Watershed size: 1,338 sq miles
Elevation range: approx 430’-10,358’
Average annual river flow at confluence: 5,809 cfs
Average annual precipitation: 40”-110” (mostly snow at higher elevations)
High Cascades

Young basalts, basaltic andesites, andesites, pumice, and ash < 7 million years old

Youngest McKenzie Pass lava flows (≤ 3000 years old)
Cascade Springs - GUSHERS!

North Olallie Spring

Roaring Springs

Roaring Springs
Groundwater Residence Time

<5 – 10 years from snowfall to spring water
Elevational Profile of the McKenzie River Basin

Rain/Snow Transition - Present Conditions

Western Cascades

High Cascades

Present Monitoring Network

(Sproles et. al., 2013)
Elevational Profile of the McKenzie River Basin

- Western Cascades
- High Cascades
- Present Monitoring Network

Rain/Snow Transition - 2°C Increase

Elevation (m)

Distance (km)
Climate Change Impacts to SWE

- Loss of snow pack in 3,000’ to 4,500’ zone
  - 56% of volume of water currently stored as snow
  - Equivalent of two Cougar Reservoirs, or ~ 400,000 acre feet
  - More rain on snow events
- Peak spring snow melt/runoff happens 12 days earlier

(Sproles et. al., 2013)
Frequency of Occurrence

Standard Deviation – Extreme Hot Weather

(Hansen et. al., 2012)
EWEB’s Drinking Water Source Protection Program

McKenzie River = Sole Source of drinking water for 200,000 people.
Revised Source Protection Program Goal

- To measure the balance between watershed health and human use over time and to implement actions that maximize EWEB’s investments for the continued viability of this critical resource
Source Protection Program Goal:

To measure the balance between watershed health and human use over time and to implement actions that maintain a healthy balance for production of exceptional water quality.
Land Ownership in the McKenzie River Watershed

Land Ownership:
- BLM
- Misc
- Private Industrial
- Private Non-Industrial
- State
- US Forest Service
Increase economic viability while reducing chemical use/increase buffers
Major Initiatives Include:

- Comprehensive Water Quality Monitoring
- Urban Runoff Treatment
- Watershed Emergency Response System
- Healthy Farms Clean Water Program
- Septic System Assistance program
- Pure Water Partners Program
- Stewardship Contracting
2018 Proposed Budget

SOURCE PROTECTION BUDGET

- Septic: 30%
- MWERS: 24%
- PWP: 27%
- WQ Monitoring: 10%
- Wetland Construction: 6%
- Other: 3%
Water Quality Monitoring
Assessment of Water Quality

• Main monitoring efforts:
  - Storm event sampling for pesticides and other organic compounds, organic carbon, and bacteria across land uses
  - Baseline trend monitoring at 16 sites throughout watershed (quarterly)
  - Continuous monitoring associated with streamflow gaging stations (USGS + EWEB operated)
  - Harmful algal bloom (HAB) monitoring in reservoirs and river between April – October
70 to 90% of pollution loadings to surface waters occur during storm runoff events.
Concentrations observed in McKenzie River Basin during 2002-2010, by major land-use category

CONCENTRATION, IN MICROGRAMS PER LITER

- **Agricultural land use**
- **Forestry land use**
- **Mixed land use**
- **Urban land use**
Prevalent caffeine detections – human waste indicator

