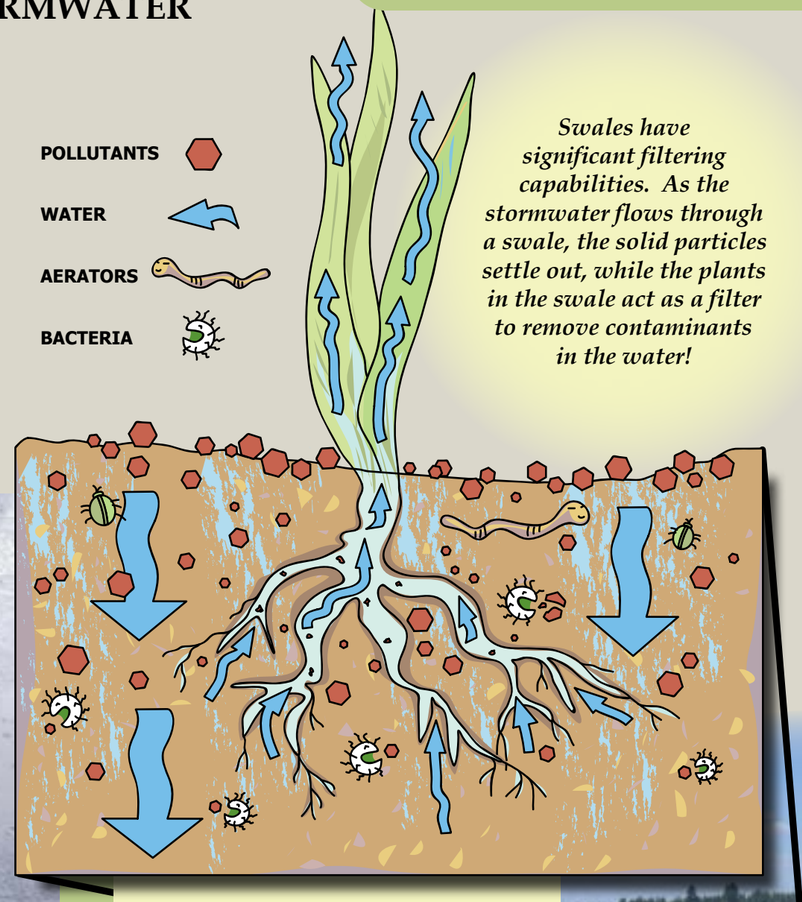
STORMWATER SWALES & THE AQUIFER

SWALES: THE NATURAL WAY TO CAPTURE STORMWATER

When it rains, the water runs over pavement and other hard surfaces, picking up pollutants along the way. Much of this polluted stormwater runoff historically flowed only to storm drains, which ultimately empties into rivers, lakes, or infiltrated to the SVRP aquifer.

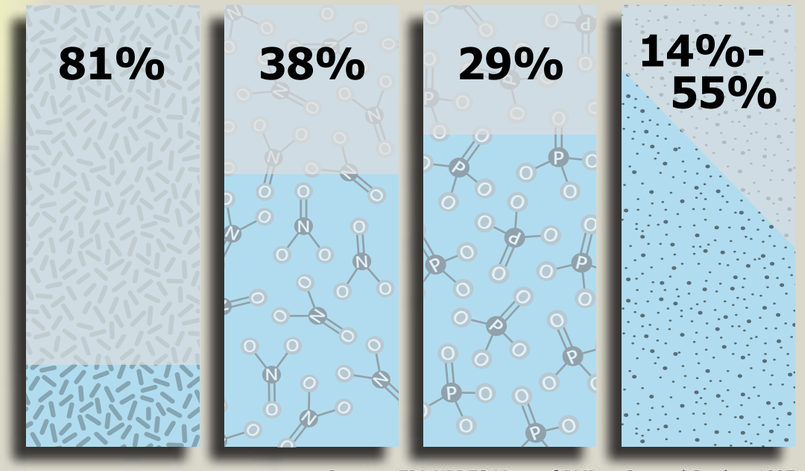
In recent years, local governments have been turning to swales rather than storm drains and drywells to manage runoff. In fact, swales are now the preferred method to handle stormwater runoff!

Swales not only provide for immediate collection of stormwater to reduce flooding, but the ponding of rainfall and snowmelt in the swale allows the water to naturally soak into the ground.



Swales have significant filtering capabilities. As the stormwater flows through a swale, the solid particles settle out, while the plants in the swale act as a filter to remove contaminants in the water!

How Much Pollution Can Swales Remove from Stormwater?



Source: EPA NPDES Menu of BMPs - Grassed Swales, 1997

LOW-IMPACT DEVELOPMENT: NATURALLY REDUCING STORMWATER RUNOFF

Low-impact development (LID) preserves and recreates natural landscape features, minimizing hard surfaces and their effects to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product. LID techniques can include bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and porous pavement.

Porous pavement prevents stormwater runoff and allows any rain or snowmelt to soak through the pavement itself and into the soil below. Rain barrels store the rain from rooftops to use for watering lawns or other plants. Vegetated rooftops can reduce stormwater runoff and act as insulation. Rain gardens and bioretention facilities function like swales and are planted with native and ornamental grasses, shrubs, and trees to filter stormwater. Rain gardens can easily be installed in your front yard to reduce stormwater runoff. Bioretention facilities are engineered for water quality and flow control.

LID over the SVRP Aquifer

You can spot LID facilities over the SVRP aquifer in many places, inlcuding the Panhandle Health District in Hayden, Coeur d'Alene High School, Broadway Avenue near Maple in Spokane, and Country Homes Boulevard in Spokane County. You can even see rain barrels in residential yards!

