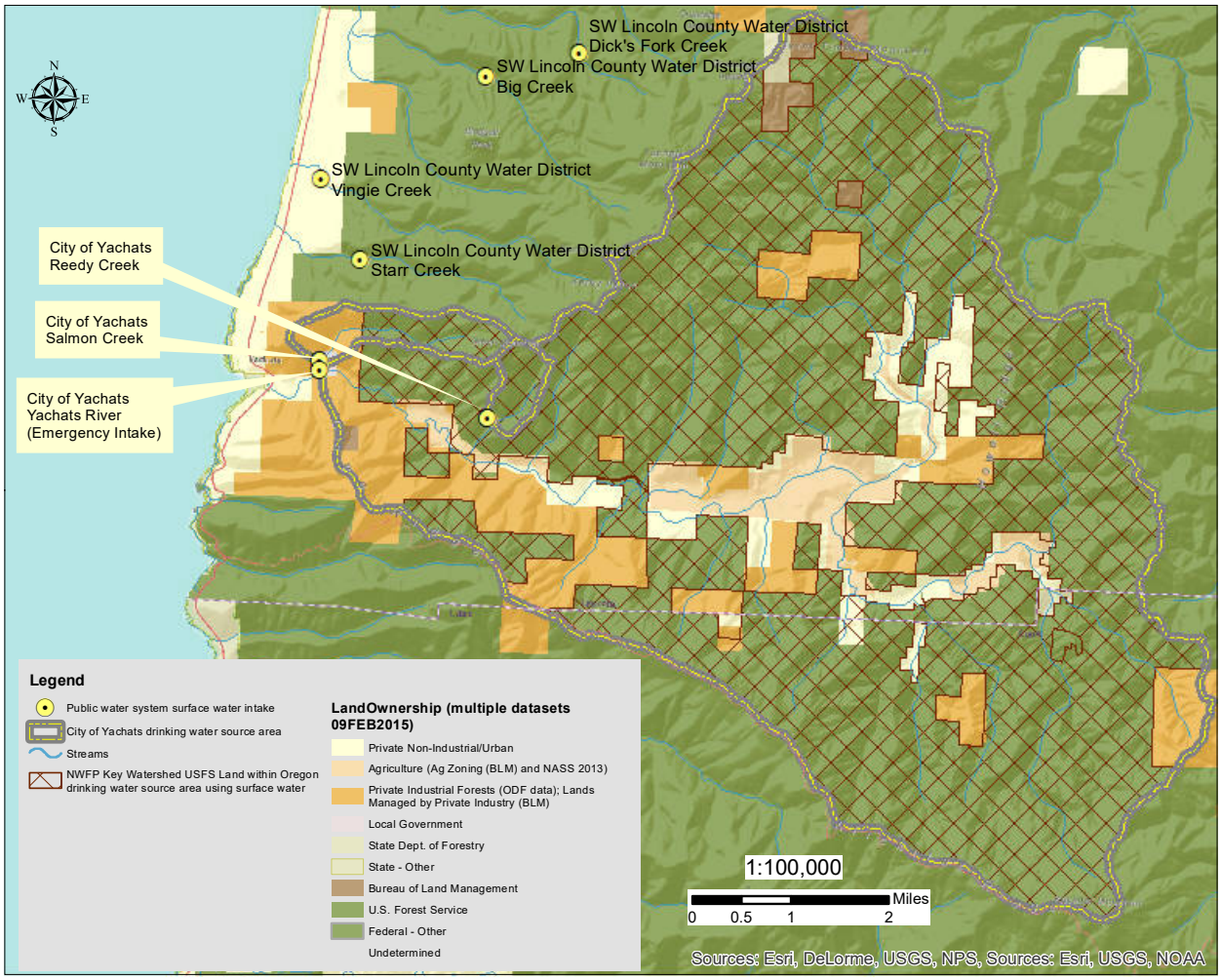
YACHATS OREGON

A CASE STUDY

CITY OF YACHATS

The drinking water for the City of Yachats is supplied by intakes on Salmon Creek and Reedy Creek. The system supplies nearly 1,000 residents of Yachats. There is also an emergency intake on the Yachats River. Five hundred acres of the DWSA is owned by the U.S. Forest Service and is managed as a key watershed. Private industrial forestlands and other land uses also occur within the watershed.

City of Yachats (PWS 00966)
Drinking Water Source Areas with Land Use/Ownership



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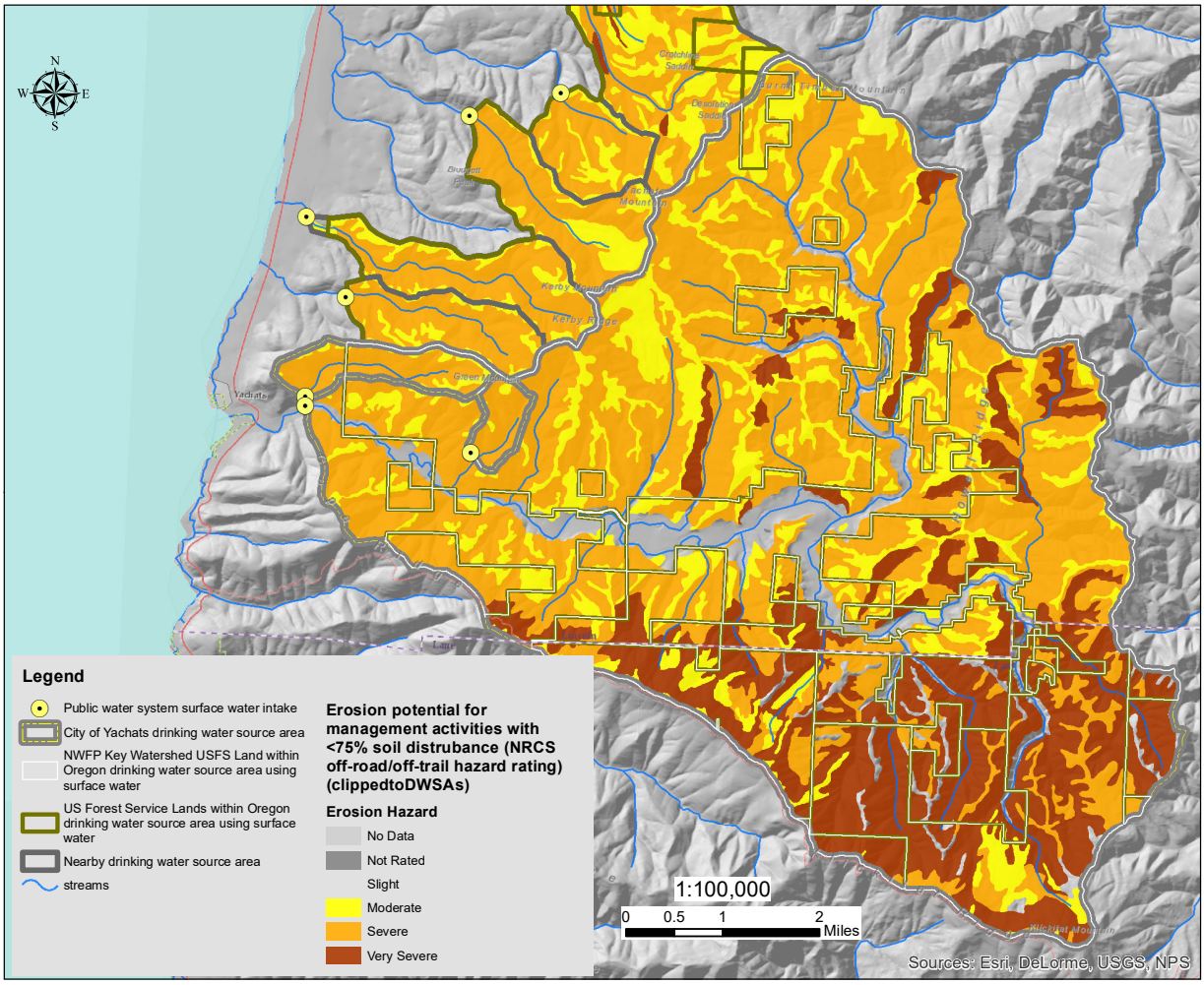
Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapA_YachatsUSFSLandUse.mxd (jkh)

The DWSA contains lands with moderate, severe and highly severe erosion potential from non-road and non-trail uses, including forest management activities.[26] 9.36 stream miles (100%) are in erodible soils. Note: The Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.[27]

City of Yachats (PWS 00966)
Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



Notes:

High Soil Erosion Potential - This dataset provides surface erosion hazard ratings for areas where up to 75% of the soil surface is disturbed by non-road and non-trail uses (such as uncontrolled grazing, forestry, heavy equipment use, fire control, and mining). The erosion hazard ratings are calculated by the Natural Resource Conservation Service using inherent soil properties for whole soil erodibility and slope. This method underestimates erosion hazard for Histosol soils and for gully erosion, plowing or other disturbances that "disturb up to nearly 100 percent of the area and change the character of the soil". In the Updated Source Water Assessments, DEQ maps only those locations where risk is moderate or higher AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible. Other assessment methods may be more appropriate for flatter terrains with 75-100% soil disturbance or in areas where NRCS soils data is not available (some National Forest Lands). Where NRCS soils data is not available (typically National Forest Lands) Soil Resource Inventory information from the US Forest Service can be used to evaluate erosion potential.

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Oregon Health Authority
DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapB_LyachatsUSFSandErosion.mxd (jkh)

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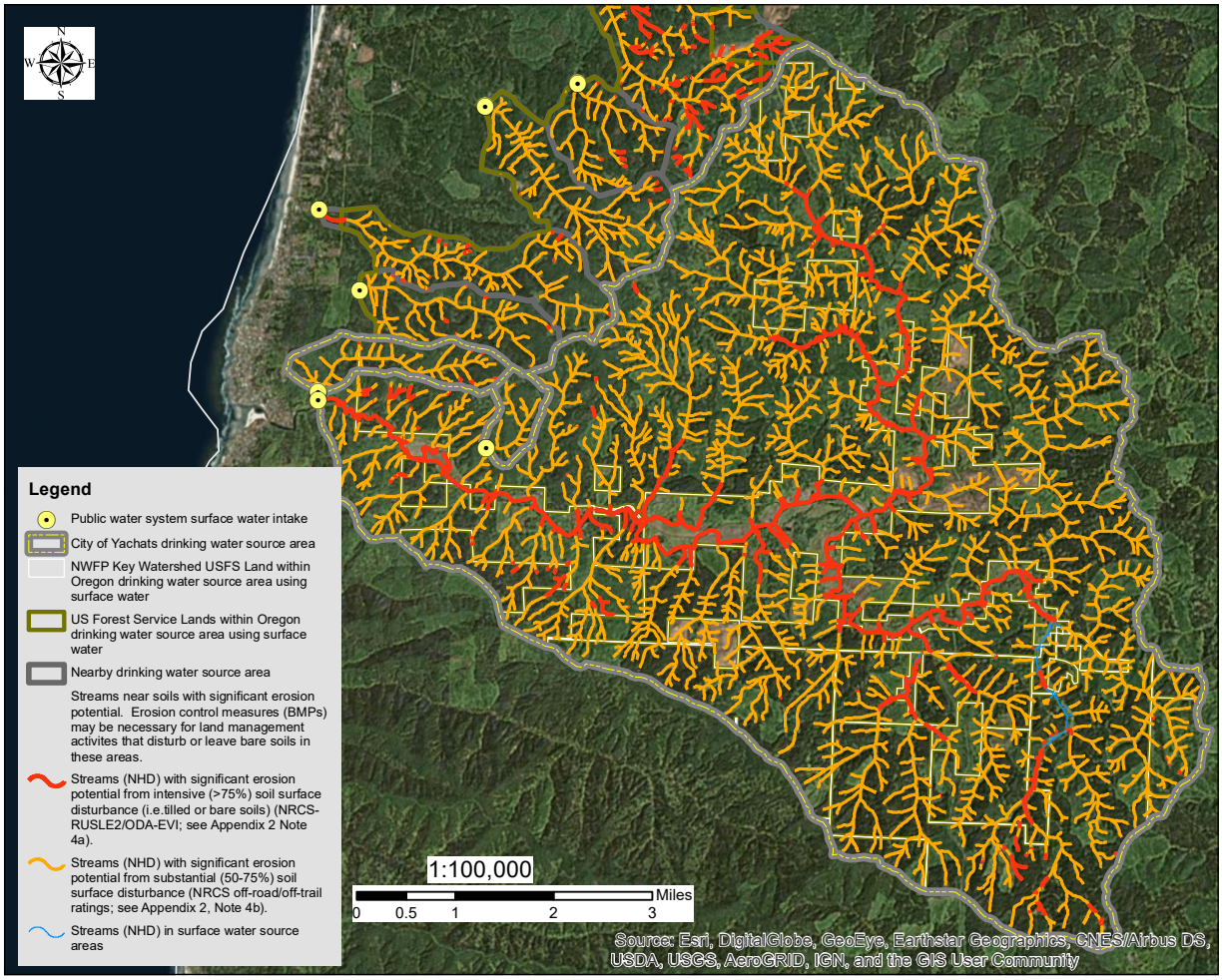