Increased development = Increased pesticides
Monitoring Sites

E01M - Mohawk River @ Hill Rd Bridge
E02M - Mohawk River @ Wendling Rd Bridge
E010 - McKenzie River @ EWEB Intake
E020 - McKenzie River @ Hendricks Bridge
E040 - USGS McKenzie River @ Vida
E060 - McKenzie River @ Holdem Creek Rd Bridge nr Leaburg
E170 - McKenzie River @ Brugers Bridge
E180 - McKenzie River @ Frissell Bridge
E210 - Cedar Creek @ Saunders Bridge
E310 - Camp Creek @ Camp Cr Rd Bridge
E390 - Gate Creek @ Hwy 15 Bridge
E480 - SF McKenzie @ Bridge below Cougar Dam
E481 - SF McKenzie @ Rte 1980 Bridge Upstream of Cougar Reservoir
E520 - 52nd Stormwater Channel @ Hwy 126
E540 - Blue River @ McKenzie Hwy Bridge
E810 - Kelzer Slough @SUB Bridge
Manganese Detections by Channel Segment
McKenzie Watershed (2000-2016)
<table>
<thead>
<tr>
<th>Station Number</th>
<th>Station Name</th>
<th>Parameter(s)</th>
<th>Data Range</th>
<th>Cost Share %</th>
<th>Cost Share Pay</th>
<th>Federal Mandate</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>14158500</td>
<td>MCKENZIE RIVER AT OUTLET OF CLEAR LAKE, OR</td>
<td>Gage Height/Discharge</td>
<td>1948-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>FERC Project # 2242</td>
</tr>
<tr>
<td>14158740</td>
<td>MCKENZIE RIVER BL PAYNE CR, NR BELKNAP SPRINGS, OR</td>
<td>Gage Height</td>
<td>2017-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>Future FERC Requirement</td>
</tr>
<tr>
<td>14158790</td>
<td>SMITH RIVER ABV SMITH R RESV, NR BELKNAP SPRINGS, OR</td>
<td>Gage Height/Discharge</td>
<td>1960-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>FERC Project # 2242</td>
</tr>
<tr>
<td>14158795</td>
<td>SMITH RIVER RESERVOIR NEAR BELKNAP SPRINGS, OR</td>
<td>Gage Height/Discharge</td>
<td>1959-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>FERC Project # 2242</td>
</tr>
<tr>
<td>14162500</td>
<td>MCKENZIE R BLW TRAIL BR DAM NR BELKNAP SPRINGS, OR</td>
<td>Gage Height/Discharge</td>
<td>2016-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>Leaburg Generation</td>
</tr>
<tr>
<td>14163150</td>
<td>MCKENZIE RIVER NEAR VIDA, OR</td>
<td>Various WQ Parameters</td>
<td>2015-Current</td>
<td>Yes</td>
<td>Source Protect</td>
<td>Yes</td>
<td>Drinking Water Support</td>
</tr>
<tr>
<td>14163900</td>
<td>MCKENZIE RIVER NEAR WALTERVILLE, OR</td>
<td>Gage Height/Discharge</td>
<td>1989-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>FERC Project # 2496</td>
</tr>
<tr>
<td>14164550</td>
<td>CAMP CRK AT CAMP CRK RD BRIDGE, NR SPRINGFIELD, OR</td>
<td>Gage Height</td>
<td>2010-Current</td>
<td>Yes</td>
<td>Source Protect</td>
<td>Yes</td>
<td>Drinking Water Support</td>
</tr>
<tr>
<td>14164700</td>
<td>CEDAR CREEK AT SPRINGFIELD, OR</td>
<td>Gage Height/Discharge</td>
<td>2017-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>Drinking Water Support</td>
</tr>
<tr>
<td>14164900</td>
<td>MCKENZIE RIVER ABV HAYDEN BR, AT SPRINGFIELD, OR</td>
<td>Gage Height/Discharge</td>
<td>2017-Current</td>
<td>Yes</td>
<td>Generation</td>
<td>Yes</td>
<td>Drinking Water Support</td>
</tr>
</tbody>
</table>
Harmful Algal Blooms (HABs)

Monthly monitoring during the bloom season (May-Oct) is conducted jointly by EWEB, USFS and USACE.

- Are blooms increasing in frequency and duration due to climate change?
- Have new toxigenic species established themselves in the watershed?
Cyanobacteria Cell Counts in Select McKenzie Watershed Reservoirs

- **Individual Species Advisory Threshold (Microcystis or Planktothrix)**
- **Combined Species Advisory Threshold (all species)**

- **Anabaena/Microcystis/Aphanizomenon (cells/mL)**
- **Gloeotrichia (cells/mL)**

Species Counts:
- **Cougar - Anabaena (Blair)**
- **Cougar - Anabaena (WML)**
- **Blue River - Anabaena (Blair)**
- **Blue River - Anabaena (WML)**
- **Walterville Pond - Microcystis (WML)**
- **Walterville Pond - Anabaena (WML)**
- **Walterville Pond - Aphanizomenon (WML)**
- **Blue River - Gloeotrichia (WML)**
- **Blue River - Microcystis**
- **Walterville Pond - Anabaena (WML) (2nd Axis)**

Count Values:
- 28,500
- 4,700,000
- 120,000
- 95,000
- 2,600,000
- 800,000
- 800,000
- 500,000
- 1,000,000
- 1,500,000
- 2,000,000
- 2,500,000
- 3,000,000
- 3,500,000
- 4,000,000
- 4,500,000
- 5,000,000
McKenzie Water Quality Data

Web Portal

The McKenzie watershed water quality web portal provides partner agencies, researchers, watershed stakeholders and the interested public with data and information collected by the Eugene Water & Electric Board on the health of the McKenzie River, Eugene’s source of drinking water.

Water Quality Database

The database contains water quality data collected since the 1950s from 54 water quality monitoring locations to monitor baseline water quality and, more recently, storm events. Monitoring locations are distributed from the headwaters to the confluence of the McKenzie River, and also include tributaries, stormwater conveyances, and power canals. Samples are analyzed for various water quality parameters that fall into the following broad groups: Bacteria/Algae; Emerging Contaminant; Major Ion; Metal; Nutrient; Pesticide; Petroleum Hydrocarbon; Semi-Volatile (SVOC) and Volatile Organic Compound (VOC) and General.

Please review the site disclaimer notice by clicking here.

Please visit our source protection program's home page to learn more about our activities:
http://www.eweb.org/sourceprotection

Data Exploration

All data are available for viewing, exploration and download. Options include:

- Spatial depiction of monitoring locations and results (where was a parameter or parameter suite monitored or detected or did the parameter exceed a benchmark)
- Through charts and tables explore how often a parameter was monitored, detected or found to exceed a benchmark, with options to focus these queries by station, by parameter, by date and by benchmark
- Through charts and tables explore by parameter or monitoring station, baseline water quality. Target queries through control of station, parameter (or suite), date and benchmark
- Through charts and tables explore by parameter or monitoring station, storm event water quality. Target queries through control of station, parameter (or suite), storm event, and benchmark. Compare to available flow and precipitation data for that storm event
- Download all or selected portions of the database in MS Excel format. Print charts and tables created during queries to Adobe pdf.

Click here to see links to the selected benchmarks used to evaluate EWEB's water quality data.

