The Spokane Valley-Rathdrum Prairie
AQUIFER ATLAS

FIFTH EDITION

WELCOME to the fifth edition of the *Spokane Valley-Rathdrum Prairie (SVRP) Aquifer Atlas*. The original SVRP Aquifer Atlas was published in 2000 and updates were issued in 2004, 2009, and 2015.

As in past versions of this atlas, the purpose is to present a comprehensive summary of the region's most precious groundwater resource. The intent is to provide a basic reference of the geographic, geologic, and hydrologic characteristics of this aquifer. It is intended for regional use in education, in planning, and as a source for general technical information.

The SVRP Aquifer spans two states, Washington and Idaho. Natural resources that cross political boundaries are often subject to different and sometimes conflicting standards, protections, and uses. All SVRP Aquifer Atlas editions are a joint effort by agencies in both states to create a holistic representation of the SVRP Aquifer as both a geologic feature and a natural resource used daily by more than half a million people.

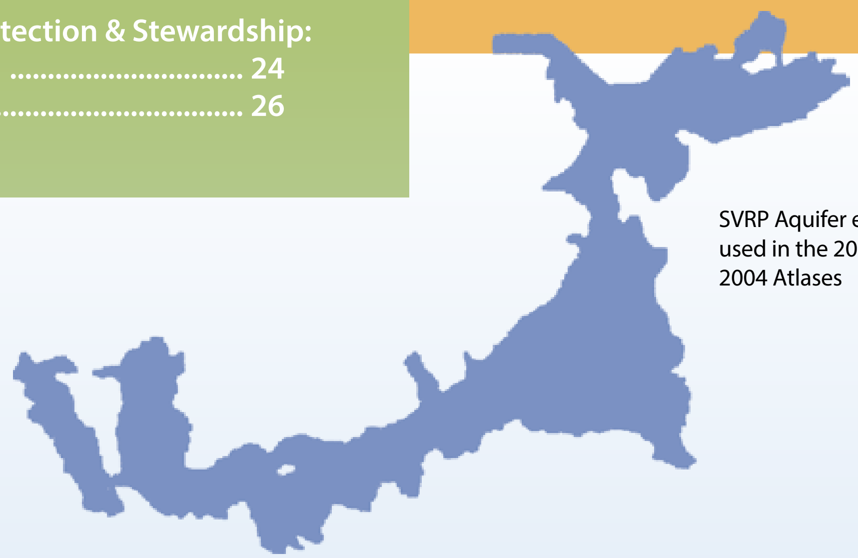
Political boundaries and objects made by people are absent from the front cover map to show the aquifer as a natural feature. The SVRP Aquifer area is a darker blue to differentiate the aquifer area from lighter surface water bodies.

What's New in this Edition

The fifth edition of the SVRP Atlas has a new design, as well as updated charts and information. It is the authors' goal to include issues that are currently facing our region. Our hope is to educate the public, and through greater understanding of this precious resource, to become good stewards who will protect and preserve this finite aquifer.

Many new issues face our region since the 2015 SVRP Aquifer Atlas was released. The dynamic interaction between the Spokane River and the SVRP Aquifer has been the subject of scientific studies, media reports, and much public discussion. Attention has been focused on the connection between the two water bodies, the quantity and quality of water that enters both resources, stormwater impacts, wastewater discharge, and seasonal minimum flow rates of the Spokane River. These issues have also raised public concerns related to the health of fisheries and general aquaculture of the Spokane River.

Nine Mile Reservoir on the Spokane River.

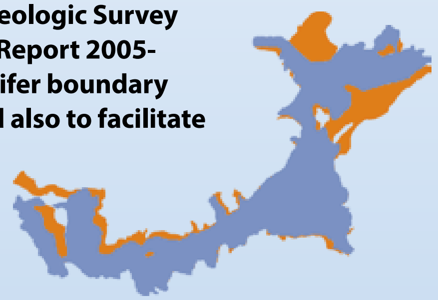


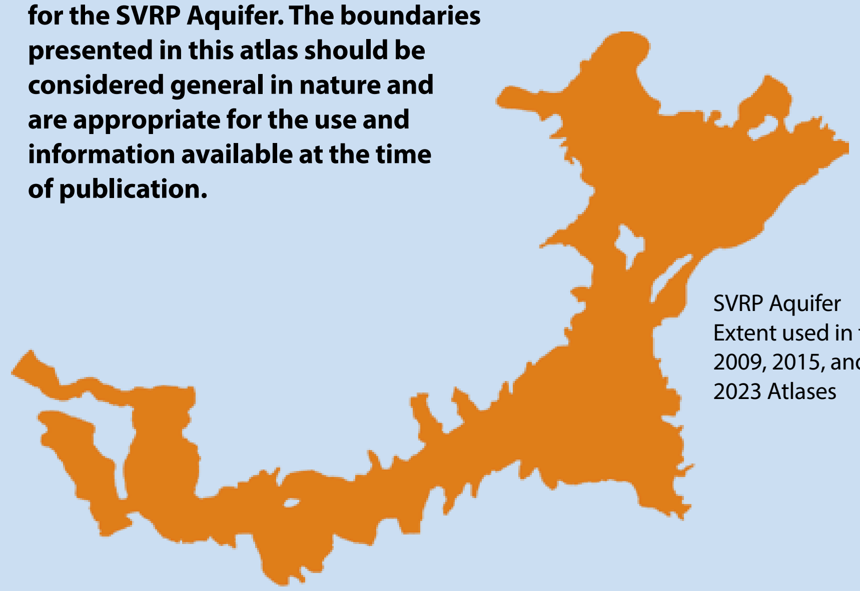
SVRP Aquifer extent used in the 2000 and 2004 Atlases

Setting Boundaries: The SVRP Aquifer Extent

The boundary of the SVRP Aquifer has been defined differently by various investigators over time. The 2000 and 2004 aquifer atlases used the aquifer boundary adopted by the Environmental Protection Agency (EPA) in 1978. The boundary used in this document is the aquifer extent described by the US Geologic Survey (USGS) in 2005 (Scientific investigations Report 2005-5227) that expanded portions of the aquifer boundary based on hydrogeologic information and also to facilitate computer modeling.

The aquifer extent defined by the USGS in 1978 or for the 2005 to 2007 studies does not represent the EPA's Sole Source Aquifer boundary defined for the SVRP Aquifer. The boundaries presented in this atlas should be considered general in nature and are appropriate for the use and information available at the time of publication.





SVRP Aquifer Extent used in the 2009, 2015, and 2023 Atlases

What is an aquifer?

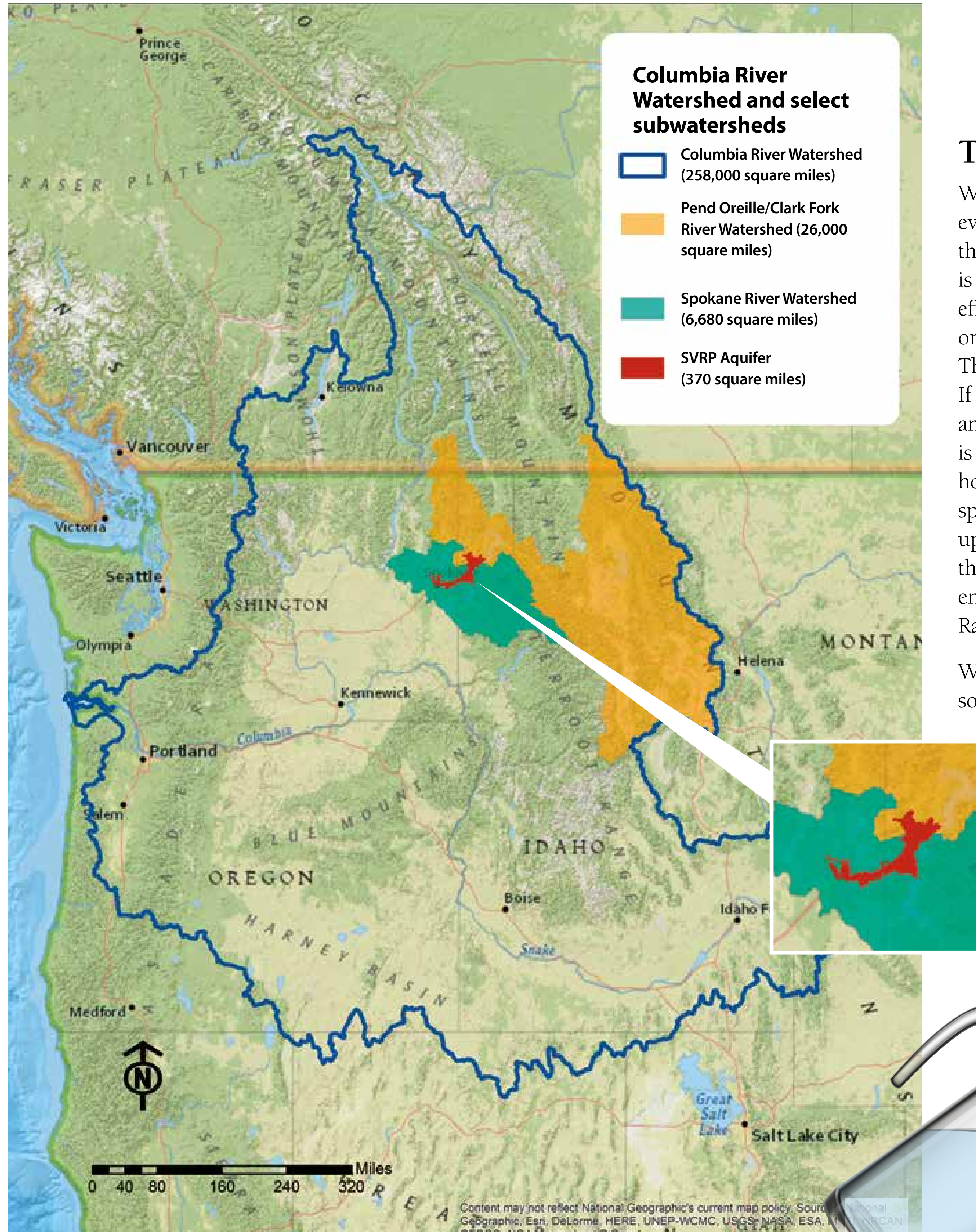
The term aquifer describes an economically useful and retrievable source of groundwater from the subsurface. Aquifers are generally characterized by the rock and/or sediment that is holding groundwater. An aquifer can be confined (there is a layer of low permeability rock or clay above it) or unconfined (no low permeability layer above it).

In terms of material that characterize aquifers there are two major divisions: unconsolidated aquifers (sediments hold groundwater) and consolidated aquifers (rocks hold groundwater). Unconsolidated aquifers, like the Spokane Valley-Rathdrum Prairie (SVRP) Aquifer, are composed of sediment like sand, gravel, cobbles, and boulders. Consolidated, or bedrock aquifers, are composed of solid rocks where cracks in the rock (fractures, joints and fissures) hold the volume of groundwater rather than the rock itself. As you might imagine, bedrock aquifers generally yield far less groundwater than unconsolidated aquifers.

The term aquifer is often misunderstood or misconstrued. Unconsolidated aquifers provide the majority of useful groundwater resources. Unconsolidated aquifers are groundwater resources that consist of sediments that are saturated with groundwater. While groundwater can seep into or out of aquifers due to their porous nature, it cannot move fast enough to flow like a river. Unconsolidated aquifers are not an underground river or lake as some might imagine but rather groundwater pulled from the empty spaces between sediments.

Watersheds are geographic areas that drain to a common point. Rain and melting snow run off from the ridges and hills down to the lowest point in the watershed, typically where stormwater empties into a river, lake or stream or sinks down (infiltrates) into the ground. The Columbia River, Pend Oreille/Clark Fork River and Spokane River Watersheds contribute to the SVRP Aquifer.

Watersheds may also be referred to as drainage basins and may vary in size. Watersheds or drainage basins may be defined by a small stream, covering only a few square miles, or they may be defined by a major river, such as the Columbia River, covering thousands of square miles.

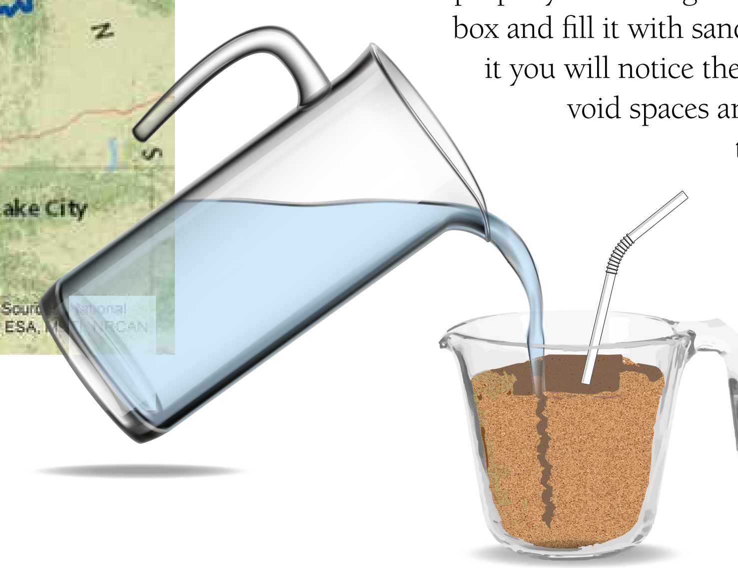


The Water Beneath Us

Wherever one is in the world if you dig deep enough you will eventually encounter water. Think about when a child plays in the sand at the beach. On most sandy beaches the groundwater is very shallow so if you dig only several inches or a foot in an effort to build a sandcastle you will most likely encounter water or a hole that begins to fill with water from seemingly nowhere. This is groundwater. Groundwater can be difficult to visualize. If you picture a lake with the water removed you could imagine an empty bowl that holds that lake water; with groundwater it is merely the empty space between sediment, dirt, and soil that holds the water. At first thought it doesn't seem like those small spaces between sand grains, soil, gravel, cobbles, etc. would add up to a whole lot of volume. Indeed it does, and for many regions this volume of water is sufficient to supply drinking water to entire cities; like for those of us living over the Spokane Valley-Rathdrum Prairie Aquifer.