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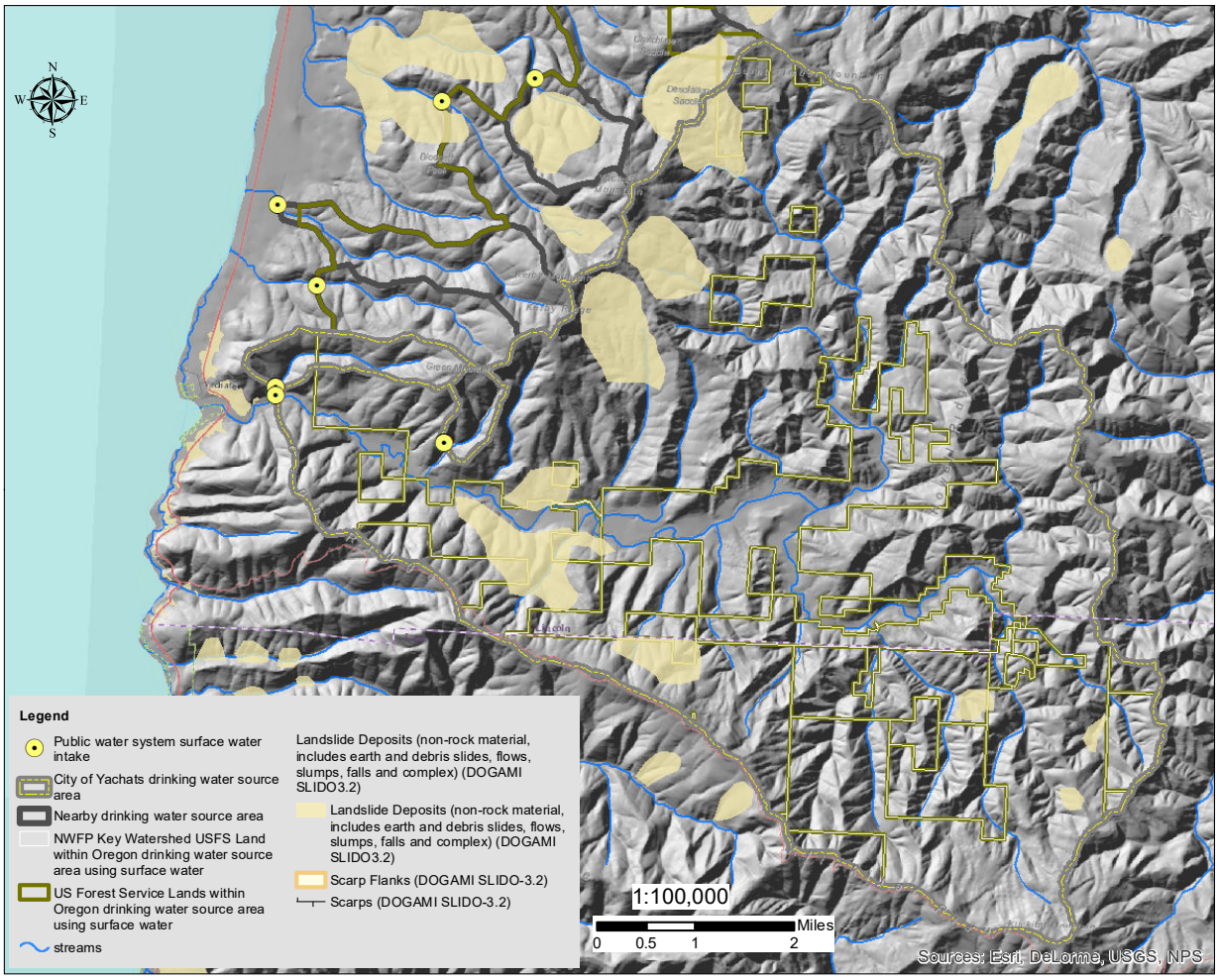
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapC_YachatsUSFSnErosionStreams.mxd (jkh)

There are moderate to severe landslide hazard within the DWSA, including near the drinking water intakes. The presence of industrial forest management activities in the watershed highlights the importance of management by the Forest Service in protecting water quality. The combination of steep slopes, erodible soils, and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

City of Yachats (PWS 00966)
Drinking Water Source Areas with US Forest Service Lands and Landslide Hazards Map



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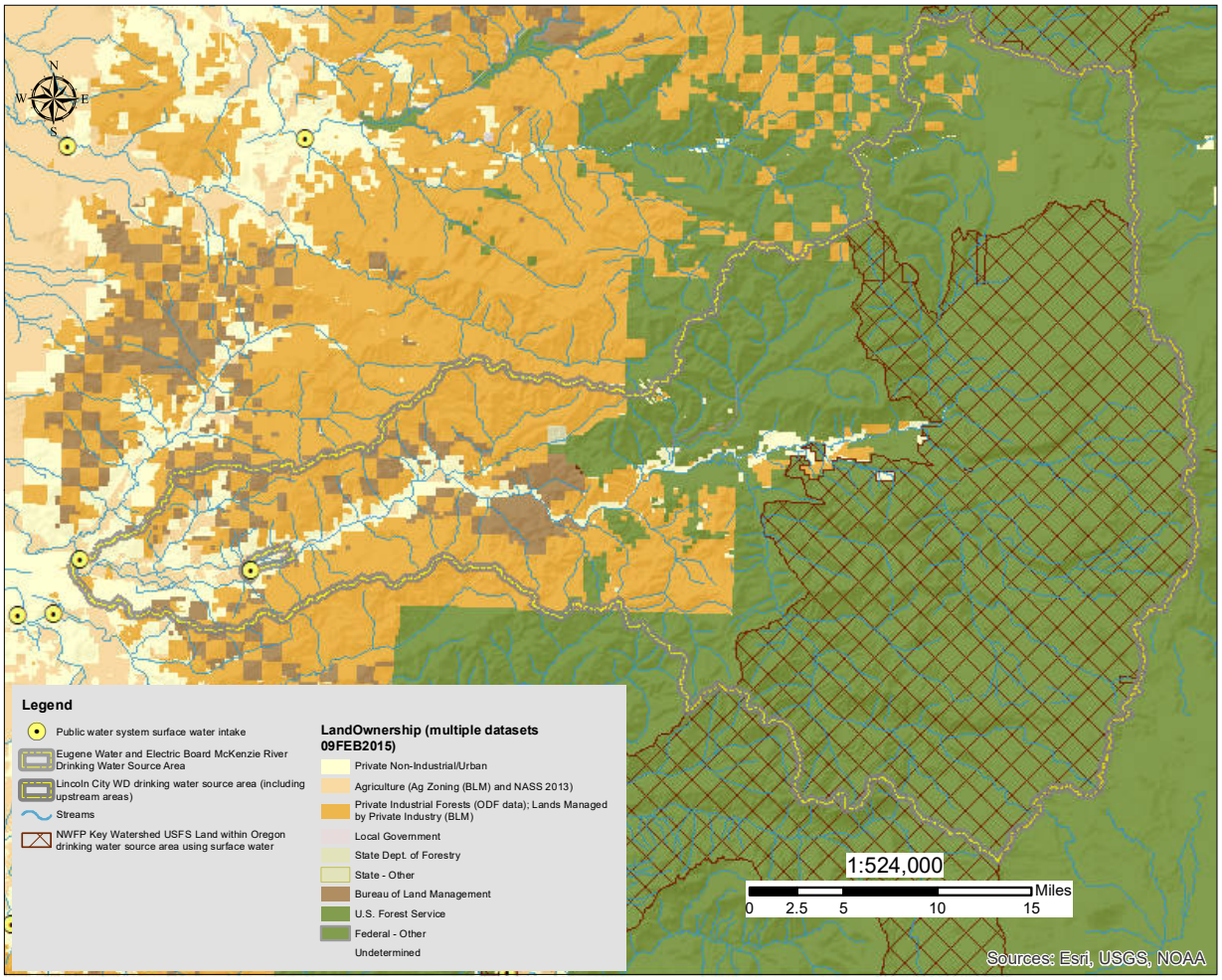
EUGENE, OREGON

A CASE STUDY

CITY OF EUGENE

Nearly 184,00 residents of Eugene get their drinking water from the McKenzie River. Much of the DWSA lies within the Willamette National Forest and is managed as a Key Watershed. In 2000, the Eugene Electric and Water Board developed a comprehensive source water protection plan to monitor and mitigate contaminates within the DWSA.

Eugene Water and Electric Board (PWS 00287) McKenzie River Drinking Water Source Area with Land Use/Ownership



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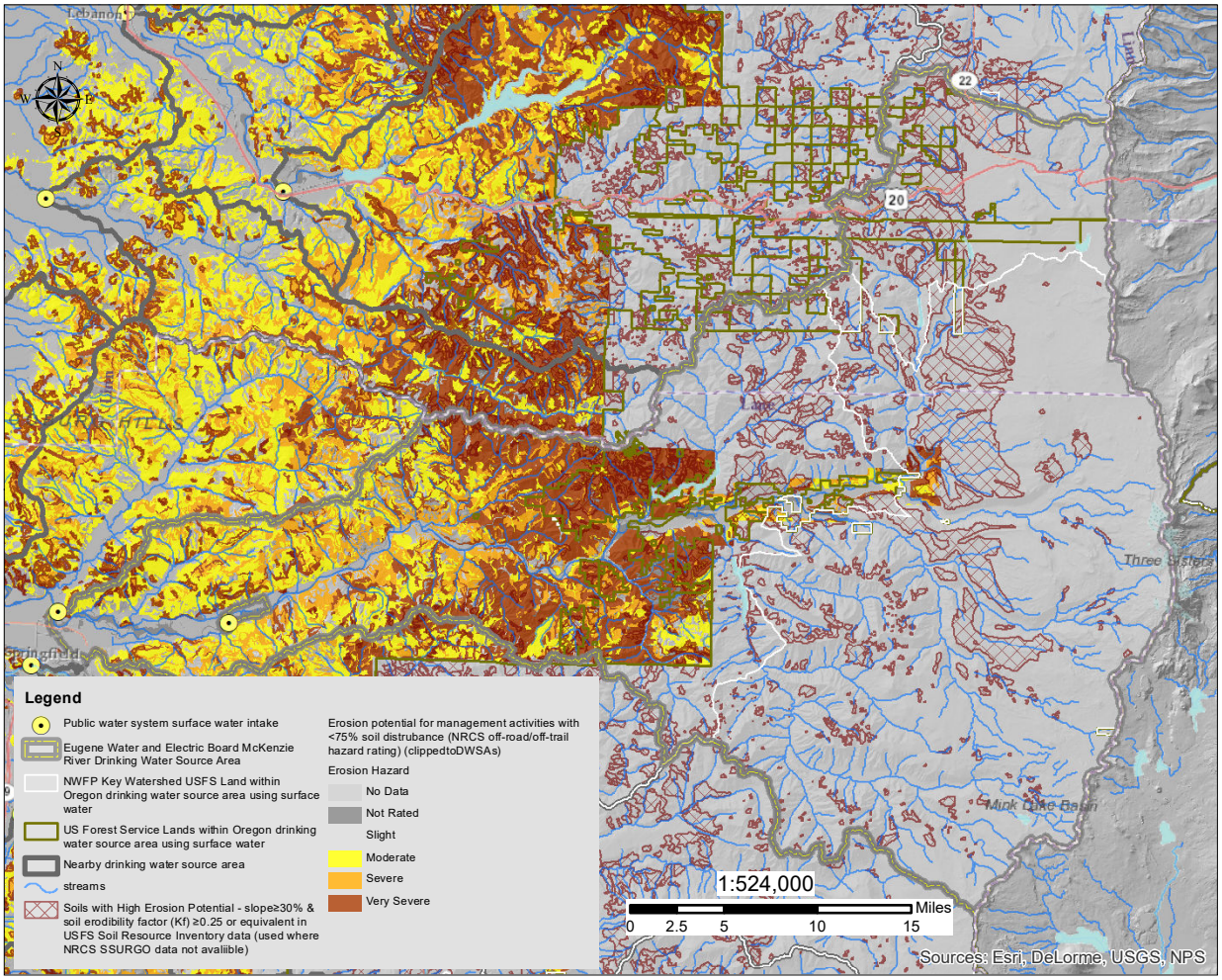
Oregon Health Authority | DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapA_EugeneLandUse.mxd (jkh)