Click here to see browser and system recommendations.
Show Help | Hide Help

What Can I Do Here?
This tool helps you explore which parameters were sampled at a station or which stations have data for a parameter. Also explore where detections and exceedances have occurred and for which parameters. Your query produces a chart of the number of samples, number of samples where a parameter was detected, and the number of samples that exceed a benchmark. A table also provides the minimum and maximum measurements and the lowest applicable benchmark source.

How Do I Proceed?
Select exploration by station or parameter by clicking the appropriate circle. To see data for a parameter group at a particular station, select station and then the parameter group of interest. Only parameter groups that have data that match your query will appear. Narrow your exploration to a particular monitoring program and time period if desired. Exceedance is defined as a concentration greater than any of the selected benchmarks.

Select station or parameter:  Monitoring program:  Select what to include:  Select monitoring period:
- Station
- Parameter
- Baseline
- Storm event
- Both
- All samples
- Only samples with detections
- Only samples that exceeded a benchmark
- Full record (1950-)
- Poor 2000
- Post 2000
- Custom

Select one location:
- E420 - 42nd Stormwater Culvert at Weyco
- E470 - Quartz Cr at Rd 105 Bridge
- E480 - South Fork McKenzie R at Bridge to Cougar Dam
- E481 - South Fork McKenzie R at Bridge upstream of Cougar Reservoir
- E482 - South Fork McKenzie R at Rte 1980 Bridge upstream of Cougar Reservoir
- E483 - South Fork McKenzie R in NW portion of Cougar Reservoir
- E484 - South Fork McKenzie R in Cougar Reservoir near Temp Control Tower
- E485 - South Fork McKenzie R above Cougar Reservoir
- E486 - South Fork McKenzie R near Rainbow
- E520 - 52nd Stormwater Channel at Hwy126

Select one, several, or all parameters (group names are in blue):
- Nitrogen, ammonia
- Nitrogen, nitrate
- Nitrogen, total
- Nitrogen, total kjeldahl
- Phosphate
- Phosphate, ortho, total
- Phosphorus
- Phosphorus, white
- 2,4-D, dissolved

Use Shift or Ctrl keys to select multiple items.
Watershed Health Monitoring

• LiDAR flights every 5 years (2009 & 2016), use algorithms to map changes in:
  – Riparian/floodplain canopy cover
  – Building footprints/infrastructure (e.g., roads)
  – Channel changes/revetment

• U of O/OSU SLICES monitoring 100 meter and 1 km slices every 10 years (track landuse, land cover, fish populations... )
Urban Runoff Mitigation Program

- Pesticides
- Fecal bacteria
- Metals
- Fertilizers
- Paints/Solvents
- Petroleum Products
Treating Urban Runoff

- Monitoring has consistently shown high levels of metals, nutrients and bacteria in stormwater channels close to EWEB’s drinking water intake.
- Enhancing wetland areas can slow down flow of water, allowing pollutants to drop out before entering the McKenzie River.
- Urban trash and hazardous material spills can be collected at designed collection points
Cedar Creek Confluence Wetland Potential
Emergency Response
In McKenzie: 500 Trucks/day with 3-5% carry hazardous materials (source: ODOT Freight Survey)
At 6:40am on 6/13/2017 tanker crashed releasing 1,700 gallons of gasoline
500,000+ gallons of contaminated groundwater pumped & treated off-site
7,800 tons of contaminated soil excavated and sent for disposal
Three Main Parts of MWERS

• Response Information (GIS): pre-determined spill response strategies, search for equipment, critical resources, personnel, etc. (new web application being beta tested)

• Response Equipment and Resources: 4 response trailers staged in watershed and equipment inventoried from 27 federal, state, and local agencies that are searchable

• Interagency Training/Drills: conduct annual drills and training among 15-20 participating agencies (10/25/17)
Fast River Boom Deployment

Bank to Bank Rope Anchor System
### Search Contacts Within Current Watershed

**Agency**
- - Any -

**Skills**
- - Any -

**Responsibility**

<table>
<thead>
<tr>
<th>Name (Last, First)</th>
<th>Agency</th>
<th>Responsibility</th>
<th>Skills / Certifications</th>
<th>Office Phone</th>
<th>Cell Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispatch Center</td>
<td></td>
<td>Law enforcement, first responder</td>
<td></td>
<td>541-726-2525</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eugene Fire Station 9</td>
<td></td>
<td>Haz.Mat. Team</td>
<td></td>
<td>541-682-8109</td>
<td>541-510-7032</td>
<td></td>
</tr>
<tr>
<td>Region 10 Duty Officer</td>
<td></td>
<td>Incident response</td>
<td></td>
<td>206-553-1263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIPS Hotline</td>
<td></td>
<td>Law Enforcement, first responder</td>
<td></td>
<td>1-800-452-7888</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency Use Only, Nonemergency</td>
<td></td>
<td>Nonemergency fire dispatch (24-</td>
<td></td>
<td>541-682-5899</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispatch</td>
<td></td>
<td>hour)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Search Equipment by Strategy and Distance to Incident