THE FOUR IMPORTANT FUNCTIONS OF A SWALE

Adsorption: The pollutants in water attach to the surface of soil particles, where roots and bacteria can use them, or where they just remain indefinitely.

Storage: Roots, insects, and worms increase the space between soil particles, making more room for stormwater storage.

Plant Uptake: Water, nitrogen, phosphorus, and other trace elements are used for plant growth.

Recharge: The excess stormwater (the water not used by the plants) recharges the groundwater supplies in the aquifer via infiltration.

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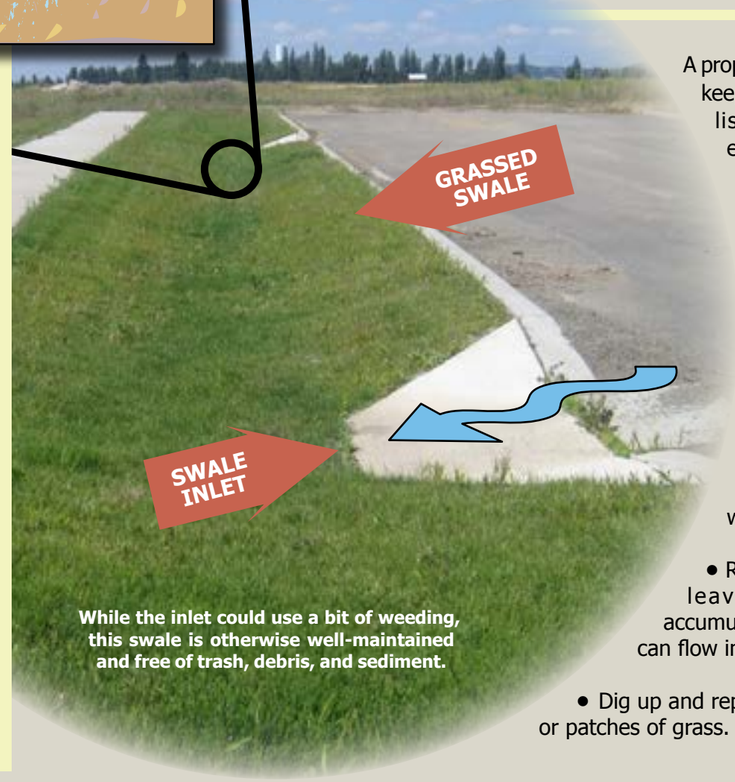
4/6/2015

SWALE MAINTENANCE TIPS FOR HOMEOWNERS



While the inlet could use a bit of weeding, this swale is otherwise well-maintained and free of trash, debris, and sediment.

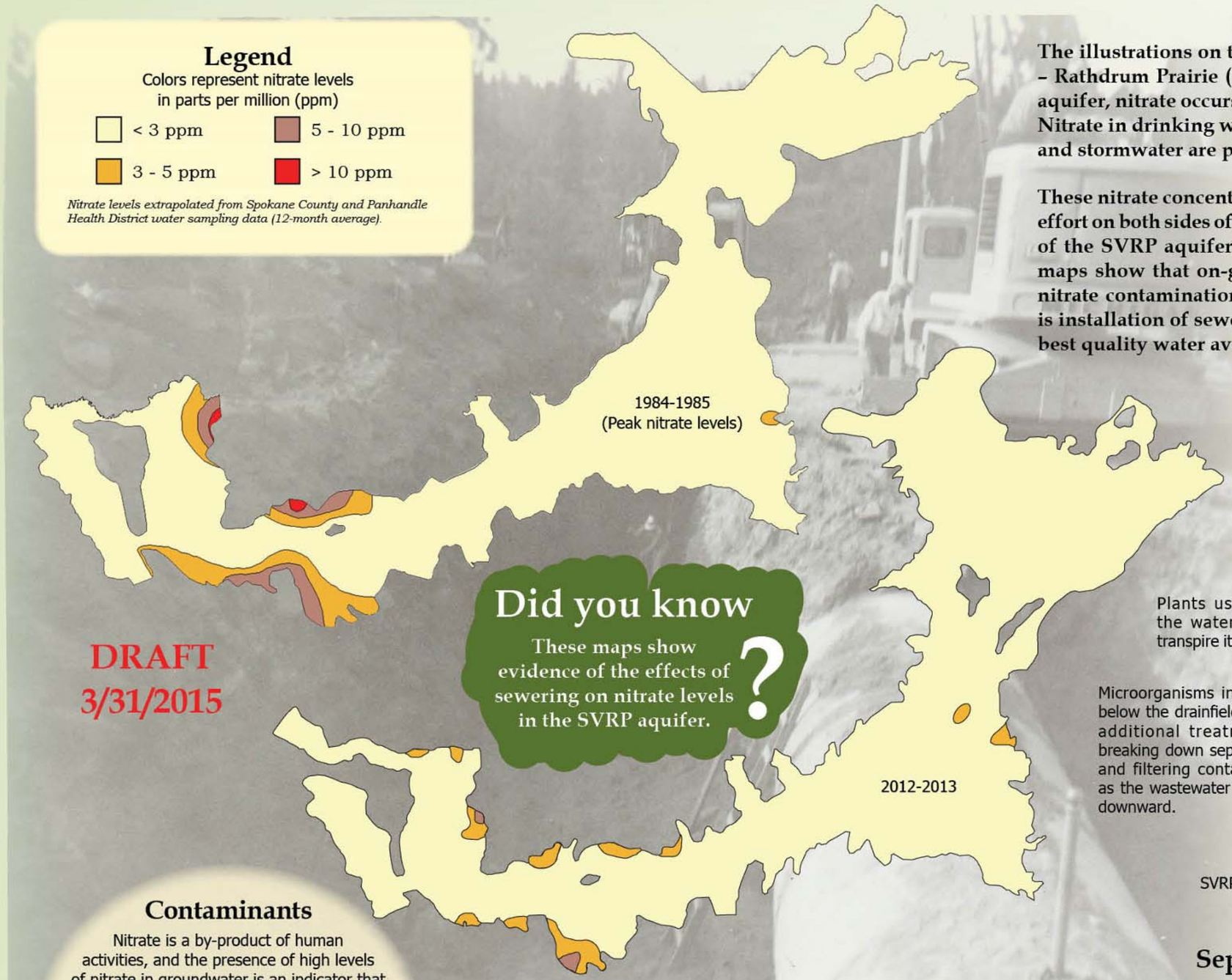
A properly maintained swale can help to keep our aquifer clean. The following list will assist homeowners by ensuring their swale can manage runoff efficiently:

- Mow grassed swales to promote healthy growth.
- Don't replace the grass or plants with rocks.
- Minimize the use of lawn and/or garden chemicals.
- Avoid overwatering; water should pond in the swale only when it rains.
- Remove sediment, litter, branches, leaves, and other debris that accumulates at the inlets so that runoff can flow into the swale.
- Dig up and replace any dead plants or patches of grass.

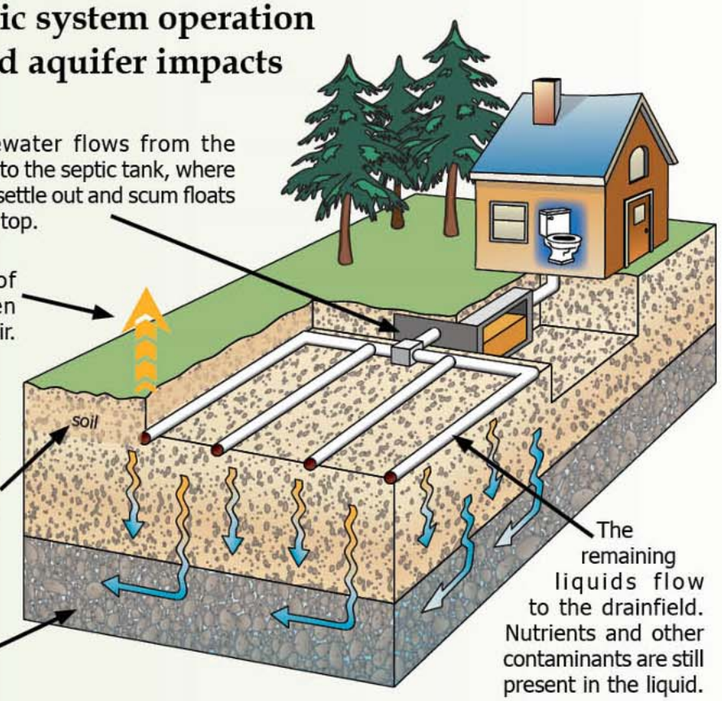
SEWERING EFFECTS

The illustrations on this page show concentrations of nitrate in the Spokane Valley – Rathdrum Prairie (SVRP) aquifer through time. Under natural conditions in our aquifer, nitrate occurs in low concentrations, typically 1 to 2 parts per million (ppm). Nitrate in drinking water above 10 ppm may cause illness. Septic systems, fertilizer, and stormwater are potential sources of elevated nitrate levels in the SVRP aquifer.

These nitrate concentration maps are from water years 1985 and 2013. In 1985 a major effort on both sides of the state line was initiated to reduce septic system contamination of the SVRP aquifer through installation of piped sewer collection systems. The maps show that on-going SVRP aquifer protection programs have decreased the nitrate contamination despite significant population increases. The main program is installation of sewers. The groundwater in the SVRP aquifer remains some of the best quality water available anywhere.



Septic system operation and aquifer impacts



Contaminants

Nitrate is a by-product of human activities, and the presence of high levels of nitrate in groundwater is an indicator that other by-products of human activity may also be present. Other possible contaminants include phosphorous, petroleum products, heavy metals, and industrial chemicals. Traces of some of these other contaminants have occasionally been found in local aquifer wells. On-going monitoring and protection programs are essential to protect the high quality of aquifer water.

Note: The latest aquifer boundary is slightly different than previous versions because it reflects minor adjustments resulting from the 2007 Bi-State Aquifer Study.

Septic System Maintenance

- Be cautious about chemical or biological additives. Research has shown that additives provide little to no benefit.
- Inspect your system annually to measure sludge and scum levels.
- Pump your septic tank every 3 to 5 years based on results of annual inspections.
- Keep a grass cover over the drainfield to help use some of the available nutrients and aid in evapotranspiration.
- Keep trees from growing over the drainfield. Roots from the trees can plug or damage the lines.

For more information, see the Lake*A*Syst Manual in Idaho or the Spokane Regional Health District website in Washington.

Background picture: 1961 installation of City of Spokane treatment plant bypass pipe.

75 YEARS OF SEWER

The region's wastewater management strategies have developed over the past century in recognition of the need to protect the Spokane Valley – Rathdrum Prairie (SVRP) aquifer and Spokane River.

Outhouses were originally used, sometimes even constructed on the nearest creek, to quickly carry the waste away! This practice was common in cities, which later installed underground pipes to carry wastewater and stormwater from residences directly to the river. Areas without access to city sewers began to use septic systems, which allowed some treatment of household wastewater in a septic system it percolated through the soil. Rural areas still use septic systems for wastewater disposal; these systems are safe and efficient when properly built and maintained.