When water from the surface such as rain, snow, runoff, or sometimes lake and river water infiltrates into the ground it eventually comes to equilibrium in which the depth of the water becomes more or less stable. This may be as shallow as 1–5 feet below the ground surface in very rainy areas or hundreds of feet below the ground surface in more arid areas. This level will also change in response to water being added by rainy seasons, water being removed for drinking or for irrigation, and by lack of replenishment in the case of a drought.

To properly visualize groundwater take a cup or a box and fill it with sand. If you pour water into it you will notice the sand will darken as the void spaces are filled with water. If you take a small pump or straw and extract water, that simulates how pumps work in the real world, just on a smaller scale.



4 Timeline

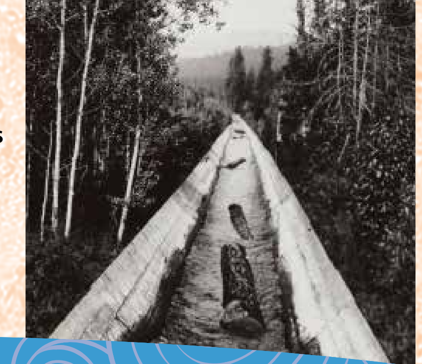
Since time immemorial, ancestors of the Coeur d'Alene and Spokane Tribes have lived in the lands surrounding the aquifer. The watershed provided them with bounteous fish, game, and plants that were, and are, an integral part of the tribal communities for millennia.

1860
James Madison Alden paints "Plante's Crossing" while official artist of the Northwestern Boundary Survey.

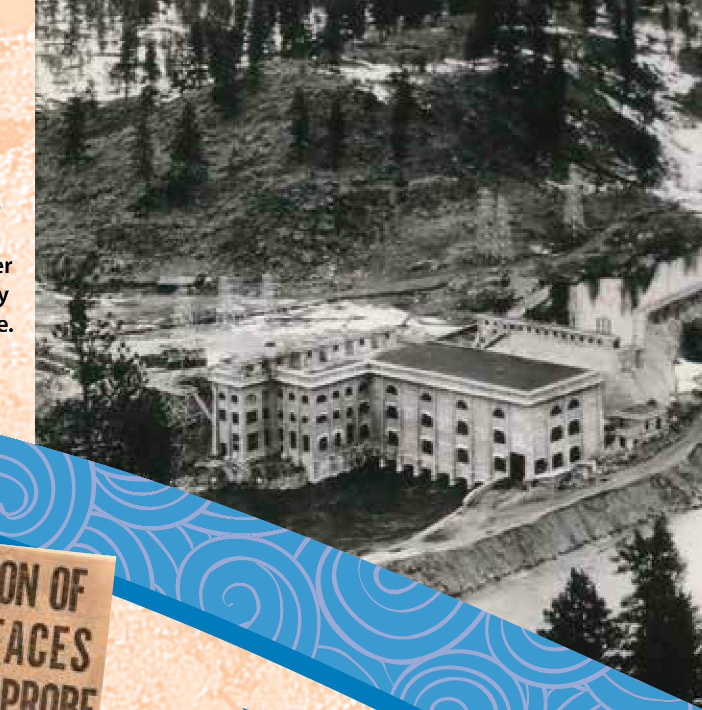
1884
City of Spokane purchases private water system consisting of two pumps and a few hundred feet of water main in downtown Spokane.

1894
Aquifer discovered during the construction of the City of Spokane's Upriver Dam and Pump House.

1899
Spokane Valley Irrigation District formed and Corbin ditch canal irrigation started.



1931
Washington Water Power Company (Avista) prepares the first comprehensive study of groundwater in the Spokane Valley and Rathdrum Prairie.



1860 1870 1880 1890 1900 1910 1920 1930 1950 1960

Plante's Crossing

1905
Modern Irrigation and Land Company, the first of many, formed to provide SVRP Aquifer water to Spokane Valley Farmers.

1907
The SVRP Aquifer replaces the Spokane River as the City of Spokane's primary source of drinking water.


POLLUTION OF RIVER FACES STATE PROBE

Governor Martin Appoints Committee to Study Problem With Officials

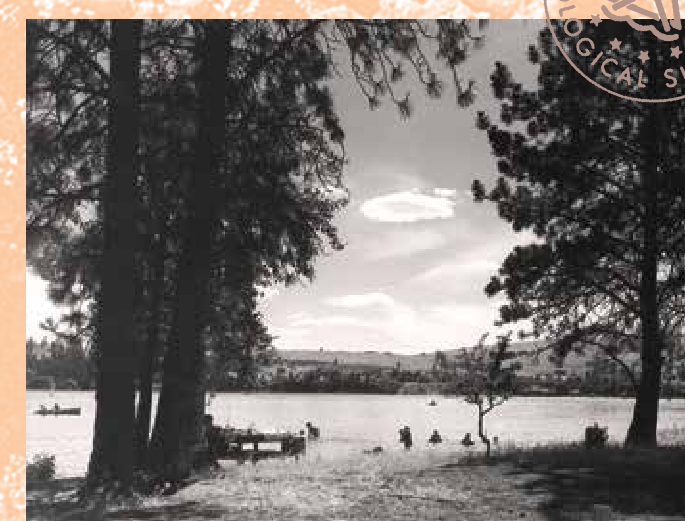
1938
A survey of all major Washington rivers and waterways found the Spokane River the foulest body of water in the state.

1940
Joseph T. Pardee, a USGS geologist, proposes that an Ice Age glacial lake (Lake Missoula) drained rapidly creating Bretz's catastrophic floods.

1951
USGS publishes an inventory of SVRP Aquifer wells in Bonner and Kootenai Counties.

1952
USGS publishes an updated inventory of SVRP Aquifer wells in the Spokane Valley.

Modern Irrigation & Land Co. 3,000 gpm, 1908.



Sandy Beach, Liberty Lake, Washington, late 1940s.

Boy travels underground.

An ancient story of the lakes and aquifer as told by Felix Aripa, Coeur d'Alene Tribe

There was a boy who lived towards Hayden Lake area. The boy loved fishing. The boy loved to walk around. He went to the forests; he went to the mountains. There he saw his friends. There were a lot of animals that lived there. There were animals that fly; there was duck, bald eagle, owl, bee, magpie. Also there were the ones that live in the forest – elk, deer, bear, squirrel. There were the fierce animals – cougar, bear. And the ones that live in the river – frog, trout. A lot live on the prairie – rabbit, spider, prairie chicken, coyote.

One day the boy went fishing. He had a canoe. And he paddled across the water at Hayden Lake. And the weather changed. It began to get windy. The sky became gray.

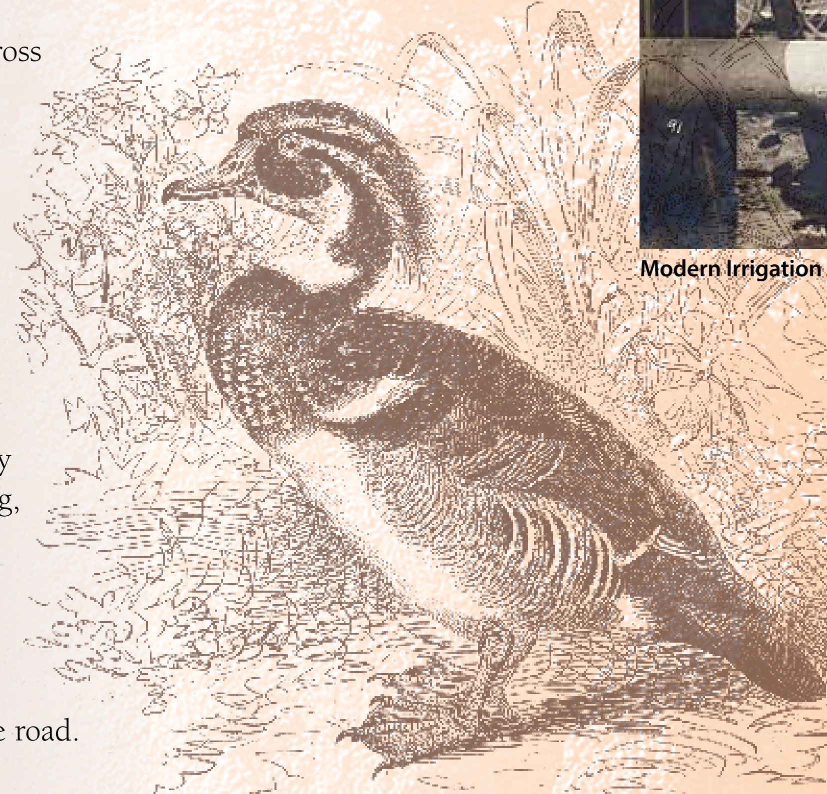
And the boy approached an eddy. He started spinning, and he went down. He dove in. He arrived at a cave. He was all wet. And the boy was really tired. He laid down. He went to sleep.

[He woke up.] He walked a long ways kind of in a confusion (of where he was at). And the boy walked for three days.

And he heard something loud. There was a waterfall! And then the boy looked through it. He saw animals; there were his friends. They were happy. There was duck, bald eagle, owl, bee, cougar, bear, frog, rabbit, spider, chicken, squirrel, coyote, trout, . . .

And the boy ran. He leaped through the waterfall. There was a splash! He dove in the river! And he swam. He crossed the water. He got really tired. He laid down on the shore. And he slept.

And he awoke. He was at q'emlin (Post Falls). That is the end of the road.



1972
Federal Clean Water Act provides authority and funding for SVRP Aquifer protection planning efforts.

1973
Liberty Lake Sewer and Water District created to protect the lake and aquifer.

1974
EXPO '74 opens in Spokane with the theme: "Celebrating Tomorrow's Fresh New Environment."

1976
Army Corp. of Engineers publishes the 14 volume Spokane Region Water Resources Study.

Local citizens and environmental groups petition the EPA to designate the aquifer as a "sole source aquifer."

1977
Panhandle Health District implements the rule that limits domestic septic systems to one per five acres.
Local "208" studies are completed, and the sources of aquifer pollution are identified.

1978
EPA designates the SVRP Aquifer as a "sole source aquifer" under Section 1424(e) of the Safe Drinking Water Act.

1980
Spokane County and Panhandle Health District initiate a groundwater monitoring program for the SVRP Aquifer.

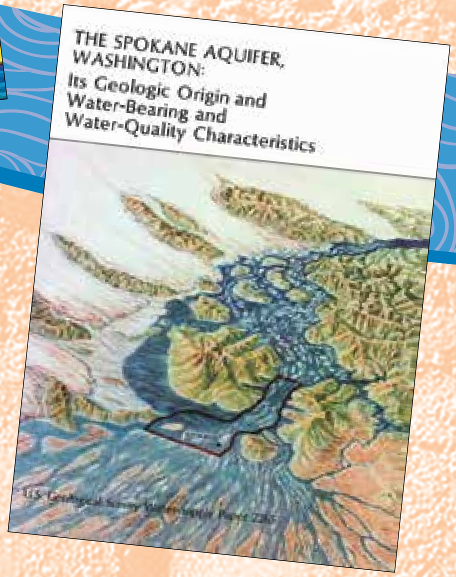
IDEQ designates the SVRP Aquifer as a "special resource water" in Idaho, the highest level of state protection.

1981
Spokane County adopts a wastewater management plan to eliminate septic systems over the SVRP Aquifer.

1985
Spokane County authorizes the aquifer protection area for 20 years in a public vote.

1988
U.S. Congress provides aquifer protection funding through the EPA.

USGS publishes Molenaar's Aquifer Report, the first modern SVRP Aquifer study.