**Strategy**
- **7 - Hayden Bridge Area**

**Maximum Search Distance**
- **10 miles**

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Amount</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boom - Solid Containment</td>
<td>700.00</td>
<td>Feet</td>
<td>Boom Objective: Collection</td>
</tr>
<tr>
<td>Boom - Solid Containment</td>
<td>100.00</td>
<td>Feet</td>
<td>Boom Objective: Protection</td>
</tr>
<tr>
<td>Boom - Solid Containment</td>
<td>100.00</td>
<td>Feet</td>
<td>Boom Objective: Protection</td>
</tr>
<tr>
<td>Boom - Solid Containment</td>
<td>300.00</td>
<td>Feet</td>
<td>shoreline protection; Boom Objective: Protection</td>
</tr>
<tr>
<td>Chemical Pump</td>
<td>1.00</td>
<td>Each</td>
<td></td>
</tr>
<tr>
<td>Compressor</td>
<td>1.00</td>
<td>Each</td>
<td></td>
</tr>
<tr>
<td>Containment Berm</td>
<td>1.00</td>
<td>Each</td>
<td></td>
</tr>
<tr>
<td>Decon Equip</td>
<td>1.00</td>
<td>Sets</td>
<td></td>
</tr>
<tr>
<td>Decon Waste Pool</td>
<td>4.00</td>
<td>Each</td>
<td>waste pools within containment berm</td>
</tr>
<tr>
<td>Fence Posts</td>
<td>6.00</td>
<td>Each</td>
<td>used to anchor A, B, &amp; C lines for boom deployment</td>
</tr>
<tr>
<td>Generator</td>
<td>1.00</td>
<td>Each</td>
<td></td>
</tr>
</tbody>
</table>
Scenario: Gasoline Spills - Protection Deployment

Response Strategy:
- Boom Objective
  - Collection
  - Diversion
  - Protection
  - Static Line
Healthy Farms Clean Water Program Goal:
Assist farmers in protecting water quality while increasing farm revenue...to keep farmland as a floodplain land use
Agricultural Land in the McKenzie River Watershed, Upstream of EWEB's Drinking Water Intake

Total Agricultural Land: ~6900 acres
Distribution of Crops in the McKenzie

- Pasture: 41%
- Hay: 26%
- Hazelnuts: 11%
- Christmas Trees: 7%
- Annual Rotation: 5%
- Grass Seed: 5%
- Golf Course: 1%
- Blueberries: 0.5%
- Lawn: 3%
- Other: 1%
- Blueberries: 0.5%
- Lawn: 3%
Healthy Farms Clean Water Program

Program Menu:

- Chemical Use Reduction
- Organic Certification
- Nutrient Management
- Ag Chemical Disposal
- Local Market Access/Local Food Connection
- Ag/Conservation Easements
- Mating Disruption
- Offstream Watering Cost-Share
Remove Old Farm Chemicals
Protects kids, pets, livestock and water quality
2006/2007 removed 44 tons from 126 farms
2010/2012 removed 3,200 lbs from 13 farms
Hazelnut Mating Disruption Project

- Disrupt moth mating patterns to prevent filbert worm
- 3-year study costs: $58,500 (EWEB) $102,000 (Hazelnut Commission)
- Years 1-2: No pesticides used on 270 acres/$13,000 savings
- Year 3: Pesticides used on perimeter
- Overall: 75% reduction in pesticides in first few years
- Currently several growers still using this technique with support from EWEB through UWSWCD
Threats from Development

- Removal of streamside vegetation
- Use of pesticides and fertilizers
- Contamination from septic systems
- Increased erosion and sediment
- Use of revetment to protect homes
37% of tax lots in McKenzie (Lane County Only) are <1 acre.

Dams have allowed development to occur in areas unthinkable 50-60 years ago.
Structures adjacent to McKenzie River

<table>
<thead>
<tr>
<th>Within...</th>
<th>Nbr of Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 ft</td>
<td>205</td>
</tr>
<tr>
<td>100 ft</td>
<td>665</td>
</tr>
<tr>
<td>200 ft</td>
<td>1911</td>
</tr>
<tr>
<td>Floodway</td>
<td>208</td>
</tr>
<tr>
<td>100 yr floodplain</td>
<td>1152</td>
</tr>
<tr>
<td>500 yr floodplain</td>
<td>2235</td>
</tr>
</tbody>
</table>

McKenzie Floodplain Analysis

- Building footprint
- 100 year floodplain
- Floodway
- 500 year floodplain

This map has been created for informational purposes only and should not be used in place of survey grade data.
620 homes or 1,152 structures are located within the 100 year floodplain.
Emergency rip-rap to protect property built close to the river
Structures within meander zones are also at risk

2004 Aerial Photo
2006 Aerial Photo

House foundation at bottom of river
>4,100 septic systems producing approx. 900,000 gallons/day
Septic System Assistance

- **Cost-share Program**: reimburse homeowners 50% of cost to inspect and pump out septic system
- **Zero-interest loan program**: for septic systems replacements or major repairs
2008 – 2017 Septic Assistance Program
• nearly 700 inspections
• over 90 homes w/failing systems
• 8 homes in 0% Interest Loan Program
PUMPING FREQUENCY
How often your septic tank needs to be pumped depends on the size of the tank, the number of people in the household, and the volume of solids in the wastewater (example, use of a garbage disposal).