Septic systems in high density population areas led to increases in nutrients in the SVRP aquifer. Over time, local municipalities have built sewers and modern treatment facilities to clean and dispose of wastewater.

The purpose and goal of modern wastewater treatment is to separate waste solids from water, treat the water with biological and chemical processes, and discharge the water as clean as possible to protect the environment. **Primary treatment** allows the largest materials to settle out of the wastestream and oils and grease to float to the top, similar to what happens in a septic tank. The removed solids are processed in a digester and further dewatered before reuse or disposal. **Secondary treatment** uses biological processes to remove the organic contaminants from the water. **Tertiary treatment** is a state-of-the-art technology that facilities in the region are beginning to implement, and uses microscopic filtration to remove smaller particles. The final step disinfects the water to remove viruses and bacteria before discharging it to the environment.

Local municipalities have invested significantly to continually improve our local wastewater treatment facilities. Local municipalities are now required to use tertiary treatment to meet the low phosphorus, ammonia, and oxygen demand standards intended to increase dissolved oxygen levels and support aquatic life in Lake Spokane.

SEWER SERVICE AREAS OVER THE SPOKANE VALLEY – RATHDRUM PRAIRIE AQUIFER

DRAFT
3/31/2015

Sewer service areas represent those areas where sewer service is available. Actual sewer hookups may not be present in all areas.

Recycled Water

Water recycling is a permitted activity that is currently used in Idaho on the Rathdrum Prairie. Wastewater from the cities of Hayden, Hayden Lake, and Spirit Lake along with Farragut State Park and Silverwood Theme Park is treated and used seasonally to irrigate various crops. The most common crops are native forest, alfalfa, and poplar trees. These plants can consume large amounts of water for irrigation and also use the nutrients in the recycled water in place of fertilizer.

The amount of water applied to these crops is restricted to only what the plants need, to limit the amount of recycled water and nutrients that can seep past the roots. How do farmers know how much water to use? Farmers use weather stations in the area along with crop and soil data to predict how much irrigation can be applied. They also monitor the amount of water in the soil and the nutrients in the plants to ensure that the right amount of recycled water is being applied. Special monitoring wells have been completed in the Rathdrum Prairie Aquifer next to the irrigated fields and are regularly tested to ensure there are no water quality impacts.

1940s Spokane residents were informed of the need for a treatment facility and expanded sewer system. Those in opposition called it "a terrific barrage of propaganda."

1971 Liberty Lake Sewer and Water District was formed by a vote of the residents. The treatment plant was completed in 1982.

1975 Spokane County began sewer construction in Spokane Valley to eliminate septic tanks. In 1980, Spokane City and County agreed to allow up to 10 mgd to flow from this area to the RPWRF.

1985 The Post Falls treatment facility came online, allowing 7,000 people to be removed from septic systems.

2012 Construction is completed on the Spokane County Water Reclamation Facility, which uses state-of-the art tertiary treatment to remove pollutants.

1940 1950 1960 1970 1980 1990 2000 2010 2020

1939 Coeur d'Alene completed its secondary-level wastewater treatment plant, one of the first of its kind in the world.

1958 Spokane opens its treatment plant, now called the Riverside Park Water Reclamation Facility (RPWRF).

The Clean Water Act was enacted in 1972, mandating secondary wastewater treatment.

1977 Panhandle Health District adopted the "5-acre rule" to limit septic system density over the SVRP aquifer.

1986 Hayden Area Regional Sewer Board (HARSB) formed. HARSB completed its secondary treatment facility by 1992.

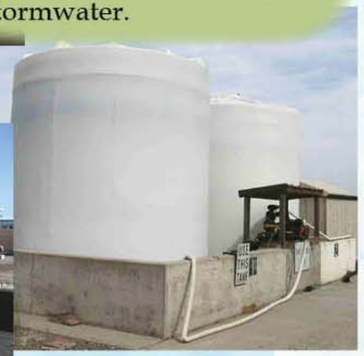
2021 All facilities discharging to the Spokane River must operate tertiary treatment technology to meet current standards.

AQUIFER PROTECTION – BUSINESS

CHEMICAL STORAGE & HANDLING

Store chemicals and hazardous waste in secondary containment to keep spills from spreading and moving. Chemicals stored outside should be covered to keep out stormwater.

Plastic containment for drums



Concrete containment

Poly-geotextile containment

PROCESS WASTEWATER

Commercial wastewater must be discharged to a public sewer when permitted and possible. When that is not possible, the wastewater must be contained on site and evaporated (if permitted) or hauled to an acceptable waste disposal site.

Wastewater retention pit with mechanical evaporator

Passive wastewater evaporation pond

SOLUTIONS - Best Management Practices at Businesses

To minimize risk, businesses are asked (or required) to implement best management practices (BMPs). BMPs are methods using current knowledge and technology to provide the best acceptable control and/or treatment of the three main sources of contamination: chemical storage and handling; process wastewater; and contaminated stormwater.

UNDERGROUND STORAGE TANKS

Underground storage tanks (USTs) are used to store petroleum or other hazardous liquids. There are nearly 300 active UST sites, often with multiple tanks at each site, operating over the Spokane Valley – Rathdrum Prairie aquifer that are regulated by state UST programs.

Every UST facility must be inspected at least once every 3 years.

All owners and operators of USTs are required to complete training in how to properly identify, operate, and maintain UST components.