Much of the DWSA contains lands with high to severe erosion potential from non-road and non-trail uses, including forest management activities. Note: Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.

Eugene Water and Electric Board (PWS 00287) McKenzie River Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



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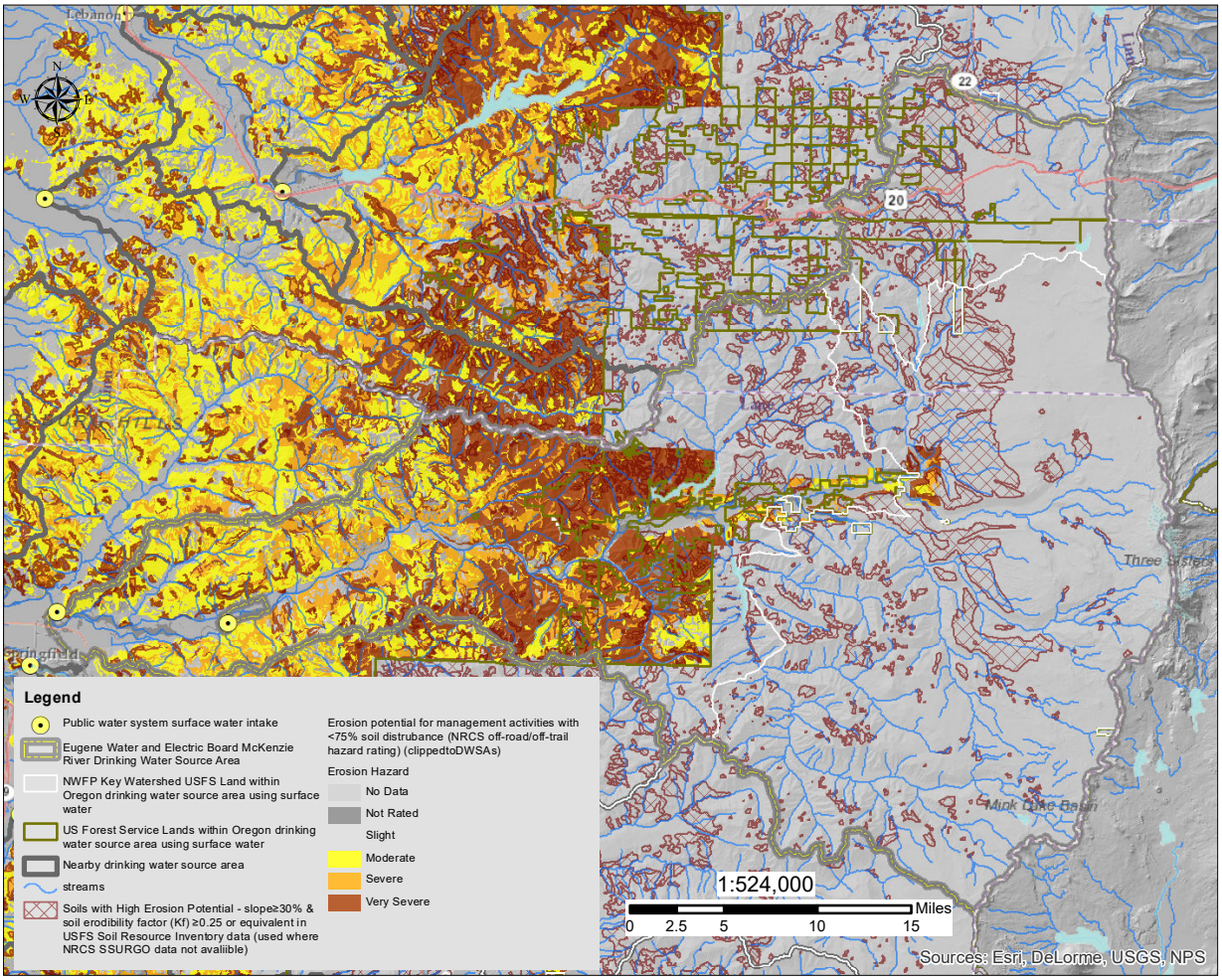

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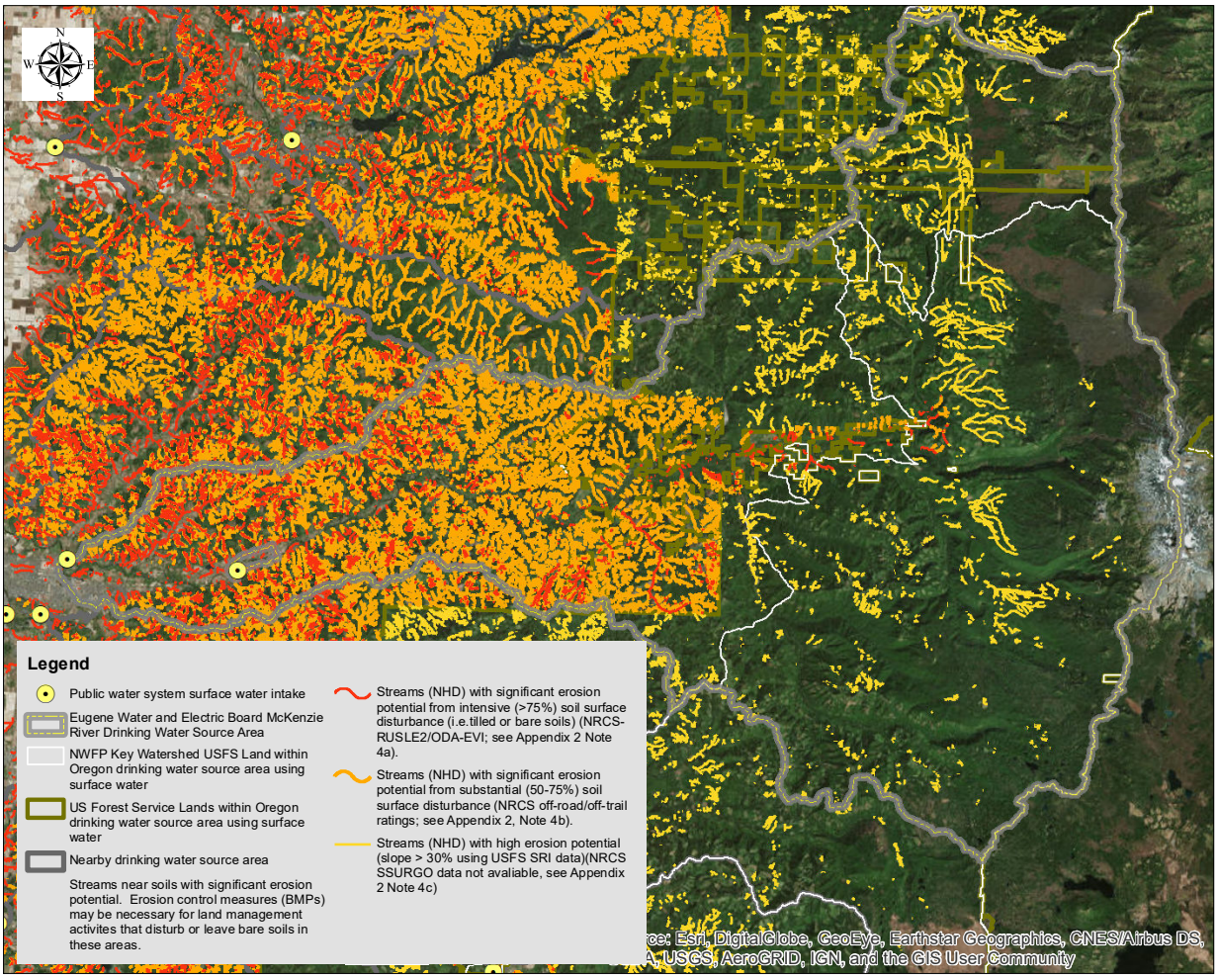
Landslides have occurred throughout the DWSA. The combination of steep slopes, erodible soils and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

Eugene Water and Electric Board (PWS 00287) McKenzie River Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



Notes:

High Soil Erosion Potential - This dataset provides surface erosion hazard ratings for areas where up to 75% of the soil surface is disturbed by non-road and non-trail uses (such as uncontrolled grazing, forestry, heavy equipment use, fire control, and mining). The erosion hazard ratings are calculated by the Natural Resource Conservation Service using inherent soil properties for whole soil erodibility and slope. This method underestimates erosion hazard for Histosol soils and for gully erosion, plowing or other disturbances that "disturb up to nearly 100 percent of the area and change the character of the soil". In the Updated Source Water Assessments, DEQ maps only those locations where risk is moderate or higher AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible. Other assessment methods may be more appropriate for flatter terrains with 75-100% soil disturbance or in areas where NRCS soils data is not available (some National Forest Lands). Where NRCS soils data is not available (typically National Forest Lands) Soil Resource Inventory information from the US Forest Service is used to evaluate erosion potential. Erosion potential for soils represented in the SRI data is based on available representative data attributes such as sedimentation yield potential, sediment, or surface soil erosion potential. Specific information on the factors used for each National Forest to evaluate sensitivity is available from DEQ upon request. In the Updated Source Water Assessments, DEQ mapped locations where soils with erosion risk is within 300 feet of surface water to estimate where delivery to water is possible.

Key Watersheds - defined by the Forest Ecosystem Management Assessment effort (Northwest Forest Plan - Record of Decision 1994). GIS data downloaded from https://www.blm.gov/or/plans/rmpswesternoregon/prmpdata-details.php?id=15471.