<table>
<thead>
<tr>
<th>TANK (Gallons)</th>
<th>1 person</th>
<th>2 people</th>
<th>3 ppl</th>
<th>4 ppl</th>
<th>5 ppl</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>5.8 yrs</td>
<td>2.6 yrs</td>
<td>1.5 yrs</td>
<td>1 yr</td>
<td>0.7 yrs</td>
</tr>
<tr>
<td>750</td>
<td>9.1 yrs</td>
<td>4.2 yrs</td>
<td>2.6 yrs</td>
<td>1.8 yrs</td>
<td>1.3 yrs</td>
</tr>
<tr>
<td>1,000</td>
<td>12.4 yrs</td>
<td>5.9 yrs</td>
<td>3.7 yrs</td>
<td>2.6 yrs</td>
<td>2 yrs</td>
</tr>
<tr>
<td>1,250</td>
<td>16.6 yrs</td>
<td>7.5 yrs</td>
<td>4.8 yrs</td>
<td>3.4 yrs</td>
<td>2.6 yrs</td>
</tr>
<tr>
<td>1,500</td>
<td>19.9 yrs</td>
<td>9.1 yrs</td>
<td>5.9 yrs</td>
<td>4.2 yrs</td>
<td>3.3 yrs</td>
</tr>
</tbody>
</table>


WATCH FOR SIGNS OF FAILURE
- Wastewater backing up into household drains
- Bright green, spongy grass on the drainfield, even during dry weather
- Pooling water or muddy soil around your septic system or in your basement
- A strong odor around the septic tank and drainfield

Call a septic professional if you notice any of these signs. One call could save you thousands of dollars!

FINANCIAL ASSISTANCE AVAILABLE FROM EWEB
The Eugene Water & Electric Board (EWEB) recognizes the important role that properly maintained septic systems play in keeping drinking water resources clean. EWEB offers two septic system assistance programs for McKenzie Watershed homeowners located upstream of EWEB's drinking water intake:
1. A zero-interest loan program for replacements or major repairs, and
2. A cost-share program for inspections and pump-outs. See eweb.org/septic/assistance for more information.

Additional Resources
Lane County Onsite Wastewater www.laneCounty.org/Departments/PW/LHD/Sanitation/Pages/default.aspx
Oregon Department of Environmental Quality Onsite Wastewater Management System www.deq.state.or.us/wq/onsite/onsite.htm
EPA Septic Smart water.epa.gov/infrastructure/septic/septicsmart.cfm

Some information in this brochure comes from Environmental Protection Agency (EPA) Septic Smart Program (water.epa.gov/infrastructure/septic/septicsmart.cfm) and Oregon Department of Environmental Quality (www.deq.state.or.us/wq/onsite/aboutseptic.htm).

Maintaining your septic system can help you avoid costly repairs and helps keep the McKenzie River clean.

EUGENE WATER & ELECTRIC BOARD
WHAT IS A SEPTIC SYSTEM?

A septic system is an underground wastewater treatment structure that uses a combination of nature and time-tested technology to treat wastewater from household plumbing produced by bathrooms, kitchen drains, and laundry.

HOW DOES IT WORK?

The septic tank captures wastewater from the home. Solid material settles in the bottom of the tank (sludge) or floats on top (scum). When the accumulated sludge and scum reach a certain level, the tank needs to be pumped out by a licensed septic system pump in order to keep the system running properly.

The liquid portion of the waste influent passes from the tank into the drainfield, where it is absorbed into the ground through perforated pipes and treated by soil organisms to remove harmful bacteria, viruses, and nutrients. This liquid portion eventually reaches the groundwater.

WHY SHOULD YOU MAINTAIN YOUR SEPTIC SYSTEM?

Saves You Money
Regular maintenance fees of $250 to $300 every three to four years is a bargain compared to the cost of repairing or replacing a malfunctioning system, which can cost between $3,000 and $7,000 or more.

Protects Your Property Value
An unserviced septic system or one in disrepair will lower your property value, and could expose you to costly legal liability.

Keeps You and Your Neighbors Healthy
Household wastewater is loaded with disease-causing bacteria and viruses, as well as high levels of nitrogen and phosphorus. If a septic system is well-maintained and working properly, it will remove most of these pollutants. Insufficiently treated sewage from septic systems can cause groundwater and surface water contamination, which can spread disease to humans and animals.

RECOMMENDED SEPTIC SYSTEM MAINTENANCE

- Conserve water to avoid overloading the system.
- Avoid or limit the use of an in-sink garbage disposal. Fats, grease and solids can clog the drainfield.
- Don’t flush any material except waste and toilet paper.
- Avoid harsh chemicals such as those in drain clog removers, gasoline, oil, pesticides and other cleaners. These can kill the beneficial ‘bugs’ that treat the wastewater.
- Don’t use septic system additives. These products generally do not help and some may even be harmful to your system.
- Know the location of the tank and drainfield. Keep maintenance records. If you don’t have drawings of your system, check with Lane County to see whether records exist.
- Don’t drive, build or pave over the drainfield. This could crush the pipes or compact the soil, negatively impacting the treatment process.
- Don’t plant trees on top of the drainfield — roots could damage the system.
- Keep roof drains, sump pumps and other rainwater drainage systems away from your drainfield area, as excess water slows down or stops the wastewater treatment process.
- Have your tank pumped out every three to five years by a DEQ-licensed pump service (see Pumping Frequency Table). You can find licensed pumpers in the phone book or online.
- Have the tank inspected every three years for function and sludge accumulation.
Perform simple, constraints-based infill analysis for building out Rural Residential categories. Count small undeveloped lots.

93 developable structures and 445 potential units on small undeveloped lots on RR-zoned lands.

Use the F2 template criteria to perform a screening analysis for reasonable minimum and maximum sideboards of potential new structures on unaddressed lots.

Maximum of 232 & Minimum of 115 structures on existing non-M37 F2-zoned lots.