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3/31/2015

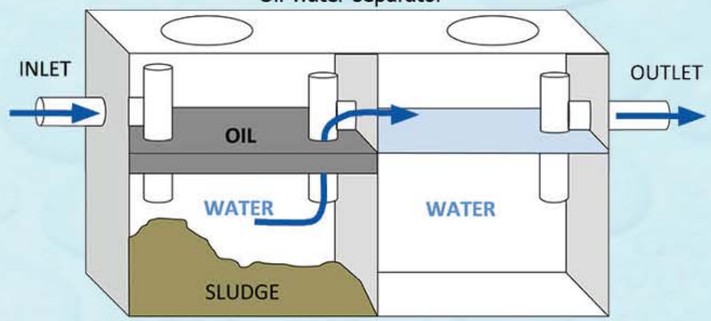
Have a spill plan and spill clean-up materials ready at all times.

STORMWATER

Rain and snow can mix with contaminants at industrial sites. The contaminants can come from historical practices or from current storage and handling. The most common way stormwater becomes contaminated is at fueling sites where drips, overfills, and drive-offs are common.

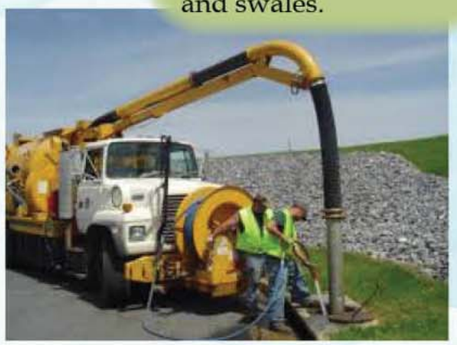
All contaminated stormwater at fueling businesses must be collected on a concrete pad and passed to a drain then through an oil-water separator.

Oil-water separator



Oil-water separators work because fluids, such as oils and fuels, which are less dense than water, float and remain in the first chamber, the heavy sludge sinks to the bottom where it can be removed and disposed of properly. Oil-water separators must be cleaned regularly to remain effective.

Regularly inspect, maintain, and clean drywells in parking lots and swales.



Sweep parking lots, work areas and streets instead of washing them to a storm drain.

AQUIFER PROTECTION – BUSINESS

We are fortunate to have many types of businesses in our area including aerospace; agriculture; vehicle maintenance and fueling; machining; manufacturing; metal fabrication; surface mining/ concrete and asphalt; and heavy equipment manufacturing and maintenance. Unfortunately, all these businesses present a potential risk to groundwater when they store and use chemicals.

RISKS

Sometimes chemicals are intentionally applied to the ground for our benefit. They may present a risk especially if unintentionally released, misapplied, or overused.

DID you know ? There are tens of millions of gallons of chemicals stored over our SVRP aquifer.

Storage containers may leak or their contents can be displaced by stormwater if left unprotected outside.

Underground storage tanks can leak and their contents can end up in the SVRP aquifer.

Precipitation can carry contaminants into storm drains that discharge into the SVRP aquifer or into our lakes and rivers.

DRAFT 3/31/2015

Transferring chemicals between containers or to a vehicle presents a risk of a spill and release to the ground.

Wastewater from washing vehicles, commercial carpet cleaning, metal plating, and numerous other manufacturing and industrial processes can pollute our water if it is not disposed of properly.

Stormwater can enter open dumpsters, contact garbage, and leak the polluted water to storm drains.

AQUIFER PROTECTION-HOME

DRAFT 4/6/2015

Household Hazardous Waste

Many products that we use every day contain hazardous materials that can be dangerous to people, water, and the environment!

Use safe housekeeping practices when storing, handling, and disposing of harmful materials, including automotive fluids, cleaning products, fertilizers and pesticides, fluorescent lights, medications, paint, and swimming pool or hot tub chemicals.

WHAT TO DO

- Use products that are non-toxic and environmentally friendly.
- Read and follow directions carefully when using any hazardous product.
- Store products in their original containers and label them clearly.
- Store products above basement flood level, and off the ground in garages and sheds.

WHAT NOT TO DO

- ✖ Don't throw toxic substances or their containers in the trash.
- ✖ Never pour leftover products down sink drains or into the toilet.
- ✖ Never mix leftover products.
- ✖ Do not dispose of household hazardous waste in streams, rivers, or lakes.
- ✖ Do not dump toxics into storm drains.

SOME THINGS DON'T BELONG IN YOUR DRAIN. THEY CAN CLOG PIPES AND POLLUTE OUR WATER!

Toilet Cloggers

Household drains and toilets are designed to take only used water, human waste, and toilet paper.

Many products, like wipes, claim to be "flushable." But that doesn't mean these items are treatable in the wastewater system!

Sink Cloggers

Eliminate the use of garbage disposals.

Ground-up garbage does not decompose easily, causes buildup of solids in septic tanks, and may clog distribution pipes.