Drinking water source area - delineated as the 5th-field watershed upstream of a public water supply (PWS) intake. Note that Oregon's surface water source areas are delineated intake to intake. For watersheds with more than one intake, the DWSA is the watershed segment from the PWSs intake to the next intake upstream. All protection areas upstream of a specific water system's intake are included in the drinking water

Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapC_EugeneUSFSnErosionStreams.mxd (jkh)

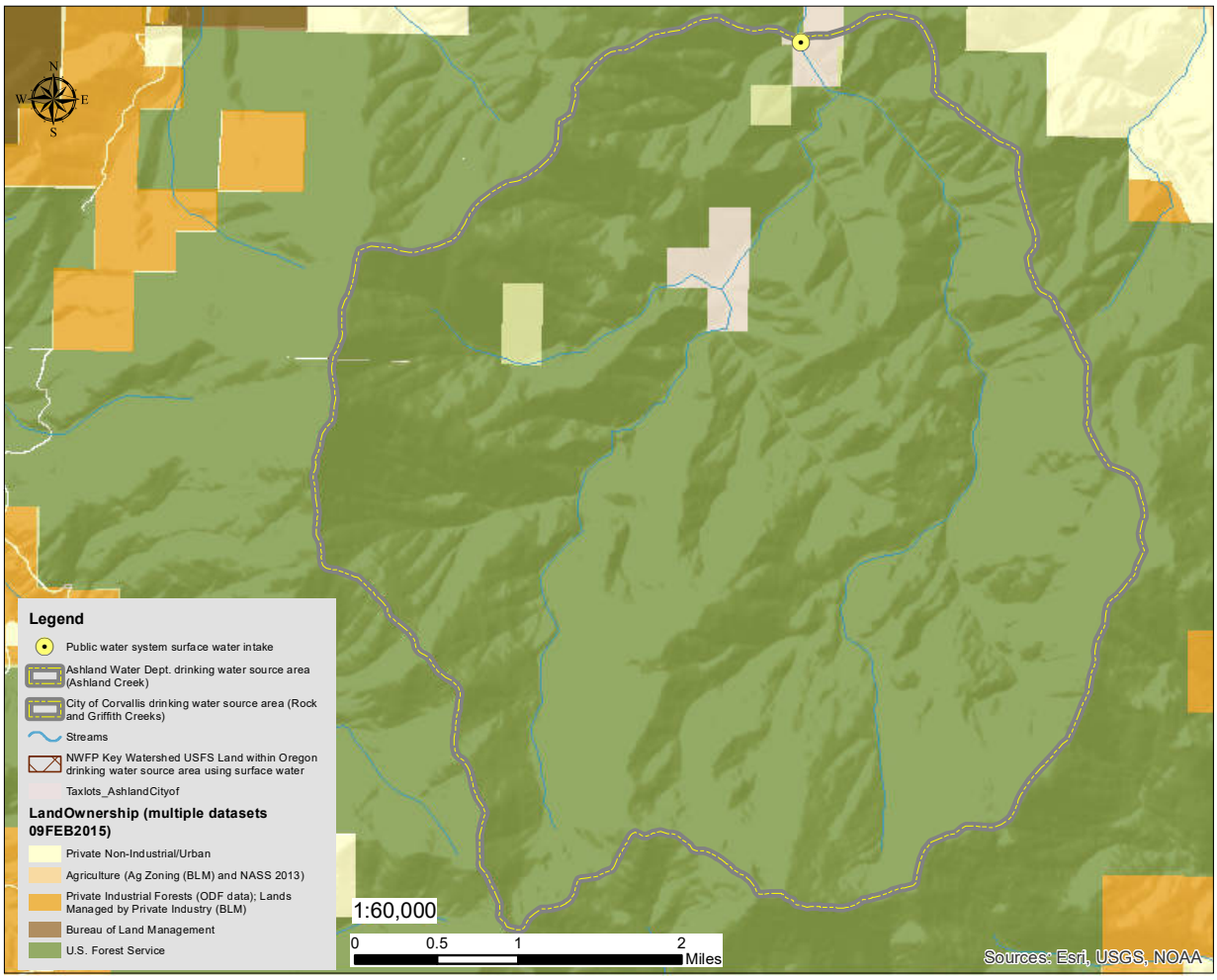
ASHLAND, OREGON

A CASE STUDY

CITY OF ASHLAND

21,105 residents of Ashland get their drinking water from Ashland Creek and Reeder Reservoir. 12,515 acres (98% of the DWSA) is owned by the Forest Service and has been managed to protect water quality since 1929.

Ashland Water Department (PWS 00047) Ashland Creek Drinking Water Source Areas with Land Use/Ownership



Notes:

Land Ownership/Use - The dataset is a combination of multiple datasets that have been modified by grouping land owner categories in order to simplify data display on the map. See Notes for data sources, methods, and data limitations avaliable at http://www.oregon.gov/deq/wq/programs/Pages/DWP-Maps.aspx. Because of the nature of combining multiple datasets, minor discrepancies will be seen in some maps especially at larger scales. Users are encouraged to use tax lot data available from individual the counties or other datasets to further refine the analysis if higher accuracy is needed.

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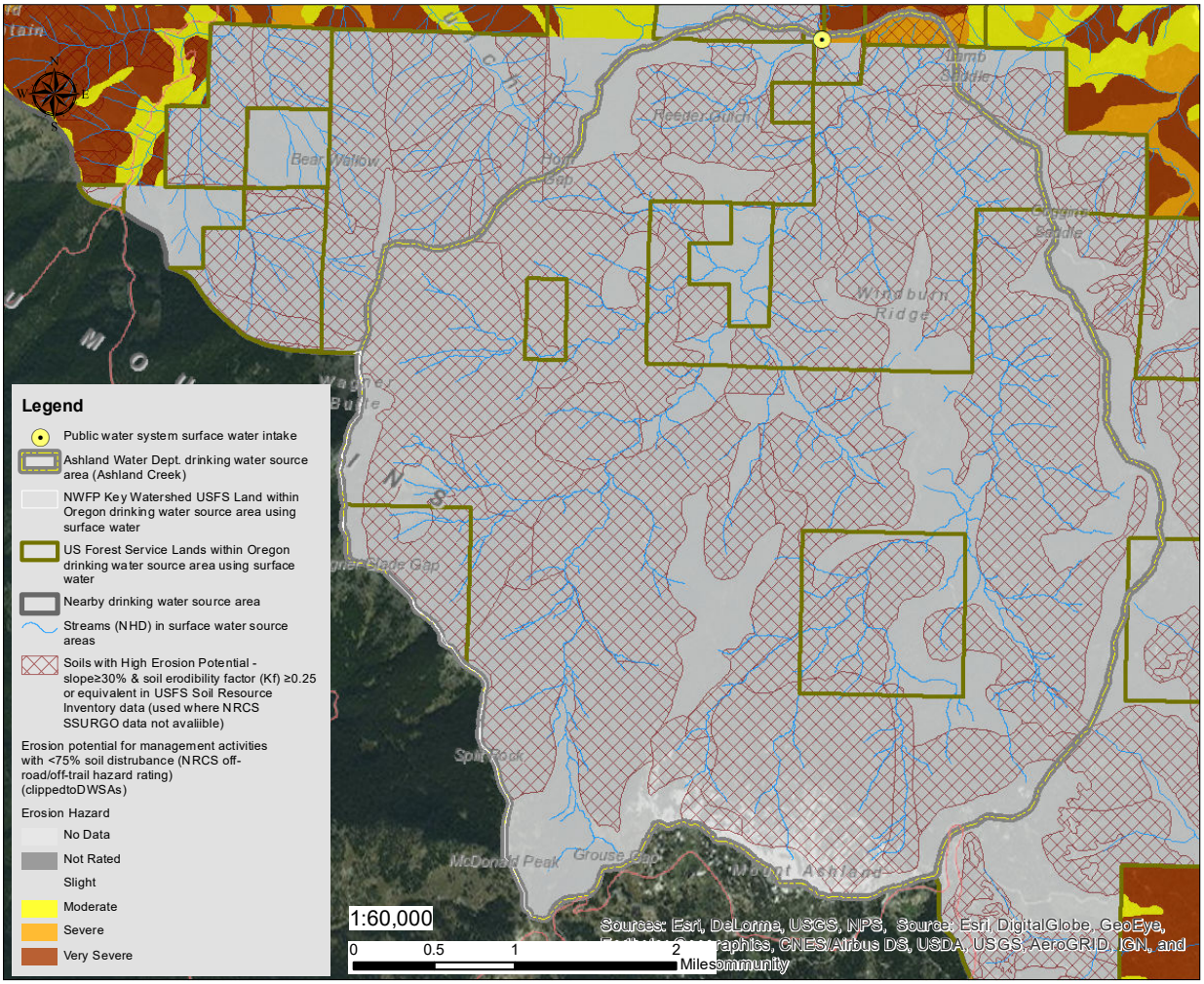
Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018May\MapA_AshlandLandUse.mxd (jkh)

Much of the DWSA contains lands with high erosion potential from non-road and non-trail uses, including limited forest management activities. There are 62 stream miles (75%) in erodible soils within the DWSA. Note: Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.

Ashland Water Department (PWS 00047)
Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities



Notes:

High Soil Erosion Potential - This dataset provides surface erosion hazard ratings for areas where up to 75% of the soil surface is disturbed by non-road and non-trail uses (such as uncontrolled grazing, forestry, heavy equipment use, fire control, and mining). The erosion hazard ratings are calculated by the Natural Resource Conservation Service using inherent soil properties for whole soil erodibility and slope. This method underestimates erosion hazard for Histosol soils and for gully erosion, plowing or other disturbances that "disturb up to nearly 100 percent of the area and change the character of the soil". In the Updated Source Water Assessments, DEQ maps only those locations where risk is moderate or higher AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible. Other assessment methods may be more appropriate for flatter terrains with 75-100% soil disturbance or in areas where NRCS soils data is not available (some National Forest Lands). Where NRCS soils data is not available (typically National Forest Lands) Soil Resource Inventory information from the US Forest Service is used to evaluate erosion potential. Erosion potential for soils represented in the SRI data is based on available representative data attributes such as sedimentation yield potential, sediment, or surface soil erosion potential. Specific information on the factors used for each National Forest to evaluate sensitivity is available from DEQ upon request. In the Updated Source Water Assessments, DEQ mapped locations where soils with erosion risk is within 300 feet of surface water to estimate where delivery to water is possible.

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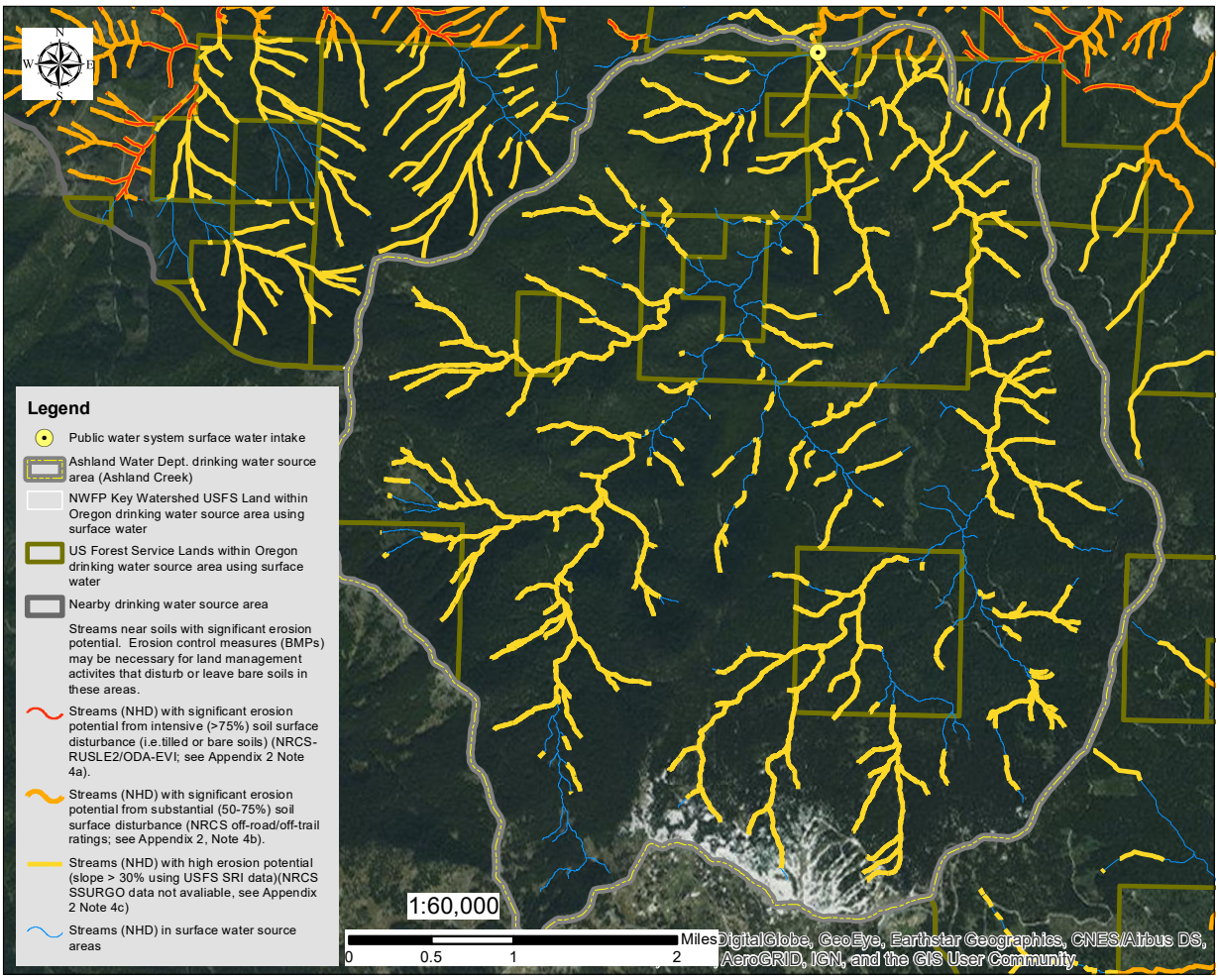
Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapB_AshlandUSFSandErosion.mxd (jkh)