Count of unaddressed lots (1) meeting minimum lot-size requirements and (2) below minimum lot size as potential new structure sites.

Maximum of 155 & Minimum of 27 structures on existing non-M37 EFU-zoned lots.

Count of lots with approved applications with three structures assumed per lot.

54 additional structures on 95 existing lots.

Total of a maximum of 979 & minimum of 734 new structures.

Estimating Future Development
Purpose: Reward good stewardship through incentives to landowners who maintain healthy riparian areas over long term while facilitating restoration on degraded portions of their properties.
• Completed comprehensive pilot 2014-2016 with 15 landowners

• Received grant funds ($143,000) to build and test Water Fund

• Received grant funds ($50,000) to prioritize outreach, assessments, plans

* Full roll-out in 2018, leveraging MRT Homewaters campaign.
Healthy Riparian Areas Provide Critical WQ & Habitat Functions

Material Flows, Habitat
Organic Matter Input, Shading
Bank Stability

Annual High-Water Mark
Waterbody

Zone of Influence
Stream Corridor

Large River
Upland
High-flow Channel
Channel
Oxbow
Upland

Zone of Influence
100 m
Watershed Valuation – Adding Value to Natural Processes

www.eartheconomics.org
## Balance Sheets

**SEATTLE PUBLIC UTILITIES - WATER FUND**  
(An Enterprise Fund of the City of Seattle)  
**BALANCE SHEETS**  
**DECEMBER 31, 2009 AND 2008**

### Assets

<table>
<thead>
<tr>
<th>Assets</th>
<th>2009</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and equity in pooled investments</td>
<td>$8,354,548</td>
<td>$7,339,673</td>
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<tr>
<td>Accounts receivable, net of allowance for doubtful accounts of $468,450 and $141,182</td>
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<td>$10,062,715</td>
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<td>Unbilled revenues</td>
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<td>Due from other City funds</td>
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<td>656,123</td>
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<tr>
<td>Due from other governments</td>
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<td>Hydrant settlement receivable</td>
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<td>Current portion of notes and contracts receivable</td>
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<td>22,400</td>
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<td>Materials and supplies inventory</td>
<td>4,171,450</td>
<td>4,999,587</td>
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<td>Prepayments and other</td>
<td>37,748</td>
<td>103,314</td>
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<td>BPA account - cash and equity in pooled investments</td>
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<tr>
<td>Redemption account, restricted</td>
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<tr>
<td>Cash and equity in pooled investments</td>
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<td>60,274,366</td>
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<td>Dedicated investments</td>
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<td>1,107,817</td>
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<tr>
<td>Interest receivable</td>
<td>-</td>
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<tr>
<td><strong>Total current assets</strong></td>
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<td>136,910,093</td>
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<td><strong>Restricted Assets</strong></td>
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<td>Bond parity account - cash and equity in pooled investments</td>
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<td>Bond reserve account - cash and equity in pooled investments</td>
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<td>Cash and equity in pooled investments</td>
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<td>Revenue stabilization fund - cash and equity in pooled investments</td>
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<td><strong>Deferred Charges and Other</strong></td>
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<td>Unamortized bond issue costs</td>
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<td>Other deferred charges</td>
<td>13,562,540</td>
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<td><strong>Total deferred charges and other</strong></td>
<td>52,296,832</td>
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<tr>
<td><strong>Capital Assets, at cost</strong></td>
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<tr>
<td>Capital assets - excluding land</td>
<td>1,531,299,805</td>
<td>1,435,137,303</td>
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<tr>
<td>Less accumulated depreciation</td>
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<td></td>
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<tr>
<td>Capital assets, net of accumulated depreciation</td>
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<td>Construction in progress</td>
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<td>Land and land rights</td>
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<td><strong>Total capital assets</strong></td>
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<td>1,131,092,316</td>
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<td><strong>TOTAL</strong></td>
<td>$1,302,507,426</td>
<td>$1,428,887,442</td>
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See accompanying notes.
Nature’s Value in the McKenzie Watershed
A Rapid Ecosystem Service Valuation

May 2012
Table 5 - Ecosystem Services Valued and/or Identified in the McKenzie Watershed

<table>
<thead>
<tr>
<th>Ecosystem Services</th>
<th>Agricultural Lands</th>
<th>Forest</th>
<th>Grasslands</th>
<th>Lakes/Rivers</th>
<th>Pasture</th>
<th>Riparian Buffer</th>
<th>Shrub/Scrub</th>
<th>Urban Green Space</th>
<th>Wetland</th>
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<td>X X X</td>
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<td>X X X X X X</td>
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<tr>
<td>Cultural and Artistic Information</td>
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<td>Science and Education</td>
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<tr>
<td>Spiritual and Historic Information</td>
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<td></td>
</tr>
</tbody>
</table>

**Key:**

- **X**: Ecosystem service produced by land cover and valued in this report
- **Ecosystem service exists with the land cover but is not valued in this report**
- **Ecosystem service not produced by land cover**
## Example of Studies Used in McKenzie Valuation – Riparian Buffer