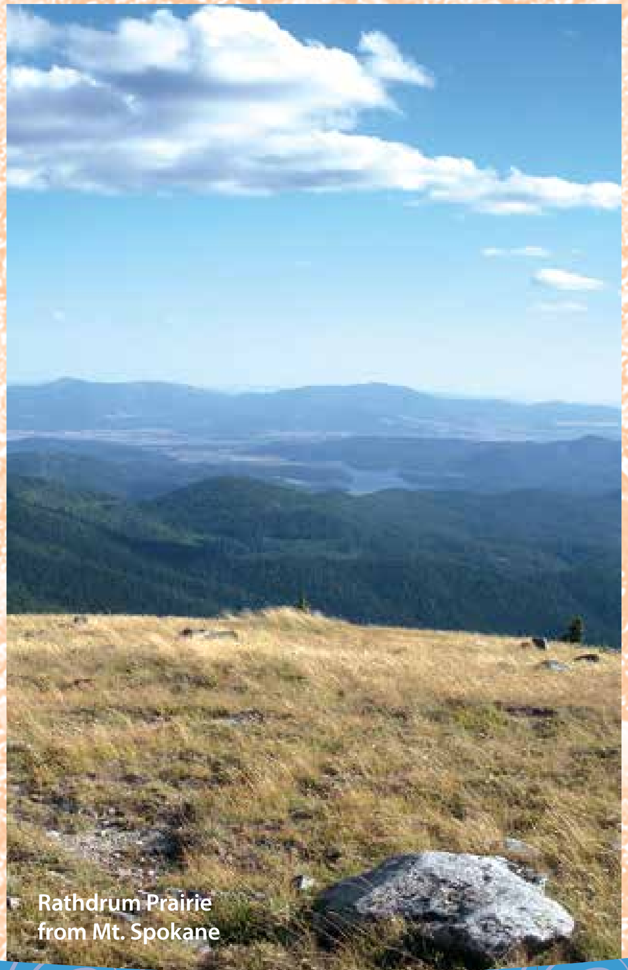
1990
Panhandle Health District begins requiring secondary containment of critical materials.

1995
IDEQ adopts guidelines for land-applying wastewater over the SVRP Aquifer in Idaho.

WA State water purveyors united for safe drinking water found the Spokane Aquifer Joint Board.

1997
IDEQ designates Aquifer as a "sensitive resource aquifer" in the Idaho state Groundwater Quality Rule.

1998
The City of Spokane and the Spokane Aquifer Joint Board publish a wellhead protection plan. The plan is updated in 2007.


Rathdrum Prairie from Mt. Spokane

2004
Spokane County voters reauthorize the aquifer protection area fee to continue funding to protect the aquifer.

2007
The results of a 4 year USGS bi-state aquifer study and monitoring program are presented to the public.

Kootenai County residents vote to form an Aquifer Protection District to fund SVRP Aquifer protection programs.

2008
Idaho begins water rights adjudication of the Rathdrum Prairie Aquifer.

2009
Avista's Post Falls and other Spokane River dams relicensed.

2010
Comprehensive Aquifer Management Plan (CAMP) is adopted by Idaho Water Resource Board and Legislature.

2011
Spokane County opens $144 Million Regional Water Reclamation Facility, treating up to 8 million gallons/day with advanced treatment.

2013
Idaho Washington Aquifer Collaborative forms to maintain and/or enhance the aquifer quality and quantity.

2014
City of Spokane begins work on the "Integrated Clean Water Plan" to prioritize projects that manage stormwater and wastewater.

2015
Washington Department of Ecology issues an instream flow rule for the Spokane River to ensure water levels that support aquatic life and recreation.

Washington Department of Ecology declares a "Drought Emergency" encompassing the entire state.

2020
City of Spokane adopts "Water Conservation Master Plan" that focuses on strategies to reduce water demand.

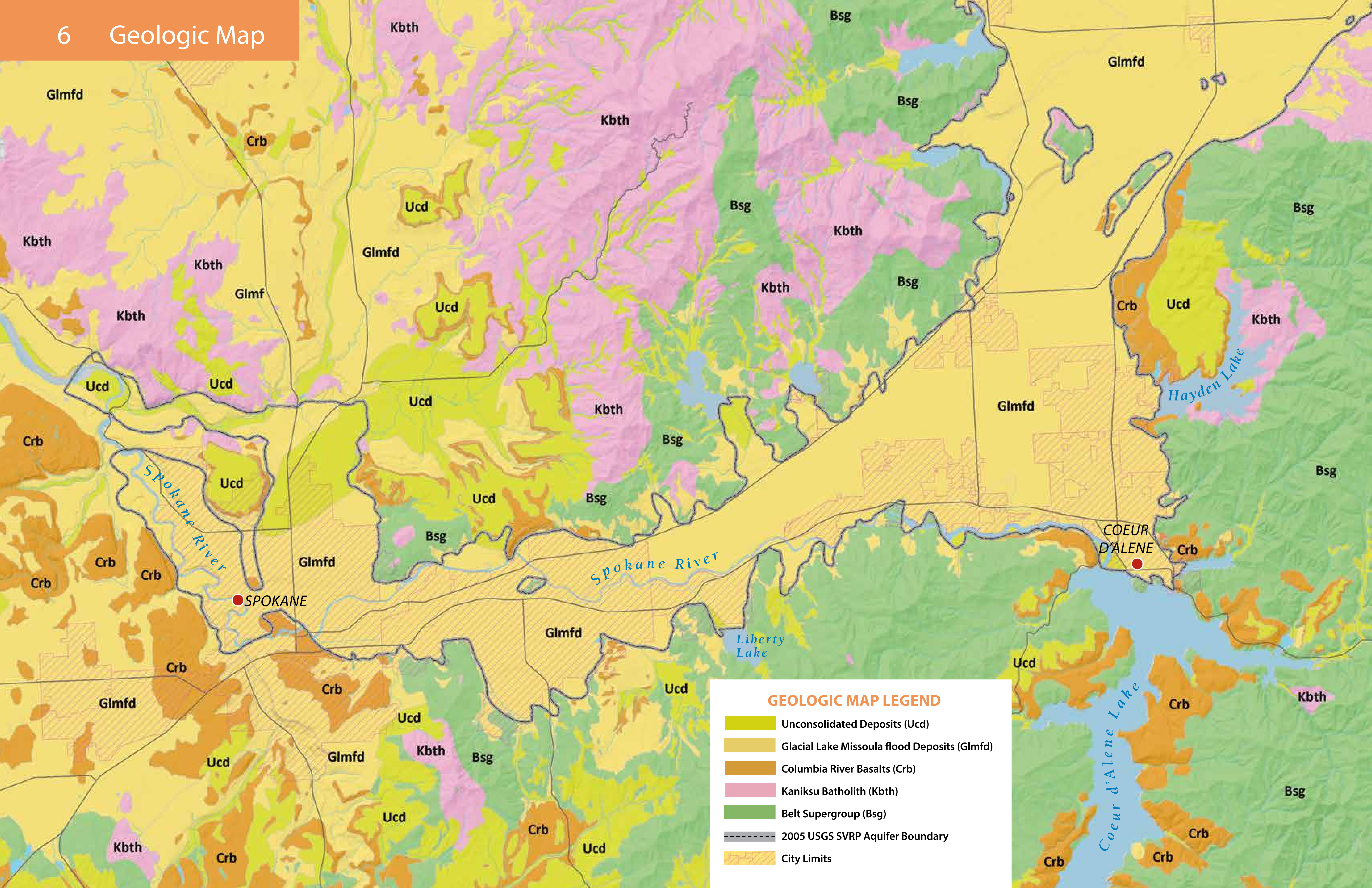
2021
Washington Department of Ecology issues a drought emergency for most of the state.

2021
City of Spokane completes additional tertiary treatment technology at RPWRF, following Spokane County in 2011, Liberty Lake in 2017, and CDA in 2019.

2022
City of Spokane adopts "Watering Rules" that limit irrigation times and days per week.


Riverside State Park, Bowl and Pitcher, Spokane

6 Geologic Map



How geology formed the SVRP Aquifer.

The geology of the Spokane Valley-Rathdrum Prairie area is the result of geologic events that have occurred over hundreds of millions of years, creating both our landscape and the aquifer of today. Understanding the geologic events of the past helps us better understand our environment and current issues affecting our aquifer. The geology of the area is complex and it has taken decades to piece the history together. Five significant geologic units make up most of the rock types found in the Spokane Valley-Rathdrum Prairie area. Brief descriptions of these units follow on the next pages. The color surrounding the name of each rock type matches the color of the geologic units shown on the geologic map on the left.

Belt Supergroup

Belt Supergroup rocks in Idaho

WHAT: Mostly fine grained mudstone and argillite with some sandstone and mafic intrusive rocks

WHEN: 1.1 to 1.4 billion years ago

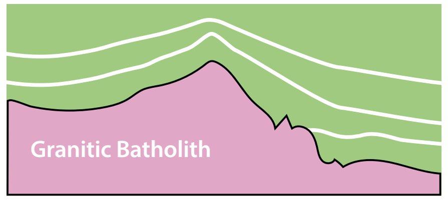
WHERE: Found in western Montana, northern Idaho, parts of Washington and Wyoming, and extending into Canada. Belt Supergroup rocks can be found in mountain ranges but also extend deep below ground surface.

HOW: Sediments (mostly clays and silts) filled an ancient sea basin for millions of years. As the sediments piled up the weight pushed the rock beneath them down making the basin deeper and allowing for the sediment to pile up over 10 miles thick. The weight of all the overlying sediment eventually caused it to metamorphose and turn into a type of rock called an argillite.

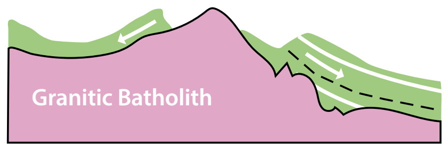
WHY IT'S IMPORTANT: The Belt Supergroup rocks are largely impermeable and water does not easily flow through them. These rocks form parts of the basin that water of the SVRP Aquifer sits on top of much like a bathtub.

Kaniksu Batholith

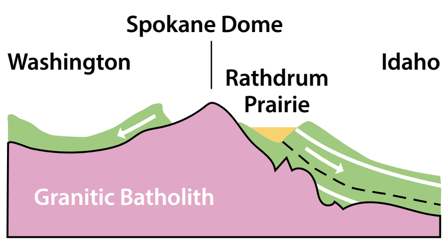
Deposition of Belt Supergroup



Intrusion of granitic batholith caused by subduction of western plate



Batholith emplacement displaces Belt Supergroup rocks to the east and west



WHAT: Mostly granitic rock

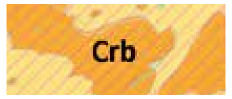
WHEN: 50 to 100 million years ago

WHERE: Northern Idaho and Northeastern Washington

HOW: About 150 million years ago, the continental margin was located along Idaho's western border, where two tectonic plates collided. This collision resulted in the western plate being forced down (subducted) and overridden by the eastern plate. As the western plate was subducted, the rock was heated and portions were melted. The melted material (magma) was lighter than the surrounding rock and rose up from deep within the earth. Instead of forming a volcano, it solidified near the earth's surface and formed what is called a batholith.

WHY IT'S IMPORTANT: The formation of the batholith played a key role in the shaping of the topography in the region by pushing the Belt Supergroup rocks upward and out, which provided preferential pathways for floodwaters and subsequent deposition of aquifer-bearing rocks. Much like the Belt Supergroup, the Kaniksu batholith also forms part of the bedrock material that the aquifer sits on top of.