Ashland Water Department (PWS 00047)
Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



Notes:

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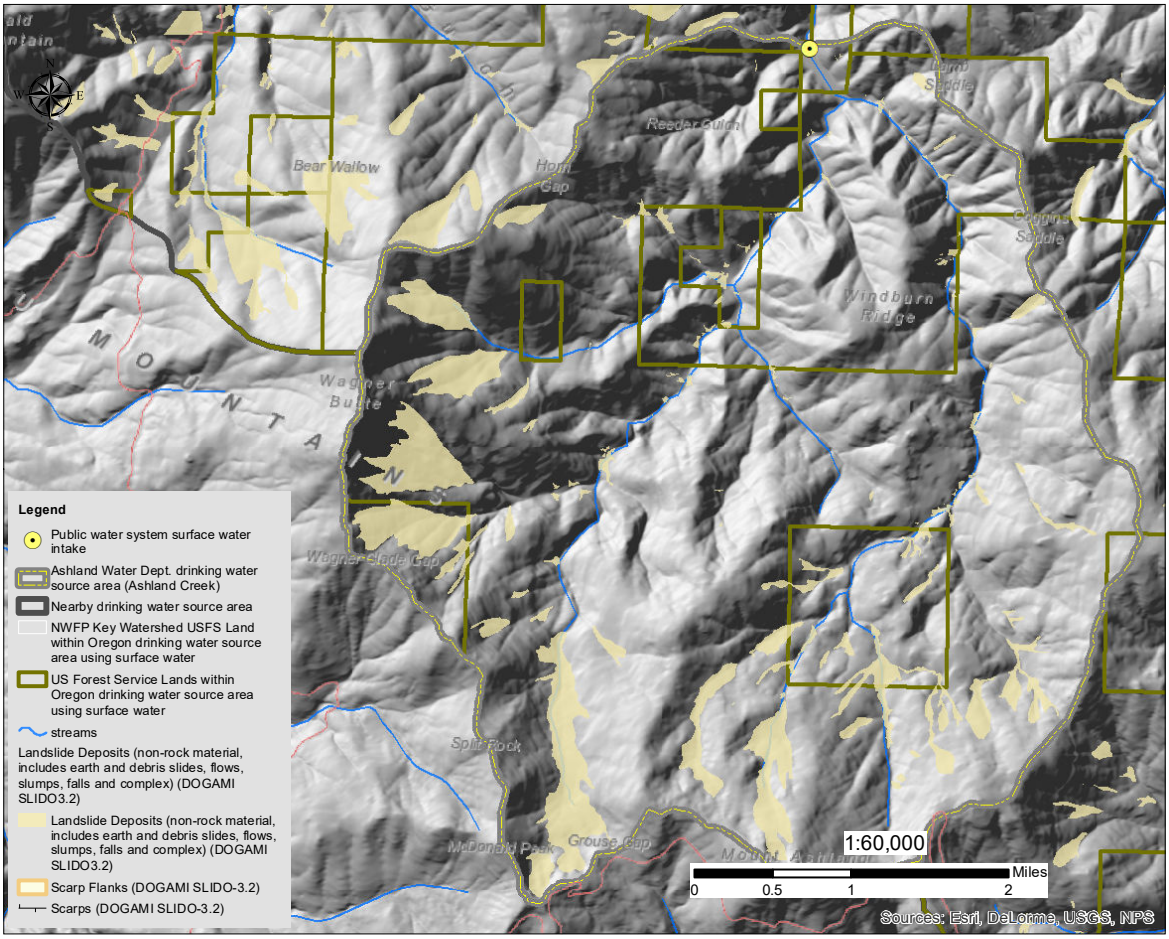
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapC_AshlandUSFSnErosionStreams.mxd (jkh)

Landslides have occurred throughout the DWSA. The combination of steep slopes, erodible soils and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

Ashland Water Department (PWS 00047)
Drinking Water Source Areas with US Forest Service Lands and Landslide Hazards Map



Notes:

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Oregon Health Authority
DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapD_AshlandUSFSandLandslides.mxd (jkh)

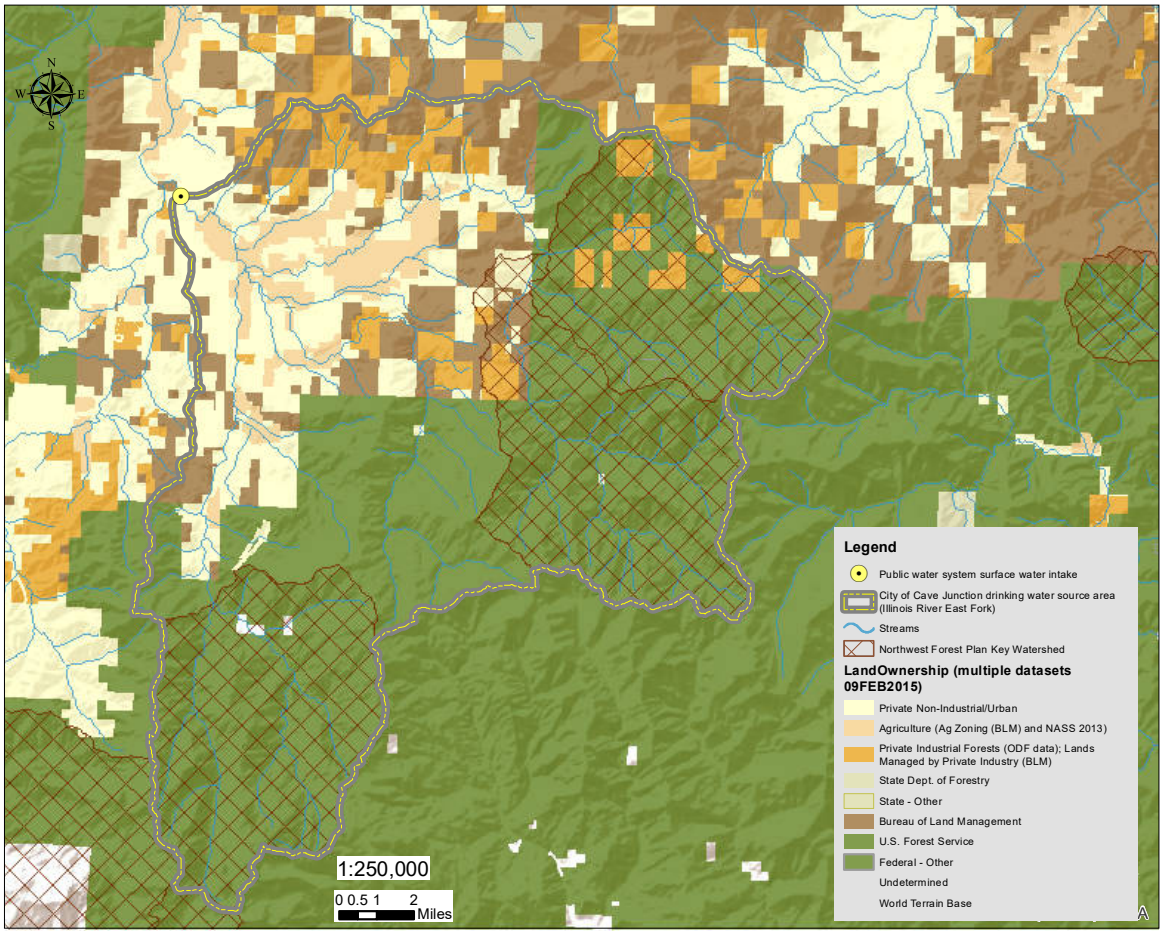
CAVE JUNCTION, OREGON

A CASE STUDY

CITY OF CAVE JUNCTION

The City of Cave Junction sources its drinking water from the East Fork of the Illinois River and the Daisy Hill Well. Nearly 2,00 residents get their drinking water from these sources. Land use within the DWSA includes, private industrial forest, agriculture and federal public forestlands. Much of the upper watershed is managed as a Key Watershed by the Forest Service. The East Fork Illinois River is listed as water quality impaired for the following pollutants: temperature, flow modification, pH and sedimentation. Private industrial forest management in the watershed highlights the importance of Forest Service land ownership in protecting drinking water supplies.

City of Cave Junction (PWS 00971) Illinois River (East Fork)
Drinking Water Source Areas with Land Use/Ownership



Notes:

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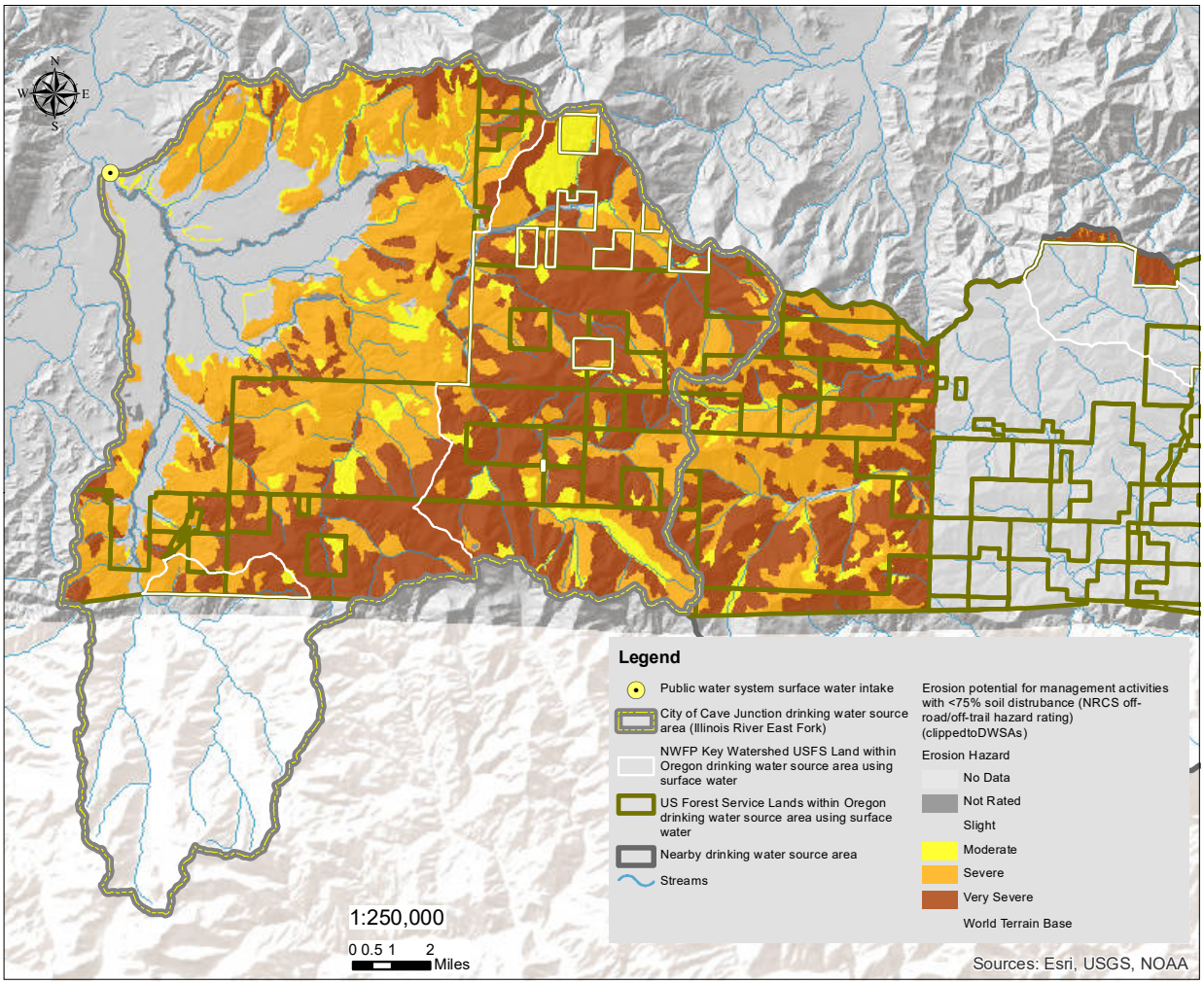
Oregon Health Authority DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018May\MapA_CaveJunctionLandUse.mxd (jkh)

Erosion potential from forest management activities ranges from moderate to very severe, and is driven by private industrial forest management. Note: Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.[28]

City of Cave Junction (PWS 00971)
Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities



Notes:

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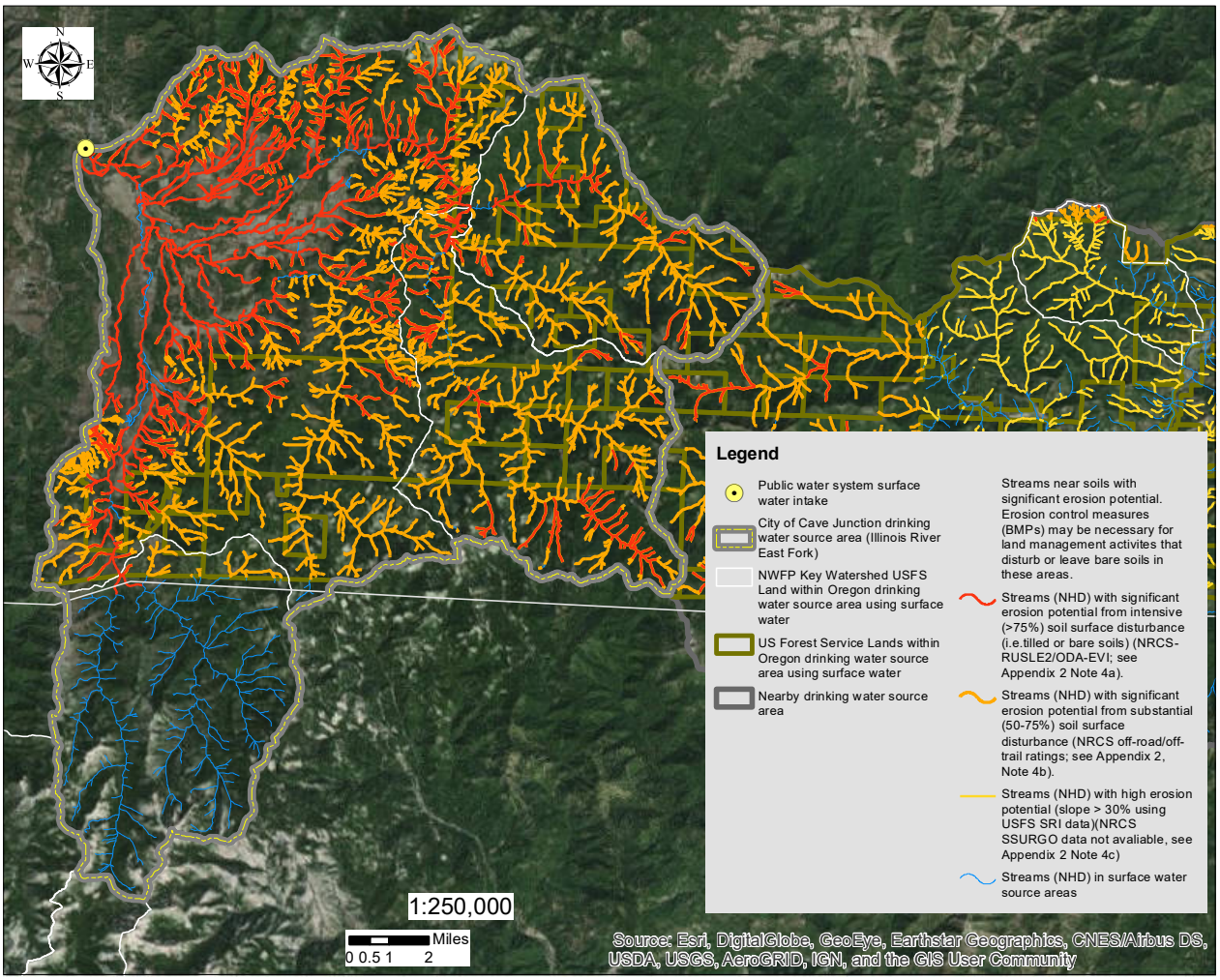
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018May\MapB_CaveJunctionUSFSandErosion.mxd (jkh)

City of Cave Junction (PWS 00971)
Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



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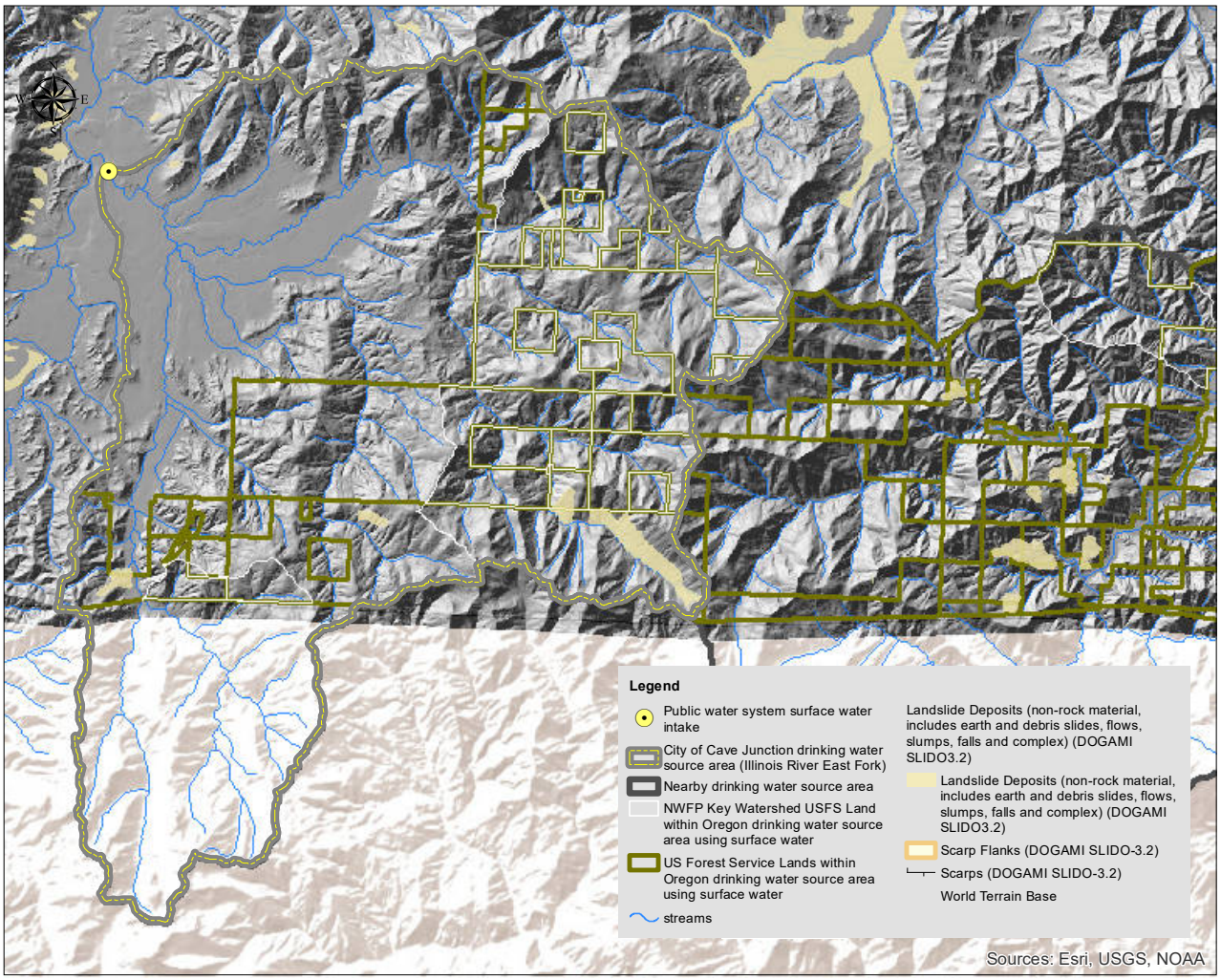
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018May\MapC_CaveJunctionUSFSandErosionStreams.mxd (jkh)

Landslides have occurred in a small portion of the DWSA. The combination of steep slopes, erodible soils and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

City of Cave Junction (PWS 00971)
Drinking Water Source Areas with US Forest Service Lands and Landslide Hazards Map



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Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018May\MapD_CaveJunctionLandslides.mxd (jkh)