<table>
<thead>
<tr>
<th>Riparian Buffer</th>
<th>Aesthetic &amp; Recreational</th>
<th>Disturbance Regulation</th>
<th>Gas &amp; Climate Regulation</th>
<th>Habitat Refugium &amp; Nursery</th>
<th>Pollination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kulshreshtha, S. N. and Gillies, J. A.</td>
<td>Rein, F. A.</td>
<td>Birdsey, R.A.</td>
<td>Amigues, J. P., et. al.</td>
<td>$413.50</td>
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<tr>
<td></td>
<td>Shafer et al.</td>
<td></td>
<td></td>
<td>Knowler, D.J., MacGregor, B.W., Bradford, M.J., Peterman, R.M.,</td>
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</tr>
</tbody>
</table>

**Valuation Method Acronyms:** Market Pricing (MP); Contingent Valuation (CV); Avoided Cost (AC); Production Approach (P); Travel Cost (TC); Hedonic Pricing (HP); Replacement Cost (RC); Value Transfer (VT); Meta-Analysis (MA).
## Comparison of Natural Asset Values

<table>
<thead>
<tr>
<th>Land Cover Type (Generalized)</th>
<th>Highest Natural Asset Value ($/acre/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands</td>
<td>$34,888</td>
</tr>
<tr>
<td>Lakes and Rivers</td>
<td>$23,041</td>
</tr>
<tr>
<td>Riparian Buffer</td>
<td>$6,717</td>
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<tr>
<td>Forest</td>
<td>$3,677</td>
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<tr>
<td>Shrub and Scrub</td>
<td>$2,710</td>
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<td>Grassland</td>
<td>$695</td>
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<tr>
<td>Agricultural lands</td>
<td>$644</td>
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</table>
Economic Analysis of Pure Water Partners
## Average Ecosystem Service Benefits of Protecting Riparian Forest in the PWP

<table>
<thead>
<tr>
<th>Benefit Category</th>
<th>Value</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Avoided Sediment</td>
<td>3.72</td>
<td>$/acre/year</td>
</tr>
<tr>
<td>Avoided Nitrogen</td>
<td>20.19</td>
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<tr>
<td>Nitrogen Interception &amp; Removal</td>
<td>148.83</td>
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<tr>
<td>Sediment Interception &amp; Removal</td>
<td>3.24</td>
<td>$/acre/year</td>
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<tr>
<td>Carbon Sequestration &amp; Storage</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>440.40</strong></td>
<td>$/acre/year</td>
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Comparison of PWP Costs and Benefits

### Cost Assumptions

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<th>PLF1</th>
<th>P0LM</th>
<th>P1ML</th>
<th>P0L2</th>
<th>P1L2</th>
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<tr>
<td>PFaDM</td>
<td>P0rF1</td>
<td>P1rF1</td>
<td>P0rF2</td>
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### Benefit Assumptions

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<th>P1ML</th>
<th>P0L2</th>
<th>P1L2</th>
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<tbody>
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<td>d2</td>
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<tr>
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<td>b1e</td>
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</table>

### Cumulative Return-on-Investment Per Acre

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<th>P1ML</th>
<th>P0L2</th>
<th>P1L2</th>
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</tbody>
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Note: The tables and text are placeholders and should be replaced with actual data.
PWP Boundary Reflects Flood/Inundation Zones

Overlay of 6 different models/methods of inundation
Outreach to Landowners

- OWEB funding to do targeted outreach to recruit 40 landowners over 18 months

- Prioritizing landowners who have:
  - high quality riparian property
  - who have worked with EWEB or partners previously
  - or who have expressed interest in the program
Prioritization

- **Quality** riparian property:
  - Proximity to conservation ownership
  - Proximity to developable lots
  - Modeled avoided nitrogen contribution
  - Proportion of vegetative cover within 100 ft of waterways
  - Area within a 100 ft setback of streams

- **Potential** = participation in other programs related to water quality
Results
Quality x Potential map
3 Paths

**Protection**
Annual payments to landowners who maintain healthy riparian areas

**Restoration**
PWP will assist landowners in obtaining funding to restore degraded land

**Naturescaping**
PWP will provide incentives and technical assistance for small streamside landowners
Pure Water Partners Program

- **Aligns funding** for riparian protection and restoration
- **Uses local partners** to work with landowners
- Provides *planning and technical assistance*
- **Provides payments** to landowners with healthy riparian areas
- Assists by *seeking funding* for areas in need of restoration
PWP Programmatic Workflow

Landowner Interest
- EWEB recruits landowner OR
- Landowner contacts EWEB

Desktop GIS Survey

Initial Site Visit
- Program description
- Sign Cooperative Agreement

Assessment Visit
- Conduct field survey

Data Analysis/Reporting
- Meet with landowner, Discuss scores/pathway

Develop Management Plan
- Protection and/or Restoration

Sign Program Agreement

Naturescaping

~$2,500/landowner

Sign Informal Agreement
ALIGN FUNDING

EWEB Protection/PWP Infrastructure

Businesses Investment/Sponsorship

Grants/Foundations One-Time Investments

OWEB Restoration/Protection

USFS/BLM Stewardship Contracting

MWMC WTP WQ Credits: Temp./Shade

Mitigation Funds Developers, ODOT Hydroelectric, DSL

Federal Programs NRCS Prgms, BPA, FEMA, Tax deductions

SWCDs % of tax base

WATERSHED CONSERVATION FUND (501(c)3)

Payments for Protection

Funding for Restoration

PWP LANDOWNERS Residential Agriculture Forestry (F2)