Rocks of the Kaniksu Batholith



Columbia River Flood Basalts

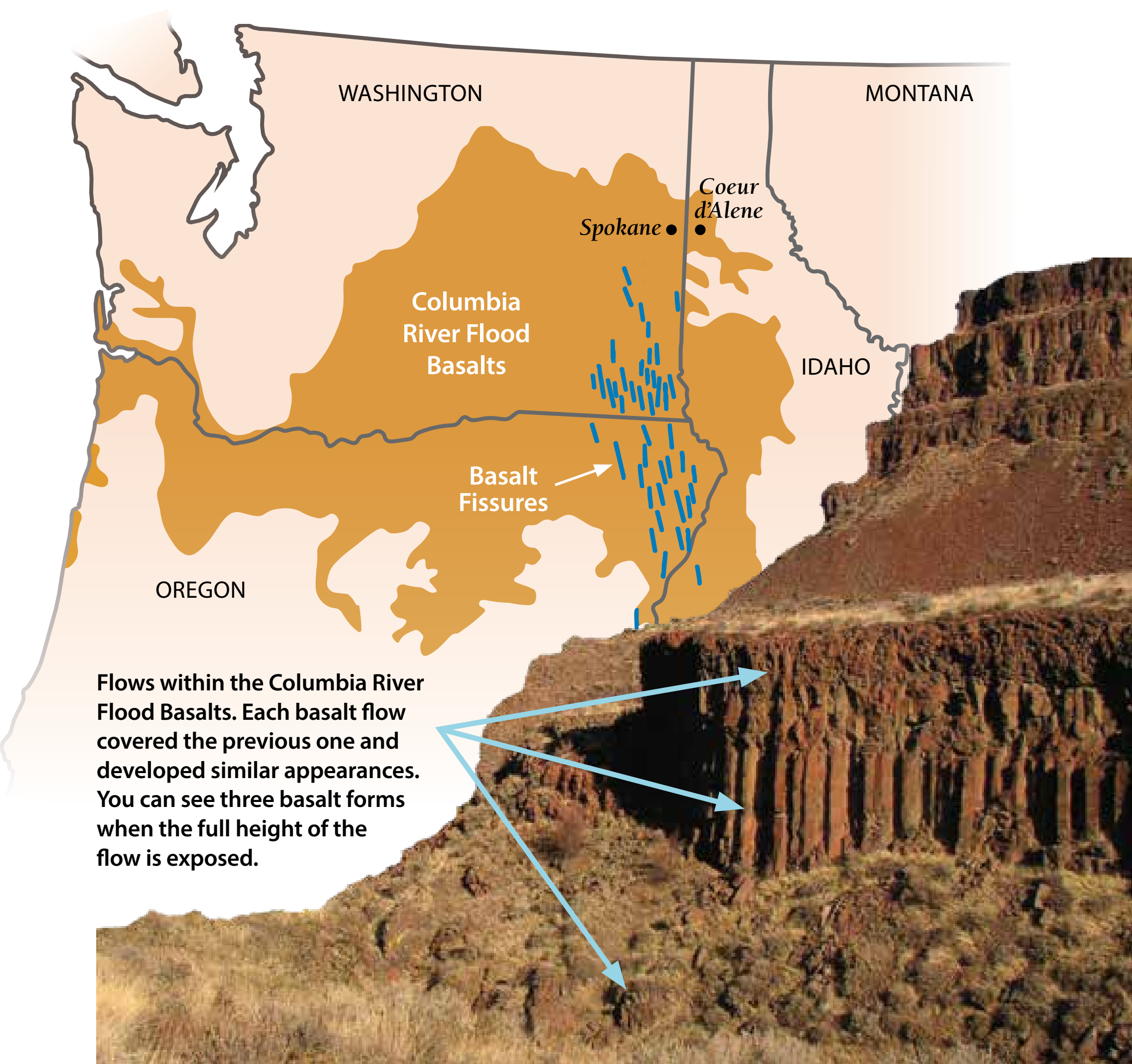
WHAT: Basalt

WHEN: 10 to 17 million years ago

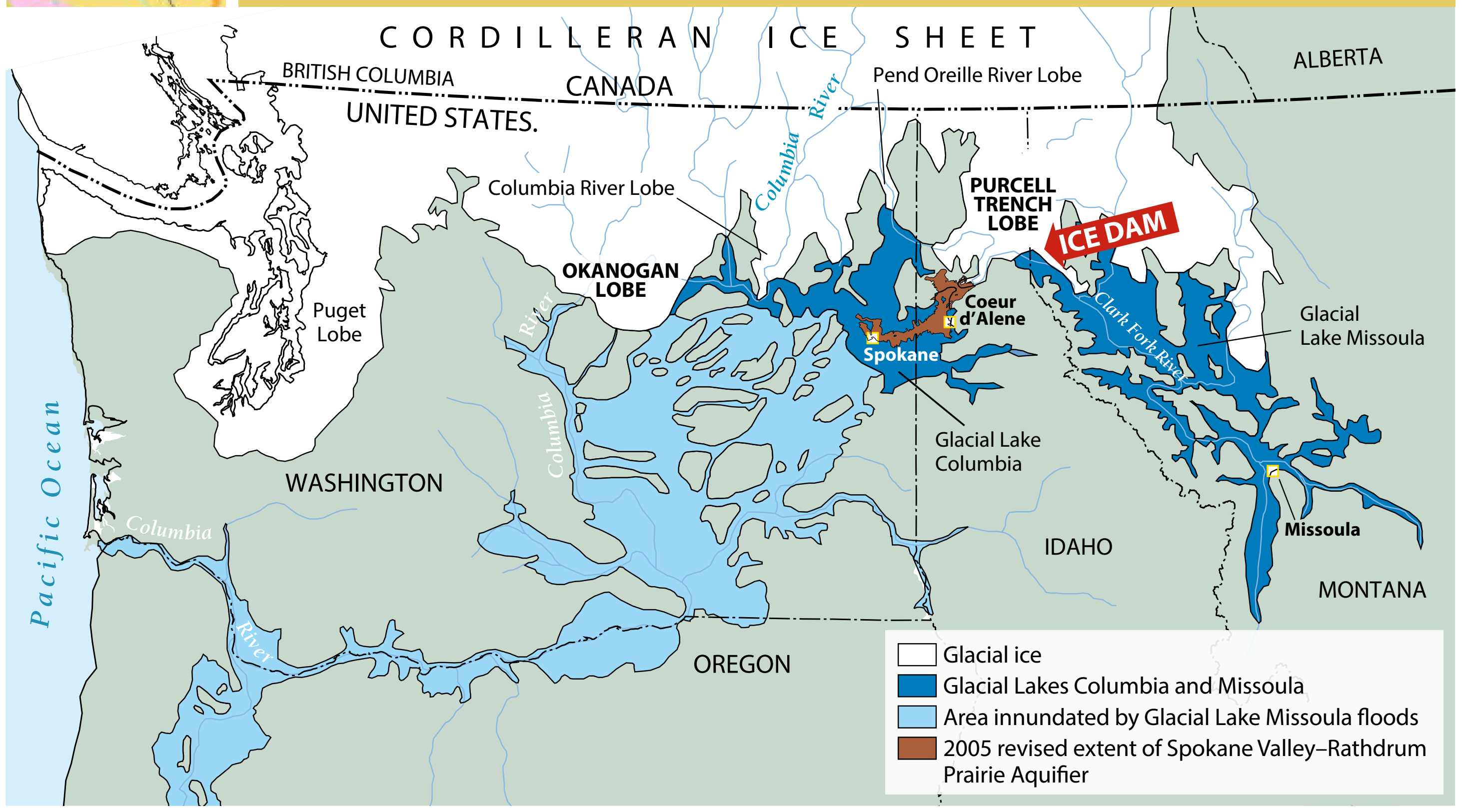
WHERE: Lava erupted from fissures near the Idaho, Oregon, and Washington borders. The rocks from the lava flows cover an area of 63,200 square miles in the three states.

HOW: The lava was too fluid to form volcanoes so it flowed like floodwaters, except much slower (estimated roughly 3 miles per hour). The lava spread over the topography and cooled to form distinct layers consisting of flow tops full of bubbles or vesicles, a middle section of tower like colonnades, and a flow bottom where the rock is highly broken and fragmented. In areas where the lava flowed into depressions the rocks are over 10,000 feet thick.

WHY IT'S IMPORTANT: While the SVRP Aquifer is not a basalt aquifer, the Columbia River Flood Basalts are an important supplier of water in much of Eastern Washington, Northern Idaho, and Northern Oregon.



Glmf Glacial Lake Missoula Flood Deposits




Example of very coarse gravels that make up the SVRP Aquifer sediments.

WHAT: Unconsolidated sands, gravels, cobbles, and boulders

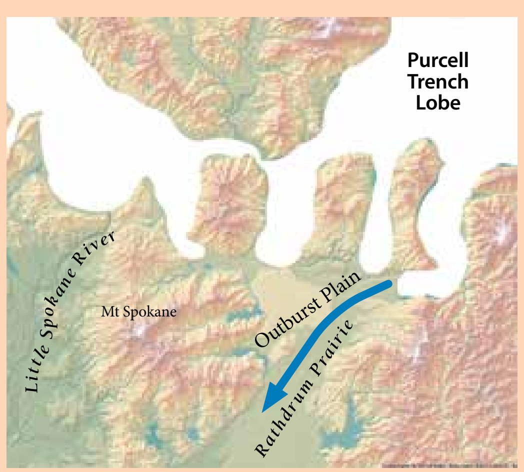
WHEN: 15 to 100 thousand years ago

WHERE: Northern Idaho, Eastern Washington, Columbia River gorge, and the Willamette Valley in Oregon

HOW: The cooling climate during the Pleistocene Epoch, or Ice Age, caused sheets of ice to advance south several times from current day Canada. A finger of the ice sheet called the Purcell Trench Lobe blocked the Clark Fork drainage forming Glacial Lake Missoula. At its maximum, the lake covered about 2,900 square miles with more than 500 cubic miles of water and was 2,000 feet deep at the ice dam.

The water behind the ice dam exerted great force on the ice dam and forced its way into the ice. Eventually the ice dam failed and released a great volume of water all at once, creating enormous floods. Ice dams reformed and exploded at least 40 times causing a *jökulhlaup*, Icelandic for "glacial run," each time. Each flood scoured out the topography and carried and deposited the sediments that filled valleys in the region.

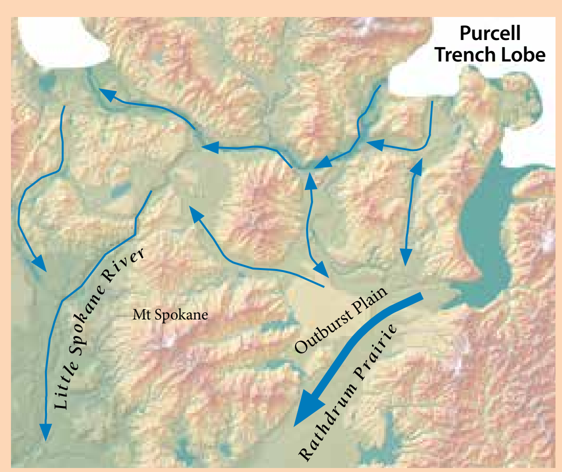
WHY IT'S IMPORTANT: The unconsolidated sediments of these flood deposits are the materials that make up the SVRP Aquifer. This "loose" sediment contains a lot of void space between grains that is highly permeable. Water easily flows through the sediment making it great aquifer material.



Full ice advance

DIFFERENT PATHS

Sometimes the Purcell Trench Lobe extended to the southern end of Lake Pend Oreille. When the ice dam broke, the only path available to the floods was south over the Rathdrum Prairie. When the Purcell Trench Lobe did not extend as far, the floods had several possible paths besides the Rathdrum Prairie. Some of the water flowed through routes that led to the Little Spokane River valley.

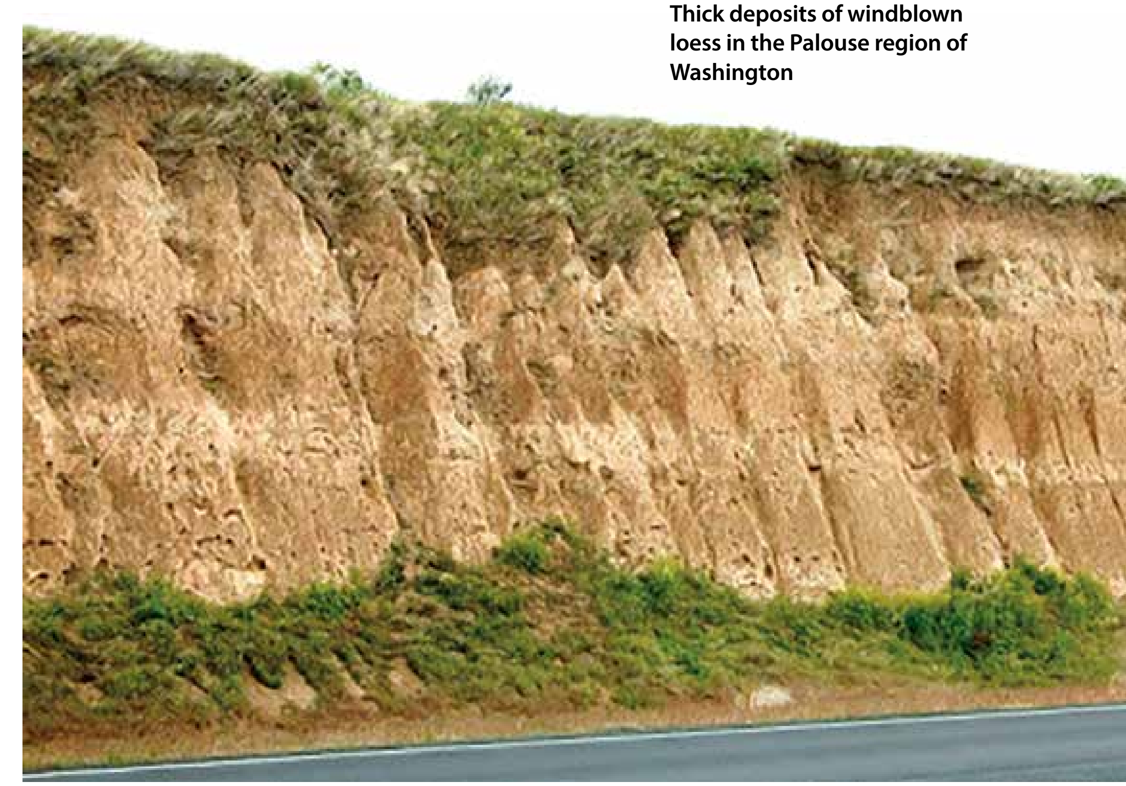


Partial ice advance

The ice dam was over 2,000 feet tall.

Glacial Lake Missoula was as big as Lake Erie and Lake Ontario combined!

The floodwater speed may have peaked at about 60 mph.


Thick deposits of windblown loess in the Palouse region of Washington

Ucd Unconsolidated Deposits

WHAT: Unconsolidated fine silt and sand (loess), gravels, sand, silt, and clay

WHEN: Present to 1.6 million years ago

WHERE: Northern Idaho and Eastern Washington

HOW: Unconsolidated sediments that have been accumulated through wind, water, or as a result of landslides. Included in this unit is the Palouse windblown sediments that extend from the Central Washington to the Pullman-Moscow area north to some of the upland areas surrounding Spokane. About a million years ago a warm dry climate existed and significant winds from the southwest carried silt from the central Washington area. The source of the fine silt was the fine material that flowed with older catastrophic floods and settled in what is now the channeled scablands. These windblown silts are also called "loess" deposits, derived from the German word for loose.