LINCOLN CITY, OREGON

A CASE STUDY

LINCOLN CITY AND KERNVILLE-GLENEDEN-LINCOLN BEACH

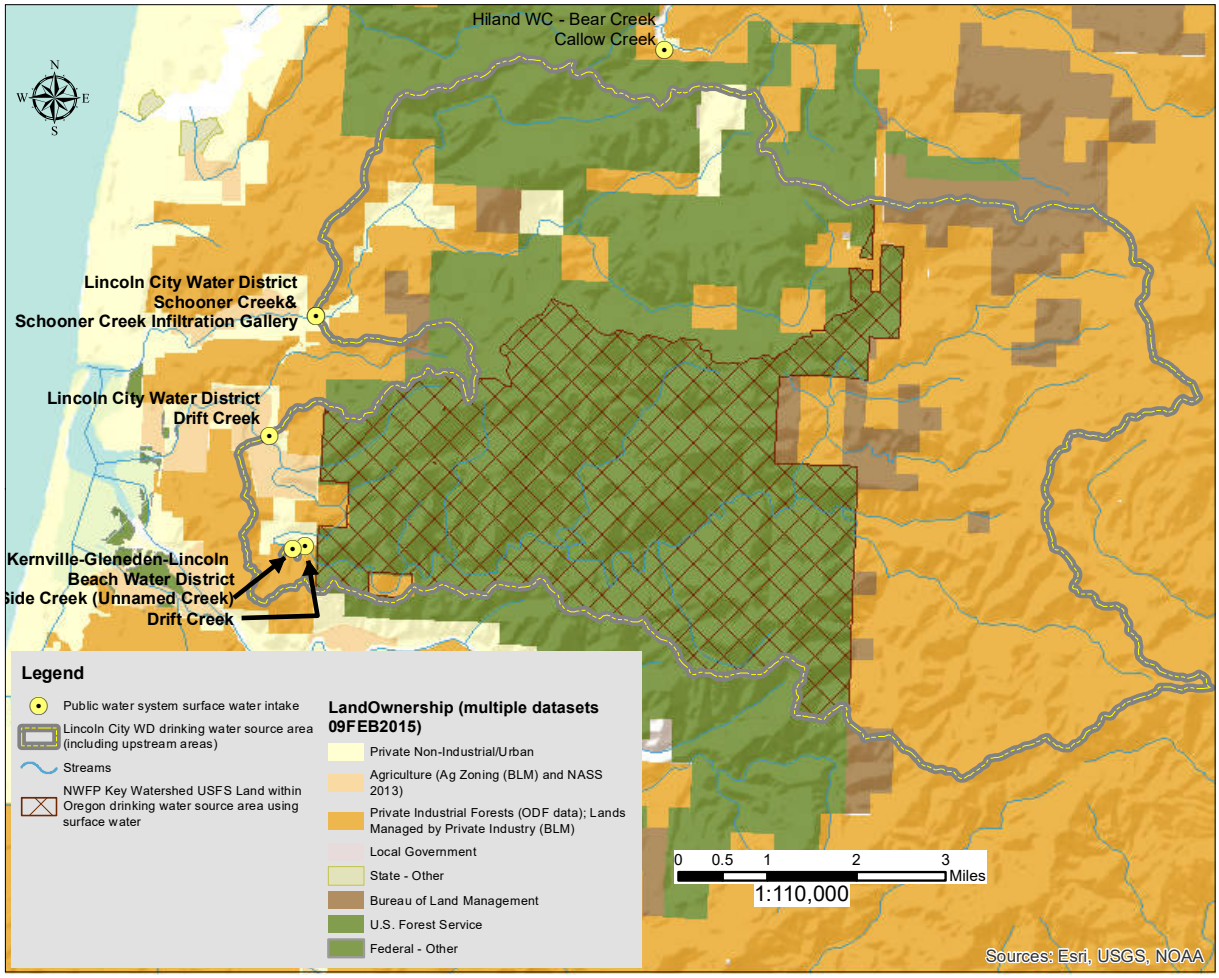
Lincoln City sources its drinking water from Schooner Creek. Within the Schooner Creek DWSA, 77% of the land is owned by the U.S. Forest Service and is managed as a key watershed. The remainder is owned by the BLM and private industrial forest companies.

Over 5,000 residents get their drinking water from Schooner Creek. Schooner Creek is listed as water quality impaired for the following pollutants: arsenic, copper, E. Coli, lead, selenium, zinc and temperature.

The drinking water for Kernville-Gleneden-Lincoln Beach is supplied by an intake on Drift Creek. This public water system serves approximately 4000 citizens. How about half the land (10,000 acres) is owned by private industrial forestland owners. Another 10,000 + acres are owned by the U.S. Forest Service and is managed as a key watershed. The BLM owns roughly 2,000 acres. Three different forest management protocols occur within the watershed, with industrial forest practices posing the greatest impact to water quality and drinking water.

The DEQ lists Drift Creek as water quality impaired for the following pollutants: alkalinity, ammonia, arsenic, barium, chloride, chromium, copper, dissolved oxygen, iron, lead, manganese, nickel, pH, phosphate, sedimentation, selenium, silver and temperature. Potential sources of contamination within the DWSA include septic systems, managed forestland (clearcuts), and forest roads and stream crossings.[29] Industrial forest management activities is a driver of erosion in the watershed.

Lincoln City WD (PWS 00483) and Kernville-Gleneden-Lincoln Beach WD (PWS 00324) Drinking Water Source Areas with Land Use/Ownership



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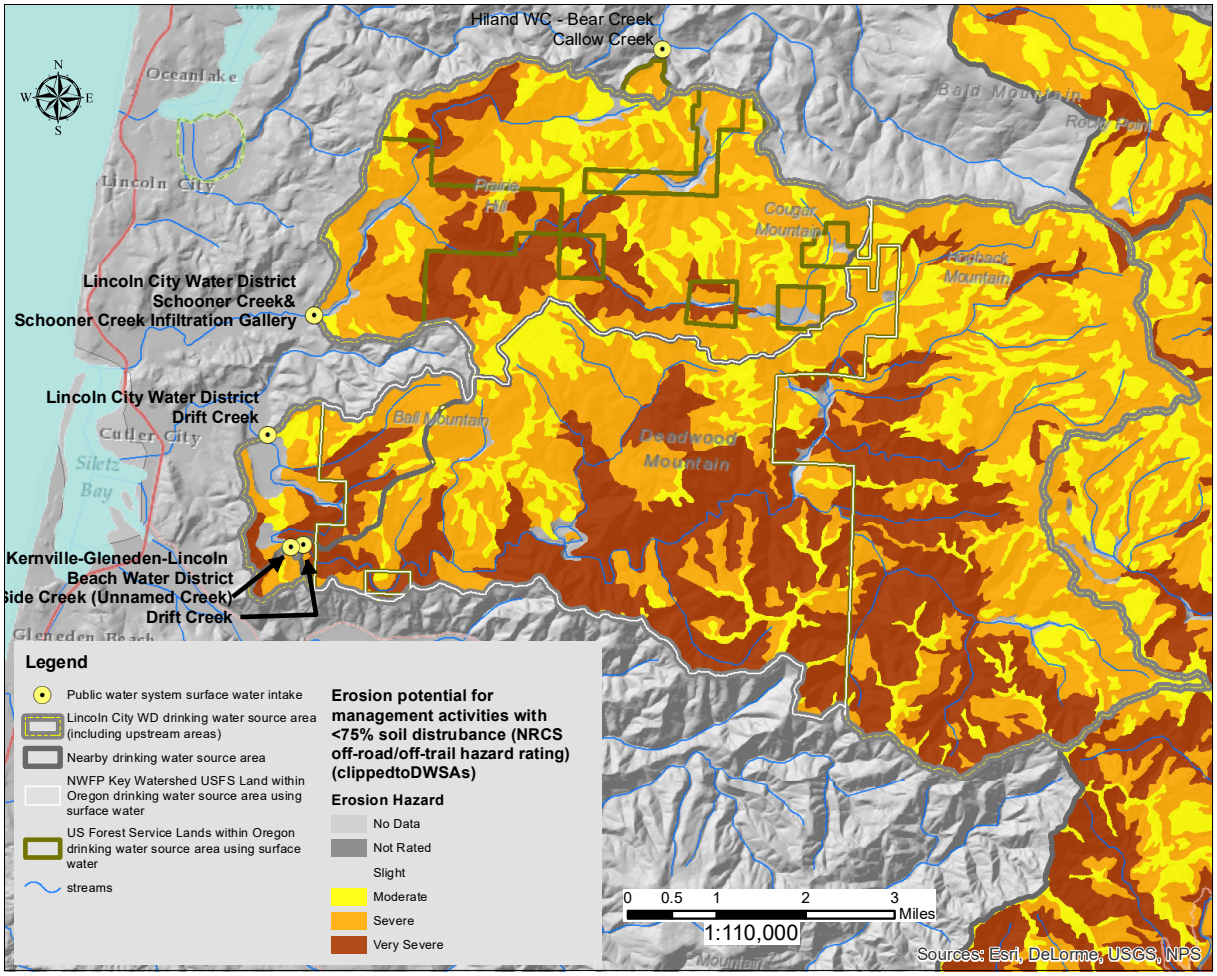
Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapA_IndividualPWSwithLandUse.mxd (jkh)

Erosion potential from forest management activities ranges from moderate to very severe. There are 143 stream miles in erodible soils and 67% of the streams have a high erosion potential within 300 feet of the stream. This illustrates the importance of Forest Service management in protecting water quality. Note: Department of Environmental Quality's Source Water Assessments only map moderate or higher erosion potential and that are within 300 feet of surface water in order to estimate where delivery of sediment to surface water is possible.

Lincoln City WD (PWS 00483) and Kernville-Gleneden-Lincoln Beach WD (PWS 00324) Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



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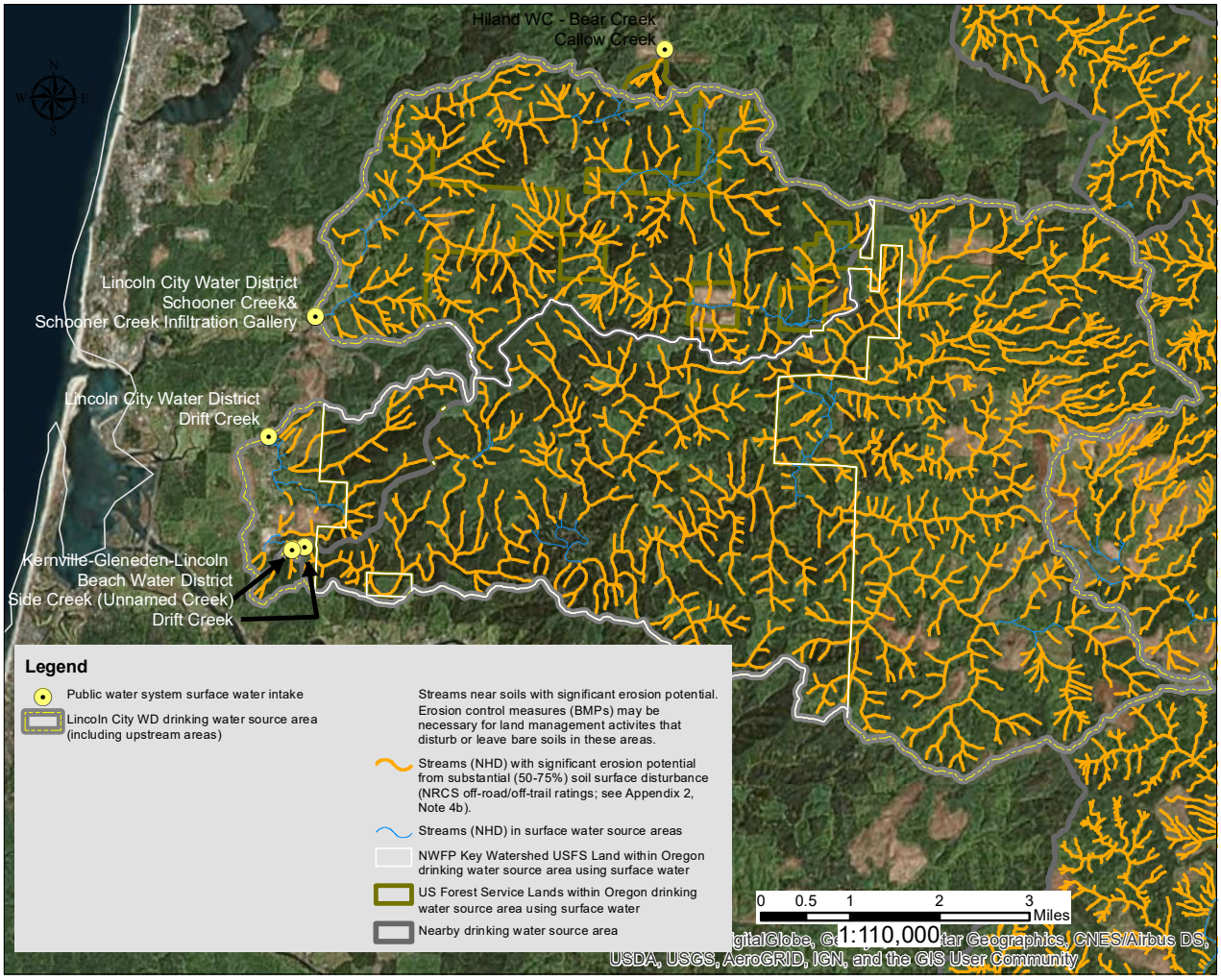
Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapB_IndividualPWSwithUSFSandErosion.mxd (jkh)

Lincoln City WD (PWS 00483) and Kernville-Gleneden-Lincoln Beach WD (PWS 00324) Drinking Water Source Areas with US Forest Service Lands and Erosion Potential for Management Activities with 50-75% Soil Distrubance



Notes:

High Soil Erosion Potential - This dataset provides surface erosion hazard ratings for areas where up to 75% of the soil surface is disturbed by non-road and non-trail uses (such as uncontrolled grazing, forestry, heavy equipment use, fire control, and mining). The erosion hazard ratings are calculated by the Natural Resource Conservation Service using inherent soil properties for whole soil erodibility and slope. This method underestimates erosion hazard for Histosol soils and for gully erosion, plowing or other disturbances that "disturb up to nearly 100 percent of the area and change the character of the soil". In the Updated Source Water Assessments, DEQ maps only those locations where risk is moderate or higher AND that are within 300 feet of surface water in order to estimate those places where delivery to water is possible. Other assessment methods may be more appropriate for flatter terrains with 75-100% soil disturbance or in areas where NRCS soils data is not available (some National Forest Lands). Where NRCS soils data is not available (typically National Forest Lands) Soil Resource Inventory information from the US Forest Service can be used to evaluate erosion potential.