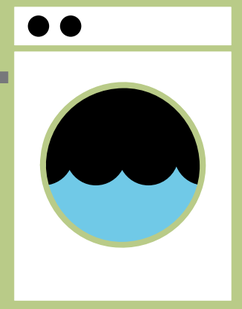
Polluters

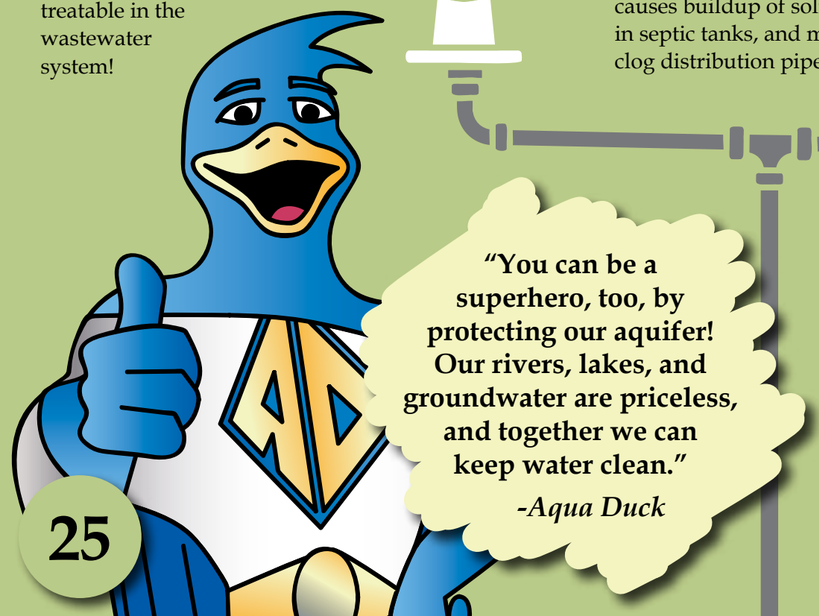
Medications and toxic substances including chemicals, cleaners, degreasers, oils, paints, disinfectants, and pesticides should never be put down the drain.

Laundry Cloggers

Use liquid laundry detergent, and use it sparingly.

Powdered detergent is more likely to have fillers that could damage a septic system!





"You can be a superhero, too, by protecting our aquifer! Our rivers, lakes, and groundwater are priceless, and together we can keep water clean."

-Aqua Duck

Remember, what goes down the drain doesn't just disappear, it ends up in our water! The following list of items should never be poured down the drain or flushed in the toilet:

- ✖ Baby wipes
- ✖ Band-aids
- ✖ Bandages
- ✖ Chemicals
- ✖ Chewing gum
- ✖ Cigarette butts
- ✖ Cleaning wipes
- ✖ Coffee grounds
- ✖ Condoms
- ✖ Cotton balls
- ✖ Dental floss
- ✖ Diapers
- ✖ Eggshells
- ✖ Feminine products
- ✖ Food
- ✖ Grease
- ✖ Hair
- ✖ Kitty litter
- ✖ Kleenex
- ✖ Medications
- ✖ Napkins
- ✖ Nursing pads
- ✖ Paper towels
- ✖ Plastic bags
- ✖ Q-tips
- ✖ Rags
- ✖ Vitamins
- ✖ Wrappers

11 WAYS to conserve WATER *in the* HOME

1 Shorten shower times, and choose showers over baths.

A full bathtub requires 70 gallons of water, while a 10-minute shower uses 25 gallons!

2 Only wash full loads in the dishwasher.

3 Only wash full loads of clothes, and use a front-loading washing machine and suds savers to save water.

4 Use a stopper in the sink if washing dishes by hand.

5 Use a broom, not a hose, to clean driveways and sidewalks.

6 Know where the water shut-off valve is in your home.

7 Repair leaky pipes, running toilets, and dripping faucets ASAP.

Faucets that drip once per second waste over 3,000 gallons a year!

8 Keep a pitcher of water in the fridge rather than letting the water run in the sink until it turns cold.

9 Install aerators and flow reducers in sinks and bath faucets.

10 Replace old appliances and fixtures with energy-efficient models. Look for the EPA Water Sense and Energy Star Logos!

11 Convert older toilets to low-flow with a displacement device.

LET'S PULL THE PLUG ON E-WASTE!

WHAT IS E-WASTE?

E-waste consists of all discarded, surplus, obsolete, and broken household or business electronic devices and electric appliances.

A typical 17-inch computer contains roughly 2.2 pounds of lead. Lead is a toxic substance that may cause lead poisoning!

WHY IS E-WASTE A PROBLEM?

Printers, computers, televisions, and cell phones contain toxic heavy metals such as cadmium, lead, mercury, and chromium.

Disposing of electronic items in the garbage means these toxins could be released into the environment through landfill leachate or incinerator ash.

E-WASTE LEACHATE & THE AQUIFER

As rainwater flows through a landfill, it dissolves many of the toxic compounds found in e-waste.

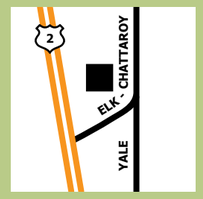
The contaminated landfill water, called leachate, eventually escapes the many layers of landfill liner. When the leachate reaches groundwater, it can be lethal to humans. For the SVRP aquifer, this could threaten the drinking water for over 500,000 people.

SPOKANE COUNTY WASTE DISPOSAL SITES

Office - 509.477.3604 **Hotline - 509.477.6800**

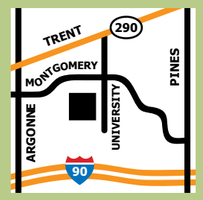
Regional facilities in Spokane County accept trash, recyclables, organics and yard waste, household hazardous waste, construction and demolition waste, and appliances.

Waste to Energy Facility
2900 S. Geiger Boulevard
Spokane, WA 99224



North County Transfer Station
22123 N. Elk-Chattaroy Road
Colbert, WA 99005

Valley Transfer Station
3941 N. Sullivan Road
Spokane Valley, WA 99216



University Transfer Station
2405 N. University Road
Spokane Valley, WA 99206
Office - 509.924.5678

KOOTENAI COUNTY WASTE DISPOSAL SITES

Office - 208.446.1430 **Hotline - 208.446.1433**

Kootenai County provides two, full-service transfer stations. The transfer stations are open to the general public and waste-hauling companies.

Ramsey Transfer Station
3650 N. Ramsey Road
Coeur d'Alene, ID 83815

Prairie Transfer Station
15580 W. Prairie Avenue
Post Falls, ID 83854

NOTE: All waste disposal facilities in Kootenai and Spokane Counties are closed on the following holidays: New Year's Day, Memorial Day, 4th of July, Labor Day, Thanksgiving Day, and Christmas Day.