WHY IT'S IMPORTANT: These unconsolidated sediments often lie above the flood deposits that comprise the SVRP Aquifer. These sediments may consist of high-quality soil that has been utilized for agriculture.

How Ice Age floods created the SVRP Aquifer.

The water in the Spokane Valley-Rathdrum Prairie (SVRP) area during the ice age floods reached depths of about 450 feet and flowed with peak velocities of 60 miles per hour. The flow rates may have reached one billion cubic feet per second—more than the flow of all the rivers in the world. Large amounts of ice, cobbles, sand, and gravel were carried along with the water.

The larger gravel, cobbles, and boulders were deposited and most of the smaller silt and sand were carried downstream. The gravel, cobbles, and boulders are now part of the SVRP Aquifer. Glacial Lake Columbia covered the Rathdrum Prairie and Spokane Valley almost to the front of the ice dam during some of the floods. When the lake was present, it slowed down the water so some silt and sand were deposited along with the gravel, cobbles, and boulders.

After flowing through the SVRP area, the floodwaters flowed across central Washington forming coulees (steep-sided channels) and deformed the landscape giving the area the name "scablands." Large pieces of ice with boulders floated many miles in the flood. The boulders were deposited as the ice melted leaving behind unusual rocks called "erratics." The flood water finally spilled into the present-day Columbia River Gorge and on to the Pacific Ocean.

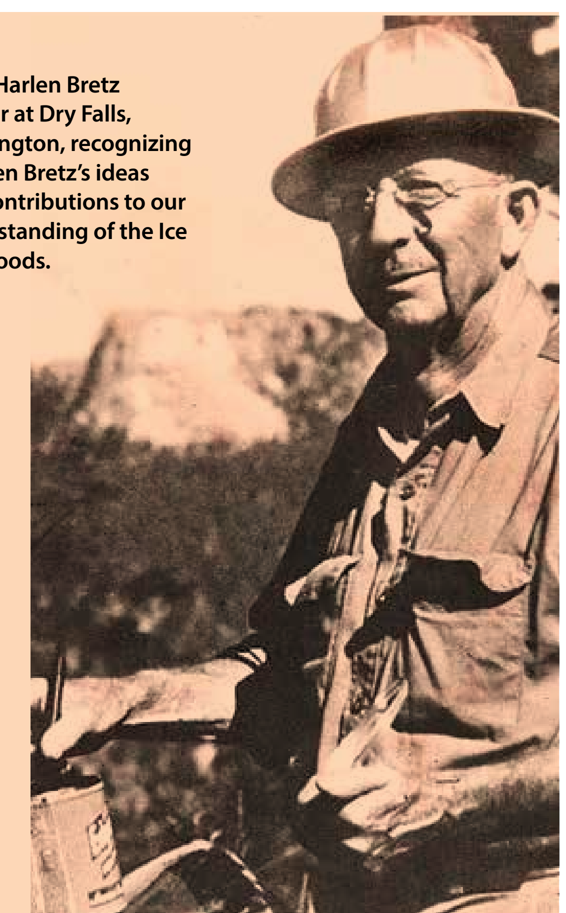
An ice rafted erratic in a coulee.

This gravel pit exposes layers of SVRP Aquifer rocks left by the Ice Age Floods.

Repeated Ice Age Floods

After a flood event ended, the ice lobe slowly moved southward, blocking the Clark Fork River once again. Eventually, this dam would fail, resulting in another flood. This repeated flooding deposited large amounts of mainly gravel and cobbles in the SVRP area and eventually blocked the tributary valleys, forming Lakes Coeur d'Alene, Hayden, Pend Oreille, Spirit, Twin, Hauser, Liberty, and Newman.

The J Harlen Bretz Marker at Dry Falls, Washington, recognizing J Harlen Bretz's ideas and contributions to our understanding of the Ice Age floods.



HARLEN BRETZ AND THE MYSTERY OF THE ICE AGE FLOODS.

J Harlen Bretz (1882–1981) was a University of Chicago professor who studied the channeled scablands of Eastern Washington. His 1923 theory proposed the scablands resulted from a catastrophic Ice Age glacial flood, an idea that was not accepted until much later because he could not prove the source of the flood.

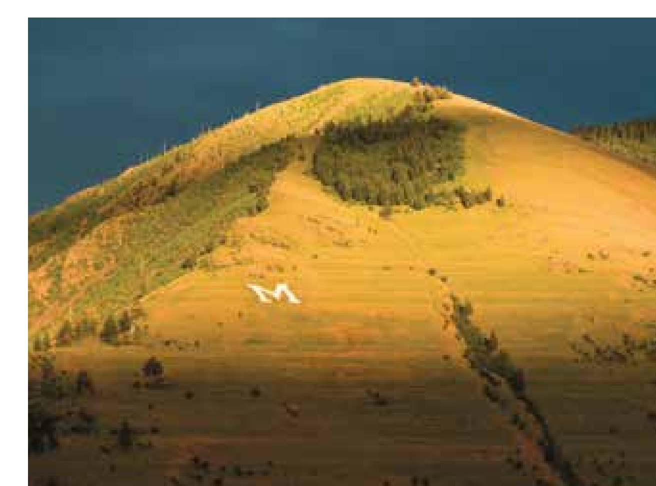
Evidence for the Ice Age Floods

The evidence for Glacial Lake Missoula comes from shoreline features called wave-cut strandlines on many hillsides in Montana. Joseph T. Pardee (1871–1960) was a U.S. Geological Survey geologist who theorized that the wave-cut strandlines above Missoula, as well as other features in western Montana, came from a large lake that emptied rapidly. In 1940 he reported the lake emptied to the west and was the source of Bretz's catastrophic flood.

Giant ripple marks on the Camas Prairie in Montana and on the West Bar in Washington, as well as large coulees, are evidence of vast amounts of water flowing rapidly. Sediment layers with large rocks on the bottom and clay on the top, called rhythmites, found in many places along the flood's path are the evidence for repeated Ice Age floods. Some rhythmites are found along the lower part of Hangman Creek. The exposed rhythmites near Touchet, Washington, have at least 40 layers.

The West Bar with ripple marks and the basalt cliffs along the Columbia River near Trinidad, Washington are evidence of the Ice Age floods.

Rhythmites exposed near Touchet, WA, provided evidence of at least 40 large Ice Age floods to geologists in the early 80s.



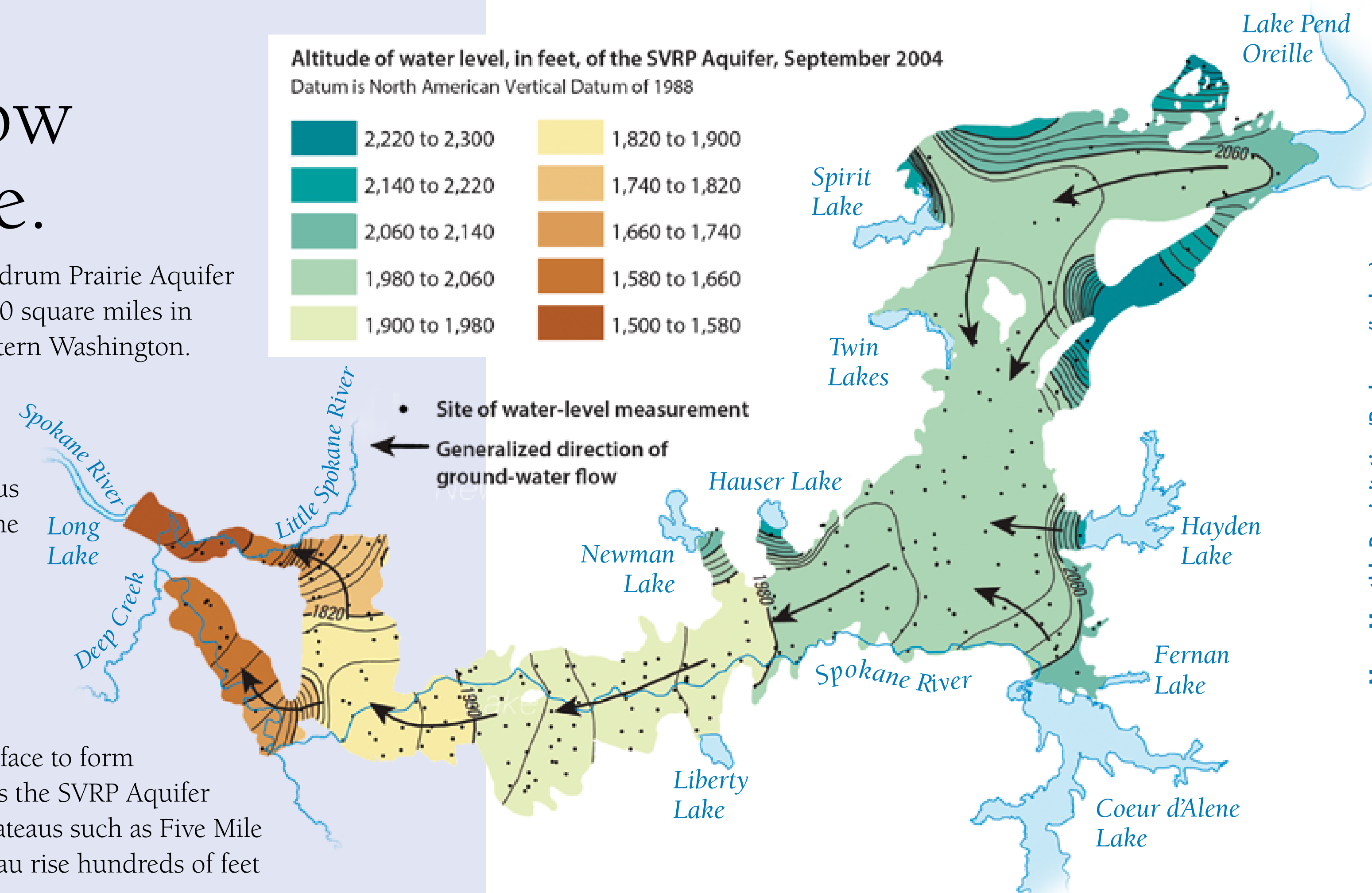
Wave-cut strandlines on the hillside above Missoula, Montana record former high-water lines, or shorelines, of Glacial Lake Missoula.

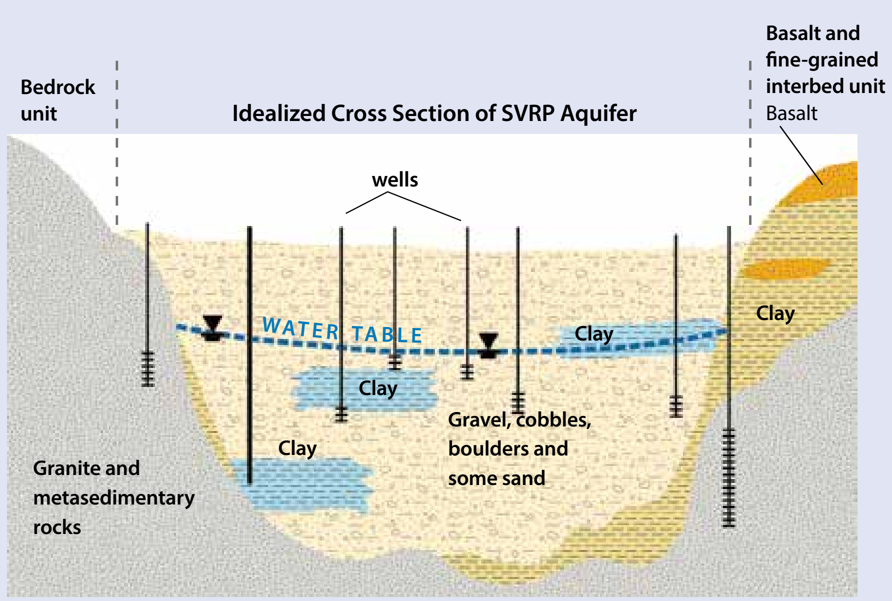
Aquifer flow & recharge.

The Spokane Valley-Rathdrum Prairie Aquifer (SVRP) covers about 370 square miles in northern Idaho and eastern Washington. It is composed of Ice Age flood deposited gravels, cobbles, and boulders and is filled with water. No continuous clay or silt layers exist across the SVRP Aquifer to keep surface contaminates from infiltrating into the aquifer.

The valley walls are composed of massive rocks and clay that continue below the ground surface to form the impervious basin that holds the SVRP Aquifer gravels. Relatively flat basalt plateaus such as Five Mile Prairie and the Columbia Plateau rise hundreds of feet above the valley.

The Bitterroot Mountains east of Rathdrum Prairie and the Selkirk Mountains along the Washington – Idaho border also form the aquifer edges (or "basin"). These mountains are more than 2,000 feet higher than the basalt plateau to the southwest.