Key Watersheds - defined by the Forest Ecosystem Management Assessment effort (Northwest Forest Plan - Record of Decision 1994). GIS data downloaded from https://www.blm.gov/or/plans/rmpswesternoregon/prmpdata-details.php?id=15471.

Drinking water source area - delineated as the 5th-field watershed upstream of a public water supply (PWS) intake. Note that Oregon's surface water source areas are delineated intake to intake. For watersheds with more than one intake, the DWSA is the watershed segment from the PWSs intake to the next intake upstream. All protection areas upstream of a specific water system's intake are included in the drinking water source area for that water system and PWSs are encouraged to work with other water providers and other entities within the Subbasin as they evaluate land use and move forward with developing protection strategies.

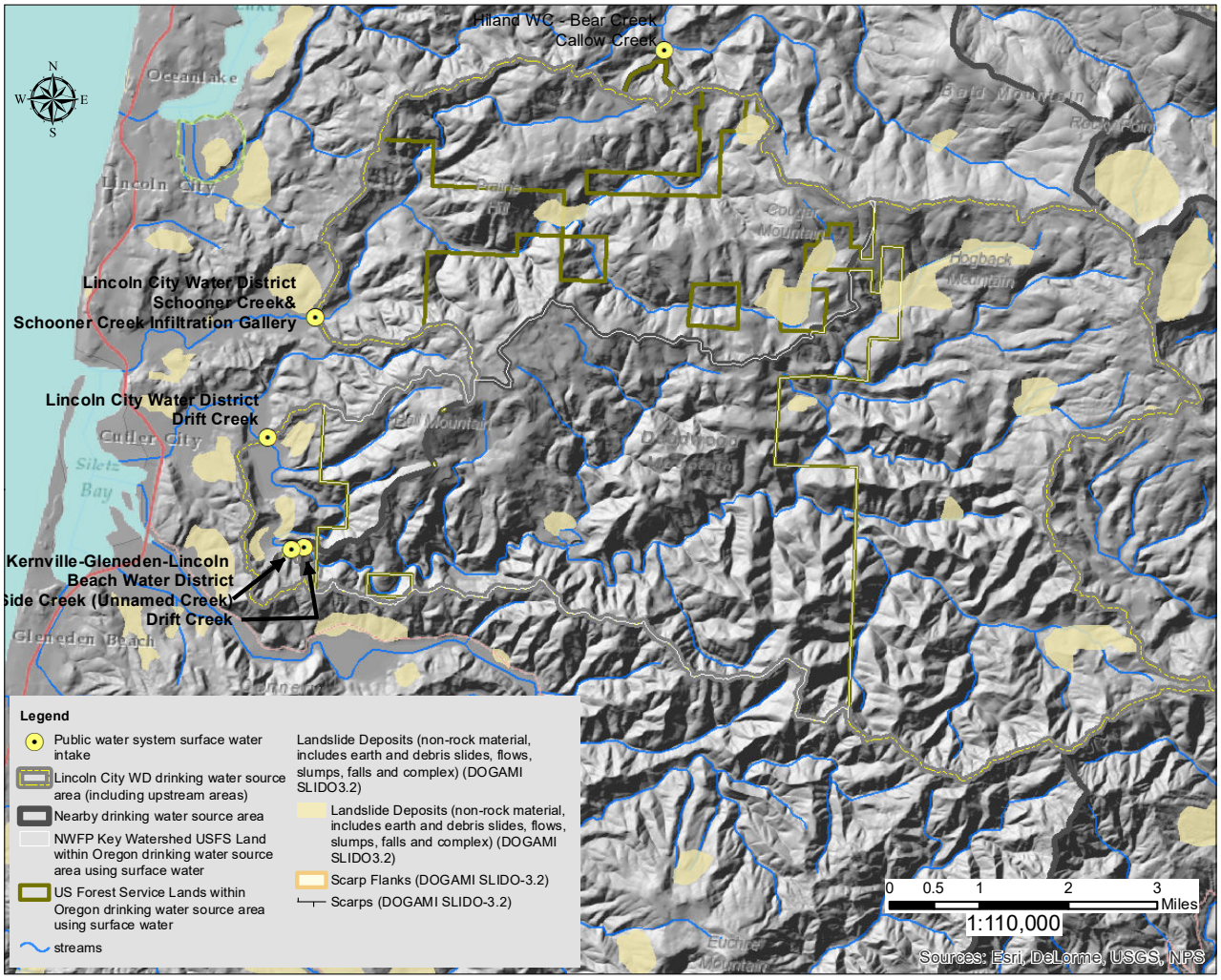
Oregon Health Authority

DEQ State of Oregon Department of Environmental Quality

Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapC_LincolnCityKGELBUSFSnErosionStreams.mxd (jkh)

Landslides have occurred in the DWSA. The combination of steep slopes, erodible soils and forest management activities are factors water providers should consider during the revision of the Northwest Forest Plan process in order to maintain protections for drinking water supplies.

Lincoln City WD (PWS 00483) and Kernville-Gleneden-Lincoln Beach WD (PWS 00324) Drinking Water Source Areas with US Forest Service Lands and Landslide Hazards Map



Notes:

Landslide Data - published by DOGAMI to improve the understanding of landslide hazards in Oregon and to provide a statewide base level of landslide data. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information. This publication cannot substitute for site-specific investigations by qualified practitioners. Site-specific data may give results that differ from the results shown in the publication. For more information see: http://www.oregongeology.org/sub/slido/

Key Watersheds - defined by the Forest Ecosystem Management Assessment effort (Northwest Forest Plan - Record of Decision 1994). GIS data downloaded from https://www.blm.gov/or/plans/rmpswesternoregon/prmpdata-details.php?id=15471.

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Oregon DEQ: Water Quality-Drinking Water Protection Program File: \\deqhq1\DWP\LandUse\2018Feb\MapD_LincolnCityKGELBUSFSandLandslides.mxd (jkh)

PHOTO: ROBERT SHELEY

ENDNOTES

1 Hydrologic effects of a changing forest landscape, National Research Council Water Science and Technology Board, National Academy Press, 2008.

2 Environmental Protection Agency, Office of Water. 2007. Factoids: Drinking Water and Ground Water Statistics. Retrieved from www.epa.gov/safewater/data/pdfs/data_factoids_2007.pdf <http://www.epa.gov/safewater/data/pdfs/data_%20factoids_2007.pdf>, p4.

3 National Research Council. 2008. Hydrologic Effects of a Changing Forest Landscape. National Academies Press: Washington, DC. 180pp

4 Tennessee Association of Utility District. 2004. Water Treatment Handbook. Retrieved from http://www.wrri.msstate.edu/se-tac/pdf/WaterTreatmentHandbook.pdf Accessed March 2013

5 Moore, R., Williams, T., Rodriguez, E., and Hepinstall-Cymmerman, J. 2011. Quantifying the value of non-timber ecosystem services from Georgia's private forests. Final report for Georgia Forestry Foundation. Retrieved from http://www.warnell.uga.edu/news/wp-content/uploads/2011/02/Final-Report-1-24-11.pdf

6 Ernst, C. 2004. Protecting the Source. Land Conservation and the Future of America's Drinking Water. Report by The Trust for Public Land and the American Water Works Association. San Francisco, CA. Postel, S., Thompson, B. 2005. Watershed protection: Capturing benefits of nature's water supply services. Natural Resources Forum 29. Pp 98-108

7 World Bank and World Wildlife Fund Alliance for Forest Conservation and Sustainable Use. 2003. Running Pure. The Importance Of Forest Protected Areas To Drinking Water. edited by N. Dudley, S. Stolton.

8 Meyer, J. L. 2007. Where Rivers Are Born: the Scientific Imperative for Defending Small Streams and Wetlands. M. N. Jensen, & D. Sutton (Eds.). American Rivers.

9 Ibid.

10 The Conservation Registry. Denver Water Forest to Faucet Partnership. Retrieved from http://www.conservationregistry.org/projects/15792

11 Santa Fe Watershed Association. Santa Fe Municipal Watershed 20 Year Protection Plan 2010-2029. Retrieved from http://www.santafenm.gov/DocumentView.aspx?DID=8948.

12 Postel, S. and Thompson, B. 2005. Watershed protection: Capturing the benefits of nature's water supply services. Natural Resources Forum 29, pp. 98–108. 99.

13 New York City Department of Environmental Education. September 2009. Long-Term Land Acquisition Plan 2012 to 2022. Report.

14 https://www.fs.fed.us/pnw/pubs/journals/pnw_2006_reeves001.pdf

15 https://www.fs.usda.gov/detail/planningrule/faqs#18

16 https://www.fs.usda.gov/detail/planningrule/faqs#18

17 Ibid.

18 36 C.F.R. § 219.7(f)(1)

19 36 C.F.R. § 219.8(a)(2)(ii), (iii), (iv)

20 36 C.F.R. § 219.8(a)(3)

21 36 C.F.R. § 219.8(a)(4)

22 36 C.F.R. § 219.19

23 Swift, L. W., Jr. 1985. Filter strip widths for forest roads in the southern Appalachians. Southern Journal of Applied Forestry. l0(1): 27-34.; Bilby, R., Sullivan, K. and Duncan, S. The generation and fate of road-surface sediment in forested watersheds in southwestern Washington. Forest Science 35.2 (1989): 453-468.

24 James R. Karr, Jonathan J. Rhodes, G. Wayne Minshall, F. Richard Hauer, Robert L. Beschta, Christopher A. Frissell, David A. Perry. 1 November 2004. The Effects of Postfire Salvage Logging on Aquatic Ecosystems in the American West. BioScience, Volume 54, Issue 11, Pages 1029–1033.

25 Perry TD, Jones JA. Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology. 2017;10:e1790.

26 State of Oregon Department of Environmental Quality, Updated Source Water Assessment, City of Yachats (2016), https://www.deq.state.or.us/wq/dwp/docs/uswareports/USWA_00966Yachats.pdf

27 State of Oregon Department of Environmental Quality, Updated Source Water Assessment, Ashland Water Department (2018), https://www.deq.state.or.us/wq/dwp/docs/uswareports/USWA_00047Ashland.pdf

28 State of Oregon Department of Environmental Quality, Updated Source Water Assessment, City of Cave Junction (2018), https://www.deq.state.or.us/wq/dwp/docs/uswareports/USWA_00971CaveJunction.pdf

29 State of Oregon Department of Environmental Quality, Updated Source Water Assessment, Lincoln City (2016), https://www.deq.state.or.us/wq/dwp/docs/uswareports/USWA_00483LincolnCity.pdf


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