For information regarding solid waste collection facilities within Bonner County, visit:
bonnercounty.us/solid-waste

ELECTRONIC WASTE BREAKDOWN IN THE UNITED STATES

56%	Televisions	10%	Business Electronics	6%	Household Electronics
18%	Electronics Packaging	6%	Monitors	4%	PCs

ACCORDING TO RESEARCH, E-WASTE IS GROWING AT 3X THE RATE OF OTHER MUNICIPAL WASTE!

LOCAL RESOURCES FOR WASTE MANAGEMENT

DRAFT 4/6/2015

Coeur d'Alene Lake*A*Syst
www.ourgem.org/documents/landowners/hazardouswastes.pdf

Idaho Department of Environmental Quality
www.deq.idaho.gov/media/1074/deq-recycling-guide.pdf

Panhandle Health District
www.phd1.idaho.gov

Spokane County Regional Solid Waste System
www.spokanecounty.org/utilities/solidwaste

EnviroStars Waste Directory
www.spokanewastedirectory.org

Kootenai County Solid Waste
www.kcgov.us/departments/solidwaste

Spokane City Solid Waste
www.spokanecitysolidwaste.com

City of Spokane Valley
www.spokanevalley.org/solidwaste

STATE AND FEDERAL RESOURCES FOR WASTE MANAGEMENT

IDAHO

The Idaho Department of Environmental Quality provides information on household hazardous waste and pollution prevention, and offers regulatory and technical assitance.

To visit their website, go to:
www.deq.idaho.gov

WASHINGTON

Households, small businesses, school districts, small governments, and charities can recycle products free of charge through E-Cycle Washington.

To find electronic recycling services in your area, call 1-800-RECYCLE or visit:
1800recycle.wa.gov

U.S. ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency offers information on proper waste disposal, household hazardous waste, and recycling.

For more details about computers and their impact on landfills, visit:
www.epa.gov/waste

SVRP AQUIFER TOUR

This Spokane Valley – Rathdrum Prairie (SVRP) Aquifer Tour is dedicated to everyone who has ever asked, "Where can I see the aquifer?"

Dams

L	Post Falls Dam
Y	Upriver Dam
DD	Upper Falls Dam
EE	Monroe Street Dam
II	Nine Mile Dam

Recharge Lakes

A	Lake Pend Oreille
C	Hayden Lake
G	Spirit Lake
H	Twin Lakes
K	Coeur d'Alene Lake
O	Hauser Lake
P	Newman Lake
R	Liberty Lake

Reclamation

F	Hayden Area Regional Wastewater Treatment Plant
I	Coeur d'Alene Wastewater Treatment Plant
M	Post Falls Water Reclamation Facility
S	Liberty Lake Water Reclamation Facility
BB	Spokane County Regional Water Reclamation Facility
FF	Riverside Park Water Reclamation Facility

Miscellaneous

D	HARSB Land Application Site
Q	Hand Pump
T	Water Tower
U	Sullivan Park Spokane Valley
X	Gravel Pit
GG	Spokane Hatchery
HH	Painted Rock Gauging Site

Historic

B	Ice Dam Site - Farragut State Park
N	Millrace Head Gate
V	Vera Water District Well (Evergreen)
W	Spokane Valley Historical Museum
Z	Original 1907 Well

Education

E	Panhandle Health District Building
J	University of Idaho Water Resource Center
AA	Spokane County Water Resource Center
CC	Mobius Science Center

DRAFT
3/31/2015

It's easy to visit the beautiful Coeur d'Alene Lake in Idaho or take a raft trip through the Bowl and Pitcher whitewater rapids on the Spokane River in Washington, but where can you go to see the Spokane Valley – Rathdrum Prairie aquifer? Only tiny portions of the aquifer can be seen by looking down a well or by driving by the gravel pits on Broadway in Spokane to get a glimpse into the gravel and rock that is permeated by the aquifer. This aquifer tour was created to help you explore the 370-square mile underground aquifer by visiting historic and geologic features; lakes that recharge the aquifer; dams, water reclamation facilities, and educational places where you can learn more about the aquifer. Have fun and enjoy the tour.

For more information use this QR code or go to www.spokaneaquifer.org.

ACKNOWLEDGEMENTS

2015 SVRP Aquifer Atlas Edition Team

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Mike Galante - IWAC
Tonilee Hanson - SAJB
Laura Laumatia - CdAT
Mike LaScuola - SRHD
Rob Lindsay - SC
Sandy Phillips - SRHD
Lynn Schmidt - CoS

Acronyms

CdAT	Coeur d'Alene Tribe of Indians
CoS	City of Spokane
CoSV	City of Spokane Valley
EPA	US Environmental Protection Agency
EWU	Eastern Washington University
HARSB	Hayden Area Regional Sewer Board
IDEQ	Idaho Dept. of Environmental Quality
IWAC	Idaho Washington Aquifer Collaborative
LLSWD	Liberty Lake Sewer and Water District
PHD	Panhandle Health District
SC	Spokane County
SAJB	Spokane Aquifer Joint Board
SRHD	Spokane Regional Health District
USGS	US Geologic Survey
UI	University of Idaho Extension
WDOE	Washington Department of Ecology

FOR MORE INFORMATION

The Spokane Valley – Rathdrum Prairie (SVRP) Aquifer Atlas 2015 Edition is online at: www.SVRPaquiferAtlas.org. The QR code at the left will also take you to the website.