*not to scale

Groundwater Flow

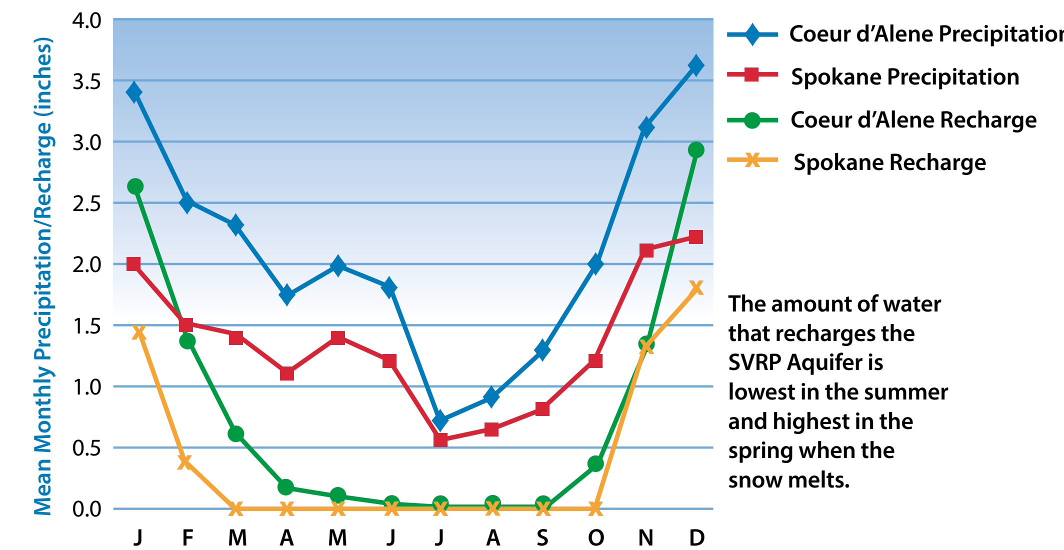
The elevation of groundwater in the northern Rathdrum Prairie is about 2,110 feet while the elevation is about 1,550 feet near Lake Spokane. Groundwater in the SVRP Aquifer flows from the northern Rathdrum Prairie area southward to Coeur d'Alene–Post Falls, then toward the west into Washington. The water flows through Spokane–Spokane Valley areas and separates to flow around the Five Mile Prairie. All the water eventually empties into the Spokane and Little Spokane Rivers that flow into Lake Spokane. Because of the very permeable nature of the aquifer, groundwater flow velocities can reach approximately 50 feet per day.

In some places, water seeps out of the bottom of the Spokane River and supplies recharge to the SVRP Aquifer. Water is pumped from the SVRP Aquifer for people to use. Some of this water is returned to the SVRP Aquifer through irrigation or septic discharge. Generally people use more water than is returned to the SVRP Aquifer, so there is a net loss.

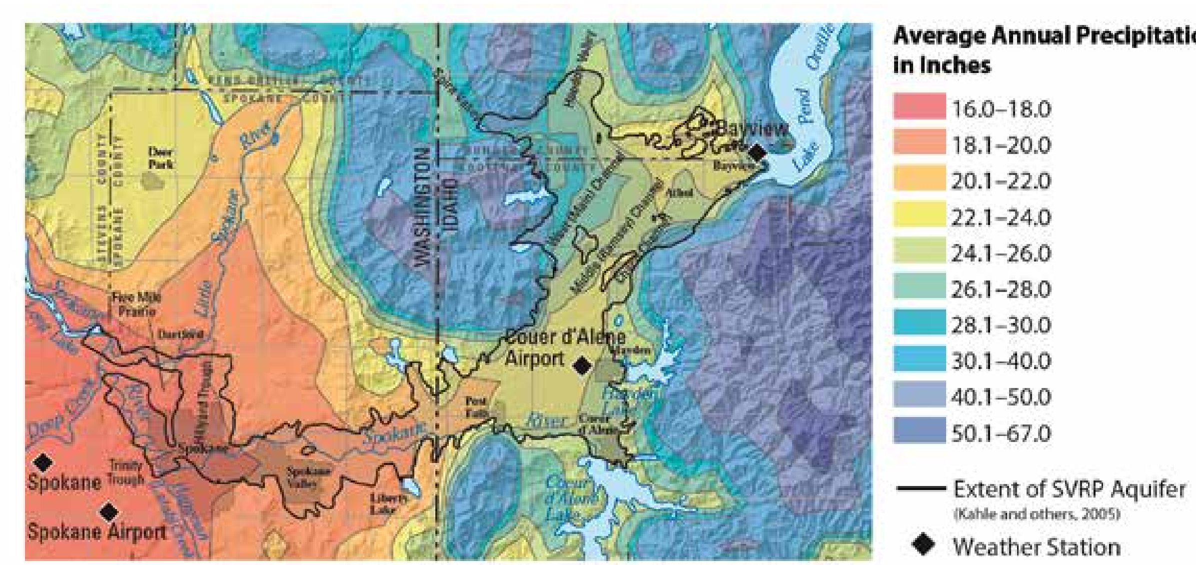
SVRP Aquifer Recharge

Water enters the SVRP Aquifer from several sources including:

- Precipitation
- Seepage from lakes
- Water from irrigation
- Inflow from upland bedrock watersheds
- Seepage from the Spokane River
- Effluent from septic systems



Precipitation that falls onto the land surface above the SVRP Aquifer eventually infiltrates and recharges the aquifer. Precipitation that falls onto the bedrock upland areas infiltrates very little because the bedrock is not very permeable. The water moves more laterally eventually combining with other water in the watershed and forming small streams. These streams flow downhill and discharge onto the permeable soils above the aquifer and quickly infiltrate downward to the water table. Some of the watersheds have lakes at the bottom that collect all the water. The lakes contribute water to the aquifer either through seepage from the bottom or overflow to streams that discharge onto the land surface above the aquifer.

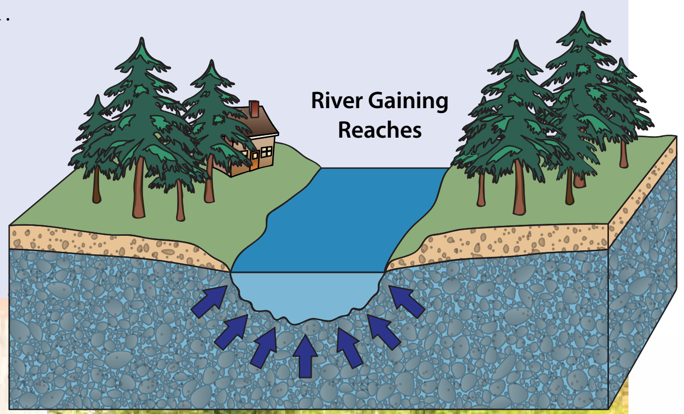


The connection between the SVRP Aquifer & Spokane River.

Spaces between the rocks and gravel in the Spokane Valley-Rathdrum Prairie (SVRP) Aquifer allow large interchanges of water with the river. The losing reaches of the Spokane River are the largest recharge source to the SVRP Aquifer. The gaining reaches of the river get additional water from the Aquifer.

The surface elevation of the SVRP Aquifer is a little higher than the bottom of the Spokane River in parts of Washington. Water flows into the river through the bottom or via springs on the riverbanks. These are called "gaining reaches."

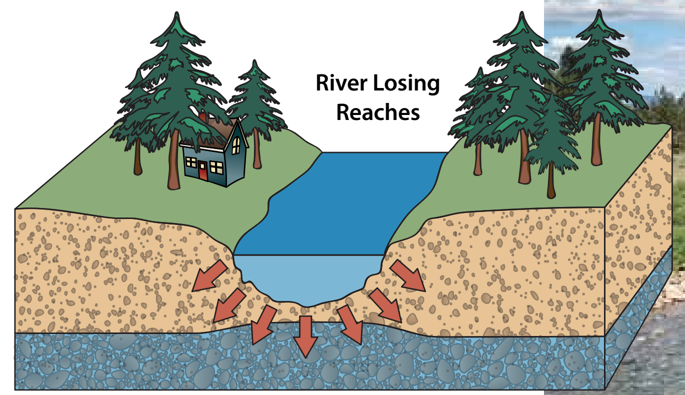
The photograph below is a gaining reach of the Spokane River near Sullivan Road. The ripples on the water at the bottom left corner of the picture shows water flowing out of the SVRP Aquifer and into the river on August 18, 2021.



Gaining reach near Sullivan Rd.

SVRP Aquifer and Spokane River Water Levels

The aquifer surface levels downstream of Post Falls depend on the flow in the Spokane River, and vice versa.

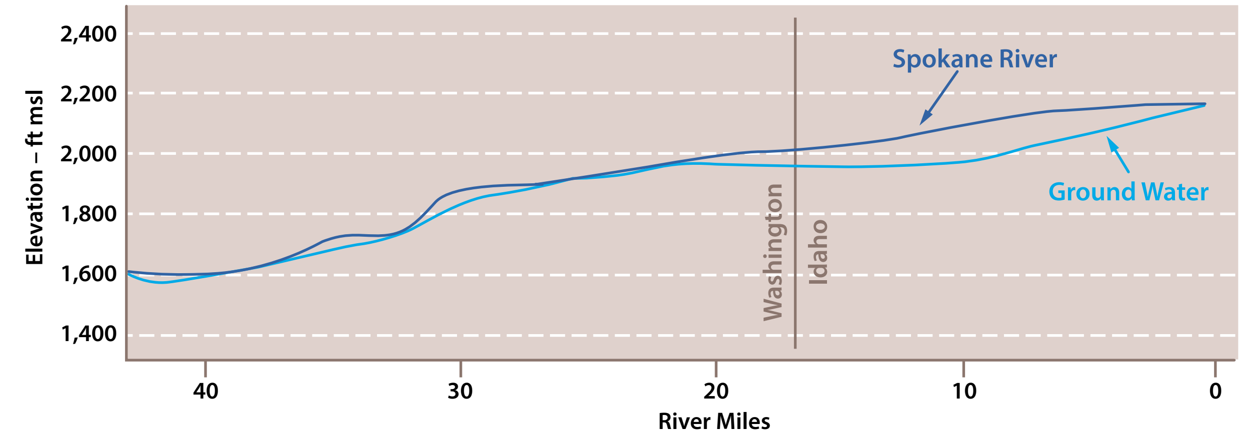


Pumping from the aquifer reduces its level, in turn reducing the areas of gaining reach. This reduces the river flow since there are fewer locations where the aquifer touches the river. (See the River Gaining and River Losing Reach diagrams). The closer a well is to a gaining reach, or the greater the pumping rate, the larger the reduction will be.

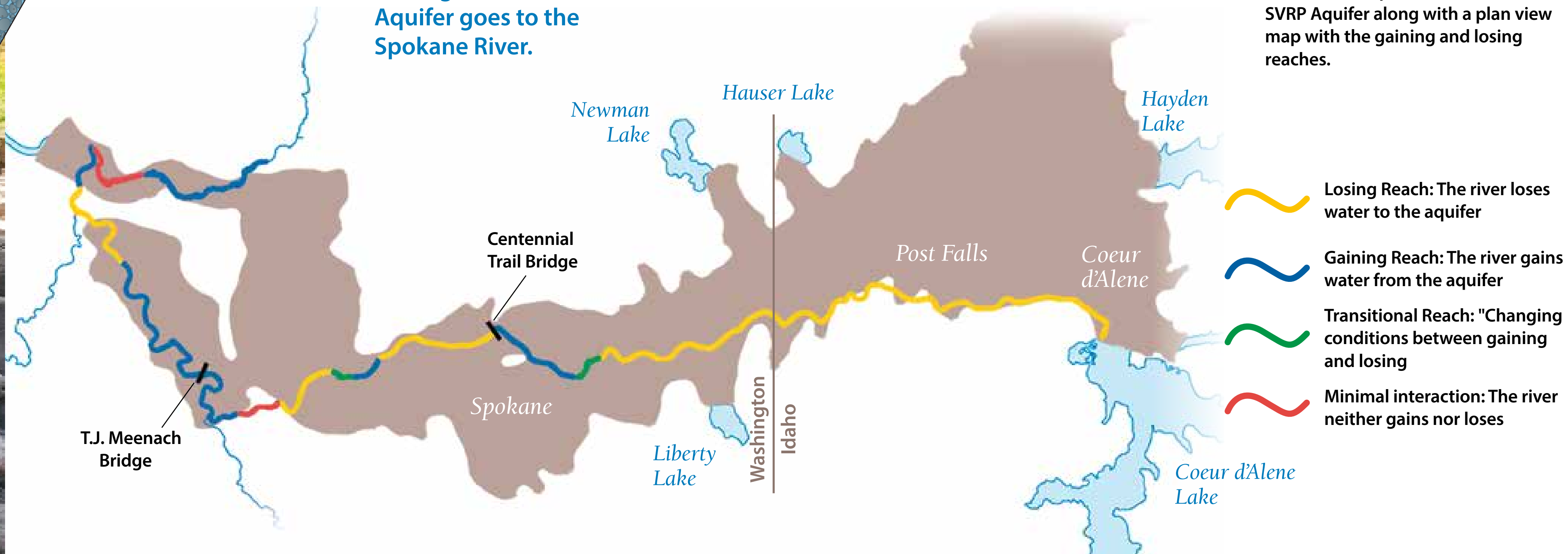
Keeping enough water in the Spokane River is important to maintain a healthy environment for fish and other aquatic life. It also supports recreation and scenic beauty. The best way to accomplish this during summer months when the river is already seasonally low is to reduce the amount of outdoor water use, particularly landscape and lawn watering.