Business Incentives

Mitigation Funds Developers, ODOT Hydroelectric, DSL

Federal Programs NRCS Prgms, BPA, FEMA, Tax deductions

SWCDs % of tax base

EWEB Protection/PWP Infrastructure

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SWCDs % of tax base

WATERSHED CONSERVATION FUND (501(c)3)

Payments for Protection

Funding for Restoration

PWP LANDOWNERS Residential Agriculture Forestry (F2)

Business Incentives
EWEB Customers Willingness to Pay

The chart shows the percentage of EWEB customers willing to pay different amounts per month for unspecified services. The options range from 'Definitely Yes' to 'Definitely No'. The chart indicates that as the monthly payment increases, the percentage of customers willing to pay decreases.
Landowner Interest in the PWP program

10) The voluntary incentive program would pay landowners to maintain existing healthy streamside forests. A partner program would fund projects to restore degraded streamside forests or convert areas currently under other uses to forest. How interested or uninterested would you be in participating in these programs? (select one response for each)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Definitely Interested</th>
<th>Possibly Interested</th>
<th>Unsure</th>
<th>Probably Uninterested</th>
<th>Definitely Uninterested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining existing healthy streamside forests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoring streamside forests that are currently degraded or unhealthy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating streamside forests on land that is not currently forested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Bar charts showing the percentage of landowners' interest in each activity.]
## Scaling-up PWP

<table>
<thead>
<tr>
<th></th>
<th>Large Tax lots (&gt;30ac)</th>
<th>Medium Tax Lots (5-30 ac)</th>
<th>Small Tax Lots (&lt;5 ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number TLs</td>
<td>197</td>
<td>467</td>
<td>1,571</td>
</tr>
<tr>
<td>TLs Enrolled in other EWEB programs</td>
<td>27</td>
<td>41</td>
<td>285</td>
</tr>
<tr>
<td>TLs w/Healthy Riparian Canopy Cover (&gt;60%)</td>
<td>21%</td>
<td>32%</td>
<td>10%</td>
</tr>
<tr>
<td>TLs w/impacted Riparian Canopy Cover (&lt;60%)</td>
<td>79%</td>
<td>68%</td>
<td>90%</td>
</tr>
<tr>
<td>Landowner Outcomes</td>
<td>Protection &amp; Restoration</td>
<td>Protection &amp; Restoration</td>
<td>Naturescaping</td>
</tr>
<tr>
<td>Success (% TLs in PWP in 5 yrs)</td>
<td>25% (49 TLs)</td>
<td>20% (93 TLs)</td>
<td>20% (314 TLs)</td>
</tr>
</tbody>
</table>

EWEB [Canopy cover & # TLs assessed for initial 100’ from waterbody]
EWEB’s Role

• Fund protection pathway (~$75/acre to protect versus $10,000/acre to restore)
• Fund program infrastructure to attract and align outside investments (e.g., USFS)
• Hold riparian long-term leases with landowners (gate keeper for directing funds)
PWP Rollout Schedule

- Prioritize landowner mailing and recruitment through end of 2017
- Open up to broader ‘public’ in Jan/Feb 2018 (publicity and workshops)
- Perform assessments in Spring 2018
McKenzie Watershed Stewardship Group

*Purpose:* to enhance the ecological functions within the McKenzie Watershed and promote the economic viability of local communities.

- Forum for information sharing, coordinated planning and collaboration around common restoration goals.
- Opportunity to align funding and resources to work in priority areas.
### Stewardship Contracts

- 7 Thin just completed and we are expecting around $110,000 in retained receipts
- Begun to discuss priorities for retained receipts
- *Receipts can be used on private lands*

<table>
<thead>
<tr>
<th>USFS Priority</th>
<th>Draft Non-federal Priority</th>
<th>Project Name</th>
<th>Project Type</th>
<th>Potential Ecosystem Service Benefit (to be refined by specialists)</th>
<th>Public/Private</th>
<th>Units</th>
<th>Estimated Cost</th>
<th>Potential Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>1</td>
<td>PWP Riparian Restoration</td>
<td>Riparian Mgt/Protection</td>
<td>water quality, fish and wildlife habitat, flow regulation, aesthetics, recreation opportunities</td>
<td>Private</td>
<td>15-30 acres</td>
<td>Potentially seeking $20,000 to $25,000 in MRSG funds. This would replace previously requested/approved $30k for the Dehne project</td>
<td>PWP, private.</td>
</tr>
<tr>
<td>n/a</td>
<td>2</td>
<td>Augment LWM and boulders in high priority tributaries (Gate Creek)</td>
<td>Augment LWM</td>
<td></td>
<td>Private/public</td>
<td>1-2 miles</td>
<td>$100,000-$200,000/mile</td>
<td>Weyerhaeuser, 412 Tech Team, BLM, ODFW</td>
</tr>
<tr>
<td>n/a</td>
<td>3</td>
<td>County Parks and Boat Launches Riparian Restoration</td>
<td>Riparian Mgt/Protection</td>
<td>water quality, fish and wildlife habitat, flow regulation, aesthetics, recreation opportunities</td>
<td>Public and Private</td>
<td>unk</td>
<td>variable</td>
<td>Lane County, MWC, River guides, schools, USFS</td>
</tr>
</tbody>
</table>
McKenzie Watershed Stewardship Group

Partners
- Cascade Pacific RC&D
- McKenzie River Trust
- McKenzie Watershed Council
- Oregon Dept of Forestry
- Oregon Wild
- Upper Willamette SWCD
- US Forest Service
- Whitewater Forests LLC