This website has links for all the agencies involved in creating this atlas and the following topics:

- Geology
- Ice Age Floods
- Hydrogeology
- Water Use
- Water Companies
- Sewers & Septic Systems
- Stormwater
- SVRP Aquifer Monitoring
- Business Best Management Practices

In Appreciation

This is the first version of the Spokane Valley – Rathdrum Prairie Aquifer Atlas without James D. MacInnis, P.E. taking the lead and doing the major portion of the work on design, layout, and text. It is also the first version without Beatrice B. Lackaff creating all the maps. Several photos taken by them are included in this edition as a way to continue their involvement. Thanks to both of them for all their hard work in the past.

RESOURCE GUIDE FOR EDUCATORS AND PARENTS

This is a stand-alone publication that provides lesson plans, activities, student projects, and other educational resources related to the SVRP aquifer. These are tied to ID/WA core educational standards. It is available for free download as a PDF document at www.SVRPaquiferAtlas.org. The guide uses the SVRP Aquifer Atlas for lessons in science, technology, engineering, math (STEM), and other areas.

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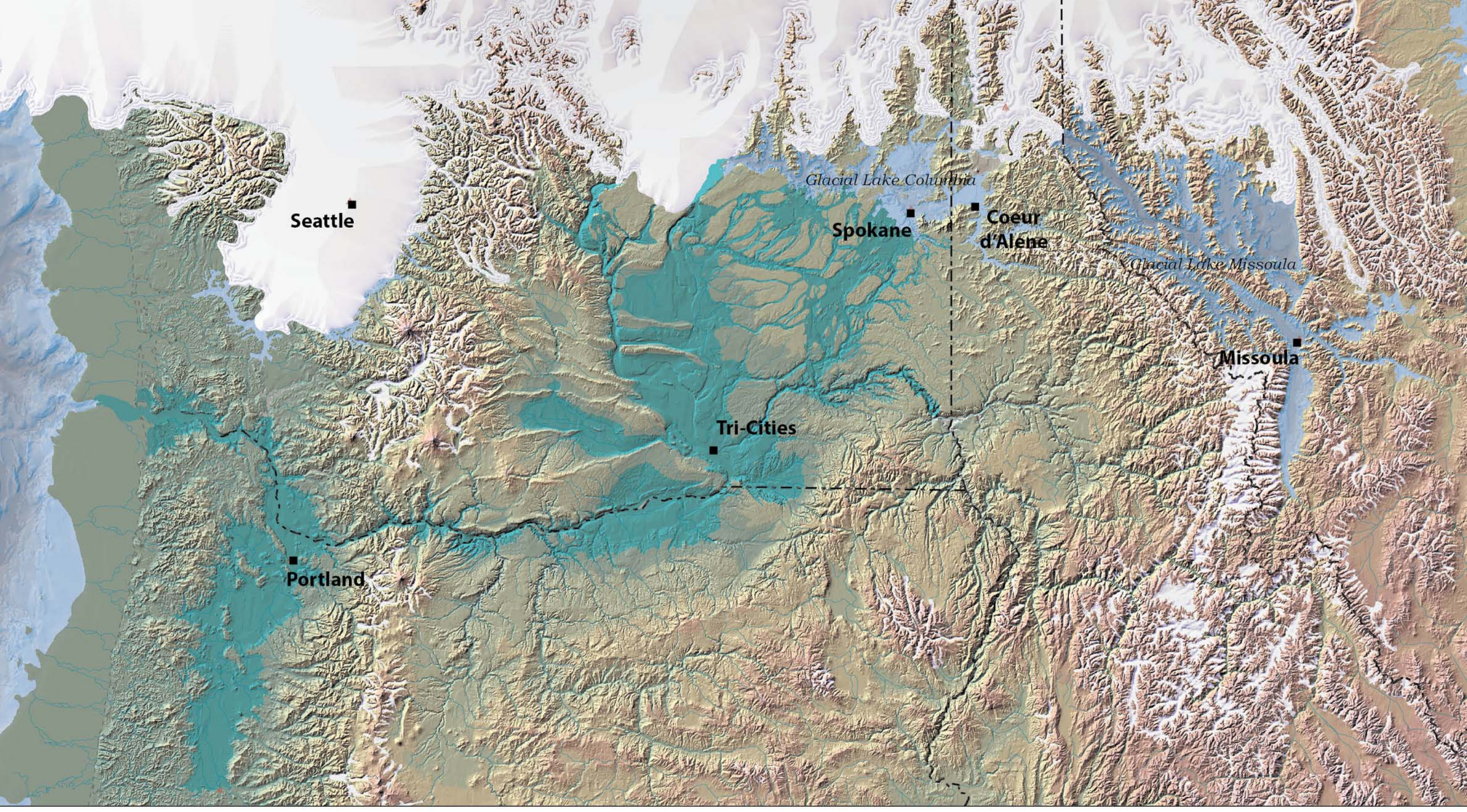

The Pacific Northwest During the Last Ice Age: 18,000 to 12,000 Years Ago

This map depicts the Pacific Northwest during the late Pleistocene Epoch based on available scientific evidence. Several interesting conditions relative to modern times are evident. The present city of Missoula, Montana, was under Glacial Lake Missoula, the lake responsible for generating the floods that created the aquifer sediments. The flood paths are shown in green. Present day Spokane, Washington, and Coeur d'Alene, Idaho, were also under water from Glacial Lake Columbia that was created when glacial ice blocked the Columbia River. The present location of Seattle, Washington, was under a lobe of the glacial ice sheet. The vast amounts of water trapped in the ice sheet caused the Pacific Ocean level to drop about 300 feet, and the ocean shore retreated several miles from its present location. A full-size map developed by Jeff Silkwood, "Glacial Lake Missoula and the Channeled Scablands", is available from the Ice Age Flood Institute.