The Spokane River is the largest source of water to the SVRP Aquifer and most water leaving the SVRP Aquifer goes to the Spokane River.

The river bottom is higher than the SVRP Aquifer in Idaho and parts of Washington. In these areas the water seeps out of the bottom of the river and recharges the aquifer. These are called "losing reaches" of the river. This losing reach of the Spokane River near Greenacres had very little flow on August 18, 2021.



Above: the elevation differences between the Spokane River and the SVRP Aquifer along with a plan view map with the gaining and losing reaches.



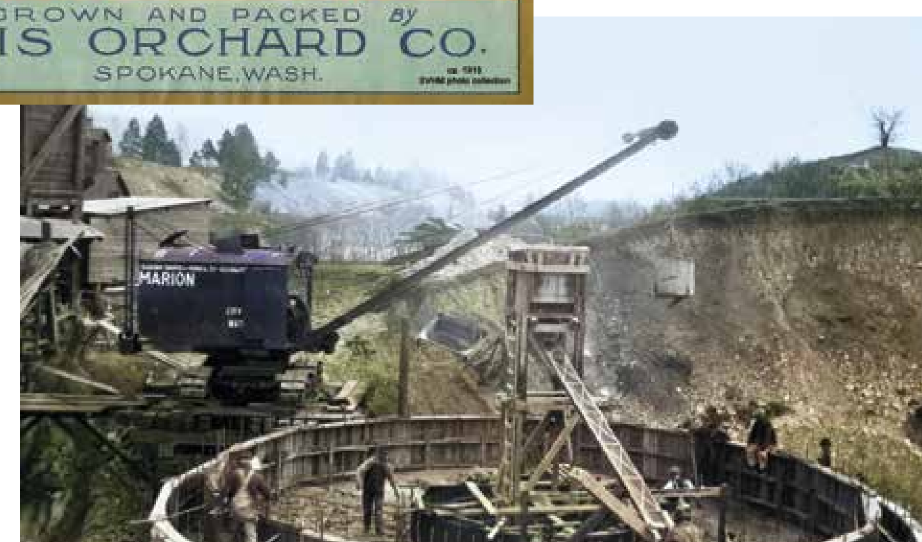
From Rocks to Agriculture.

Low rainfall and rocky soil made agriculture difficult above the Spokane Valley-Rathdrum Prairie (SVRP) Aquifer. In 1895, irrigation canals bringing water from Newman and Liberty Lake allowed agriculture to surge in the Spokane Valley. Modern Electric Water Company was formed in 1905 to provide irrigation water by pumping water from the newly discovered groundwater. The company set up a test plot, planted with every likely crop—and a few unlikely ones such as cotton and peanuts—and soon settled on the crop deemed most profitable: apples.

The newly irrigated fields of Spokane Valley were planted with acre after acre of apple trees. The railroads provided a way to get the apples to many markets, making the demand very high and by 1922 there were more than 1.6 million apple trees in the Spokane Valley. The main road from Spokane to Coeur d'Alene was named the Apple Way (or Appleway) because it was lined with miles of apple trees.

The early 1920s proved to be the peak apple-growing years. By about 1925, farmers were beginning to remove their orchards due to a variety of problems: plant disease, insect infestations, low prices, untimely freezes, and competition from the Wenatchee and Yakima valleys where the climate and nearby rivers for irrigation were perfectly suited for apple growing. Apples turned out to be a risky venture – far from the surefire cash crop predicted and in 1926, around 200,000 apple trees were torn out and by 1945, only about 50,000 apple trees remained.

Truck farms growing melons, berries, and vegetables replaced apple orchards but had very limited success. Today, the remaining large-scale agriculture are primarily located on the Rathdrum Prairie producing livestock crops such as grain, hay, and pasture for grazing. Mint can also be seen (and smelled!) in some locations.



Left to right:

1908 Apple orchard in Spokane Valley "Opportunity"

1925 Construction and excavation of the City of Spokane's "Well Electric" well station at the Upriver Dam.

1952 View of the Rathdrum Prairie

From Agriculture to Development

CLIMATE Between 1920 and 1955, the farmers on the SVRP Aquifer came to understand the local climate. On the eastern edge of the plains next to the mountains, the weather consists of infrequent but intense cold snaps (as low as -25º F), multi-year droughts, and extremely wet times interspersed with periods of ideal growing conditions. The climate was much too variable to be relied on for long-term success in largescale growing of fruits and vegetables. When a bad cold snap hit in 1955, the remaining large-scale apple orchards on the SVRP Aquifer were decimated and the area never returned as a major player in the Washington apple trade.

DEVELOPMENT Railroads, streetcar lines, and automobiles encouraged the growing population of the area to travel along the major roads including Appleway. Businesses sprung up to serve the travelers and people began to spread out. Orchard Avenue, an early land development in the Spokane Valley, began breaking up the farmland into ½ - 1 acre land tracts in 1909. The development included a water system, park, school, general store, and post office.

INDUSTRY Nearby timber fueled the early manufacturing of matches and paper. Gravel mining and cement making were also important industries. In the 1940s, cheap electricity from Grand Coulee Dam encouraged manufacturing to replace even more agriculture. These many new industries brought people to the area and the 1950s population boom led to increases in housing, which replaced even more agriculture in the Spokane Valley. Today most commercial agriculture in the Spokane Valley occurs in greenhouses.

PRE 1900s

Before wells with pumps were drilled into the Spokane Valley-Rathdrum Prairie Aquifer, people used lakes, rivers, and springs for all of their water needs. Gravity was the only force that moved the water to its destination. This greatly limited the distance people could live from a water body.

1920s

Canals and flumes carried water from lakes, rivers, or hand-dug wells to the first irrigated crops over the SVRP Aquifer. Canals needed the correct slope to get water to the fields, so they were difficult and costly to build. Large quantities of water leaked out of the bottom of the canals, so much of it was lost on the way to the fields. Water flow was manually controlled by "ditch walkers" who opened and closed gates.

1950s

The first agricultural sprinklers used above-ground pipes to get water to crops from the canals. The pipes could be moved easily, and the slope was not as important. The sprinklers shot water up into the air before falling on the crop.

1967

In 1967, the last big irrigation canal shut down and water from the aquifer was instead pumped from wells into water towers and piped to its destination, whether for agriculture or other uses throughout the system. Underground pipes did not lose as much water as canals as they did not leak as much and did not lose water to evaporation. Water flow in pipes was, and still is, controlled by valves in the pipes.

1990s

In the late 20th century, large agricultural sprinklers, such as center pivot sprinklers, were changed to spray water down to reduce the evaporative losses before reaching the ground/crop.

2000–2020

Steady population growth in the counties over the SVRP Aquifer is reflected in rapid development and residential expansion. This growth is replacing agriculture water use with domestic and municipal water use. The SVRP Aquifer is now used primarily for indoor water use and residential and commercial landscapes.

With a population that has almost doubled in 10 years, development demands of housing and industry are swiftly replacing agricultural land in Kootenai County. Visualized in the image below of Rathdrum, ID.

TECHNOLOGY in the last two decades has greatly improved water use efficiency. Indoors we can use WaterSense® appliances and fixtures. Outdoors, many new computer-based innovations help put water on our landscape and crops evenly and at the right time.

One technology uses visible and infrared images, captured from satellites and aircraft to help farmers identify where fields are stressed, need more water, or are receiving too much water. With this information, farmers (and other land managers) can adjust their irrigation practices to maximize the crop yield obtained from a field while reducing water waste.

A large network of automated weather stations placed near agricultural fields, called AGRIMET, allows for field-specific irrigation scheduling. This makes it possible to use the right amount of water needed for a crop, as local weather conditions can vary greatly over small distances.

AgriMet

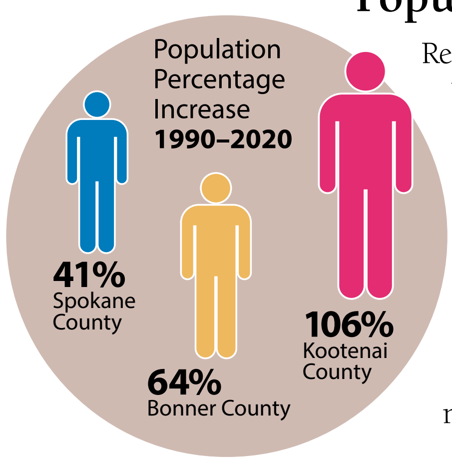
These weather stations are now becoming useful in helping homeowners efficiently irrigate their yards by transmitting evapotranspiration (ET) data wirelessly to residential controllers. The data informs the controller how much water has been lost to evaporation and transpiration for a specific crop and adjusts the scheduled watering cycle up or down, depending on the plant needs. The result is healthier grass with deeper roots, less water waste, and cheaper utility bills!

AGRIMET Weather Station Instrumentation

Aquifer and river stewardship.

Everyone who lives in the Spokane Valley-Rathdrum Prairie Aquifer service area uses the aquifer as their water supply. We use this groundwater to flush our toilets, water our yards, irrigate crops and, most importantly, we drink it! Protecting our water supply for future generations requires long-term vision and water stewardship from all who rely on the aquifer and enjoy the river.

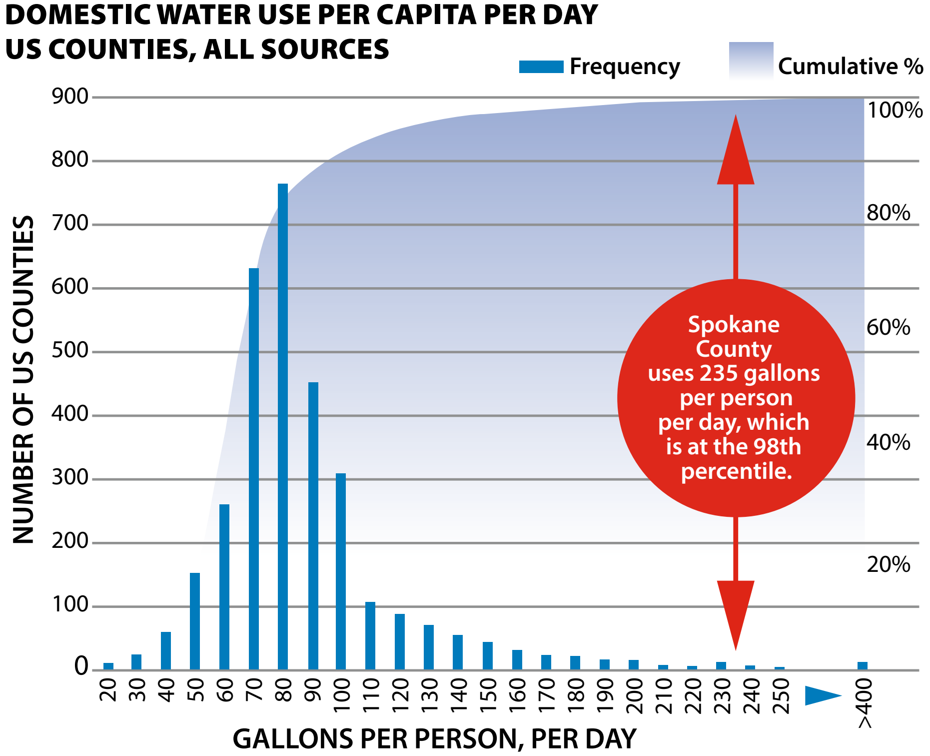
WHAT Impacts Our Aquifer & River Levels?

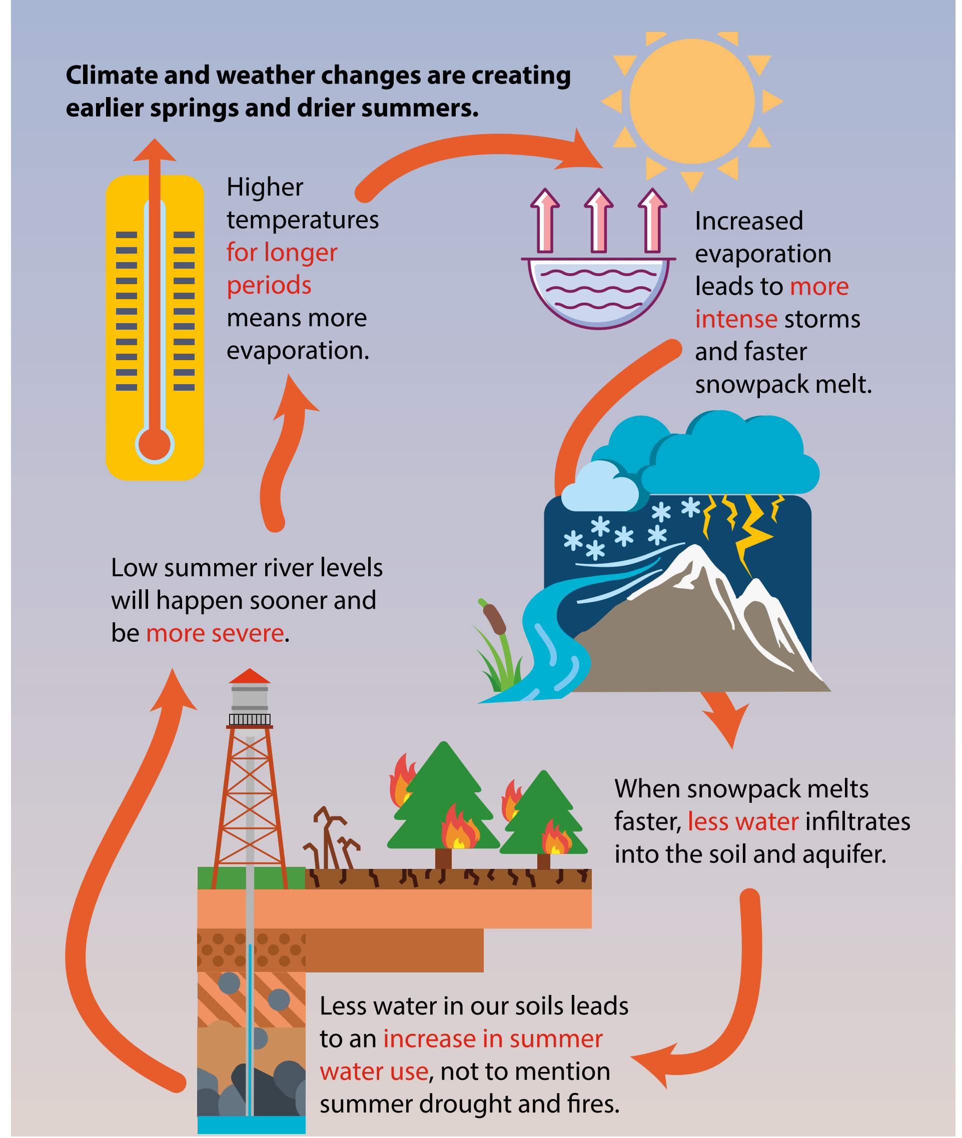


Population

Research is ongoing to determine if the Pacific Northwest will experience an exceptional influx of residents fleeing undesirable or inhospitable climate conditions elsewhere. Regardless, the tri-county population in which the SVRP Aquifer exists has already increased significantly since 1990, particularly in areas that utilize the aquifer. Suffice it to say, more people = more water use.

DOMESTIC WATER USE PER CAPITA PER DAY
US COUNTIES, ALL SOURCES





Climate and Weather

Predicted higher temperatures will bring earlier and faster snowmelts, causing drier late spring and summer months. Lower river flows will result and higher summer pumping rates for urban and rural irrigation will increase pressure on the SVRP Aquifer and Spokane River.

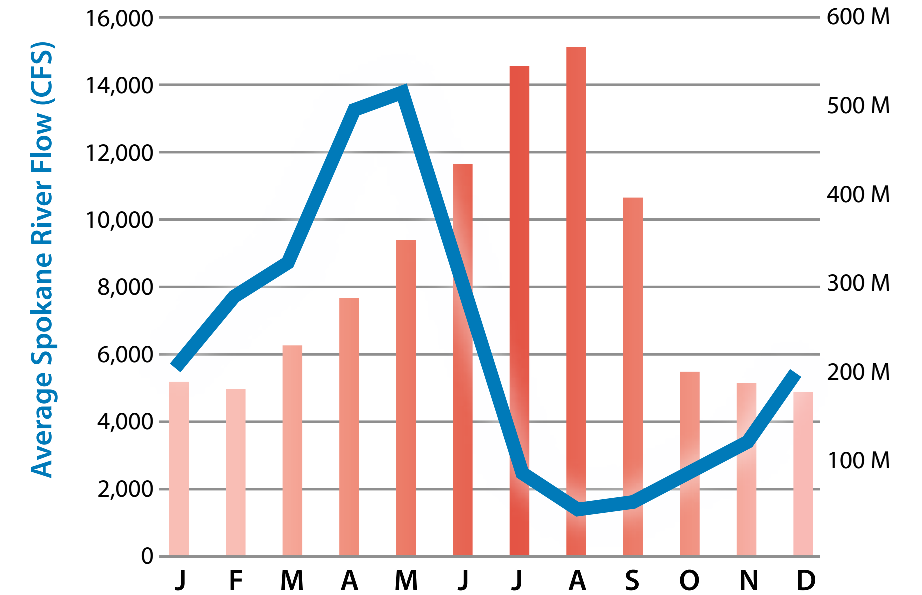
The Cost of Water

We are fortunate to have efficient hydropower and live on top of a very clean and accessible water source. This keeps our costs much lower than most areas of the country. The result? Spokane County ranks in the top 2% in the nation in highest water usage per person, per day. See chart at left.

Currently water drawn from the SVRP Aquifer is very affordable. However, the question we might ask ourselves is: "Why waste water that I don't need?"

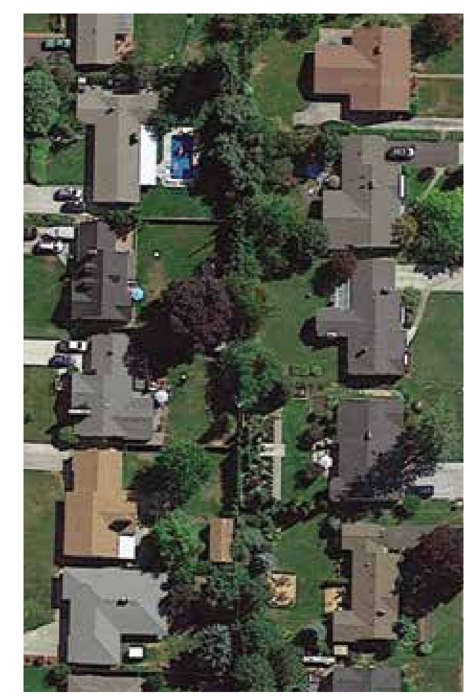
Percentage of county populations served by the SVRP Aquifer:

AVERAGE SPOKANE RIVER FLOWS & WATER PUMPED IN SPOKANE COUNTY



We Pump at the Worst Time

Just as we are pumping more water from the aquifer to water our lawns during the summer, the river flows are at their lowest. It is during this time, the river – and the aquatic life in it – need water the most. See the graph above.



Landscaping Choices

The green spaces we develop in our cities and homes greatly impact water use. Whether it's a rural property with fewer people per acre or a suburban home with green lawns, landscaping choices impact water use.

Indoor water use remains flat even as our population has increased due, in great part, to water efficient shower heads, faucet aerators, toilets and changes in plumbing code.

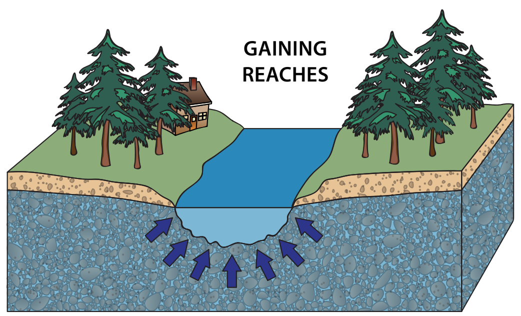
Outdoor water use and landscaping have not gone through the same efficiency revolution.

If we VALUE water more — will we waste it less?

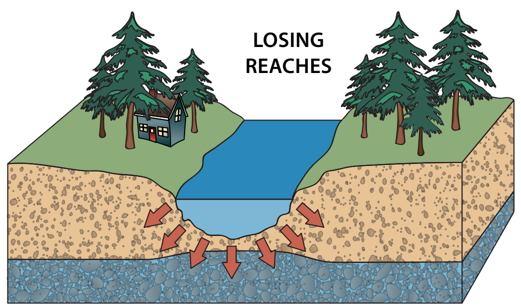
WHY Should I Care?

Preserving Our River Ecosystem

When we pump from the SVRP Aquifer, it reduces the river flows to the detriment of the aquatic life in the river. This is due to the special connection between the Spokane River and the SVRP Aquifer. As the aquifer is drawn down, less of that groundwater seeps into the river and gaining reaches are reduced. With continued population increases in the tri-County areas served by the SVRP Aquifer and the expected hotter summer months, now is the time to take actions that protect our summer river flows and habitat.



Gaining Reaches occur when the aquifer touches the bottom of the river. Aquifer water pushes into the river through the bottom or enters via springs on the banks of the river.



Losing Reaches occur when the aquifer does not touch the river bottom. River water then drains downward into the aquifer.

Developing a Regional Culture

The historical low cost of water in our region has supported its overconsumption for more than a century. It is important to develop a regional culture of conservation now. If decades-long drought seizes our region at the same time more people rely on the aquifer, adopting and teaching conservation habits will prepare future generations. This culture takes time to develop, and it requires a community of caretakers. If we wait, there may be ecosystem damage that will cost more to reverse than it will to prevent.

Preventing Unnecessary Infrastructure Expenses

If water providers must build their entire system for the peak use of outdoor summer irrigation, an increase in users without conservation will mean additional infrastructure (tanks, booster pumps, wells, etc.) at a significant cost to residents.

HOW Can I Make a Difference?

Reduce Your Water Use!

Every individual that contributes to water conservation is key to long-term preservation of the Spokane River and SVRP Aquifer. If area residents wish to have a water-secure future for the next generation, the time to develop good habits is now. Individual actions matter.

Irrigate Efficiently

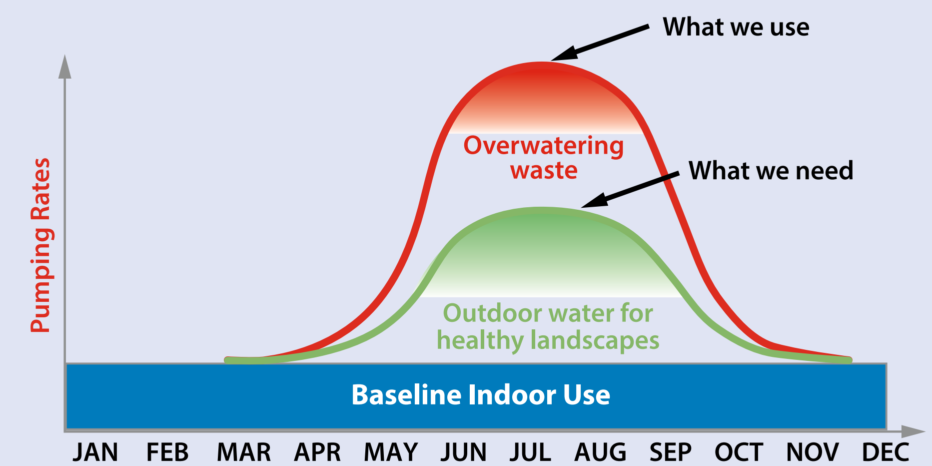
- Switch to newer sprinkler heads. Technology and research together have resulted in very efficient spray patterns.
- Water in the early morning hours to reduce water loss due to evaporation.
- Invest in a "Smart" Irrigation Controller that will adjust timing based on real-time weather.
- Visit **OutdoorWateringNerds.org**, a local website, for great guidance on reducing your outdoor watering footprint.

Lawn vs. Drought Tolerant Landscaping

- Less lawn, more life! Replacing grass with drought tolerant plants, trees, and mulch uses less water and supports beneficial pollinators while saving you time and money.
- Learn more online at **WaterWiseSpokane.org** and **SpokaneScape.org**. Check with your water provider to see if they offer incentive programs.

WATER WASTE

Once you have efficient sprinkler heads to help reduce overwatering, pay attention to other wasteful scenarios such as overspray, misting, and runoff.



The perennial garden pictured left is a great example of a colorful drought tolerant landscape that beautifies the neighborhood. Plants include: pink and purple Creeping Phlox, Purple Bearded Iris, Karl Foerster grass, and variety of Sedum species.

ONLINE RESOURCES:

Previously mentioned SpokaneScape.org is a great online resource as are both the Washington State University Extension Office and the University of Idaho Extension Office.

The Spokane Valley-Rathdrum Prairie (SVRP) Aquifer is the primary source of water for drinking and irrigation for over 500,000 people living in the area. The SVRP Aquifer has been designated as a sole source aquifer by the US Environmental Protection Agency and as a sensitive resource aquifer by the Idaho Department of Environmental Quality. The large number of people that use the SVRP Aquifer and the lack of any natural barriers to prevent pollutants from reaching the aquifer mean it is important to monitor the water quality and water quantity.

The **Panhandle Health District (PHD)** has been monitoring the aquifer on the Rathdrum Prairie since 1975. The sampling began because of concerns about the increasing number of septic systems and the potential to impact water quality. The sampling program has changed over time. Today PHD monitors water quality for approximately 28 wells three times a year, looking for chemicals such as nitrate, arsenic, and chloride.

The **Idaho State Department of Agriculture (ISDA)** groundwater monitoring program addresses issues that involve pesticides, fertilizers, and other potential agricultural contaminants. ISDA regional monitoring projects are located in areas where groundwater quality is susceptible to degradation from agricultural practices.

The **Idaho Department of Water Resources (IDWR)** began monitoring groundwater on the Rathdrum Prairie in 1990. The program objectives are to characterize the groundwater quality of the state's major aquifers, identify trends and changes in groundwater quality within the state's major aquifers, and identify potential groundwater quality problem areas.

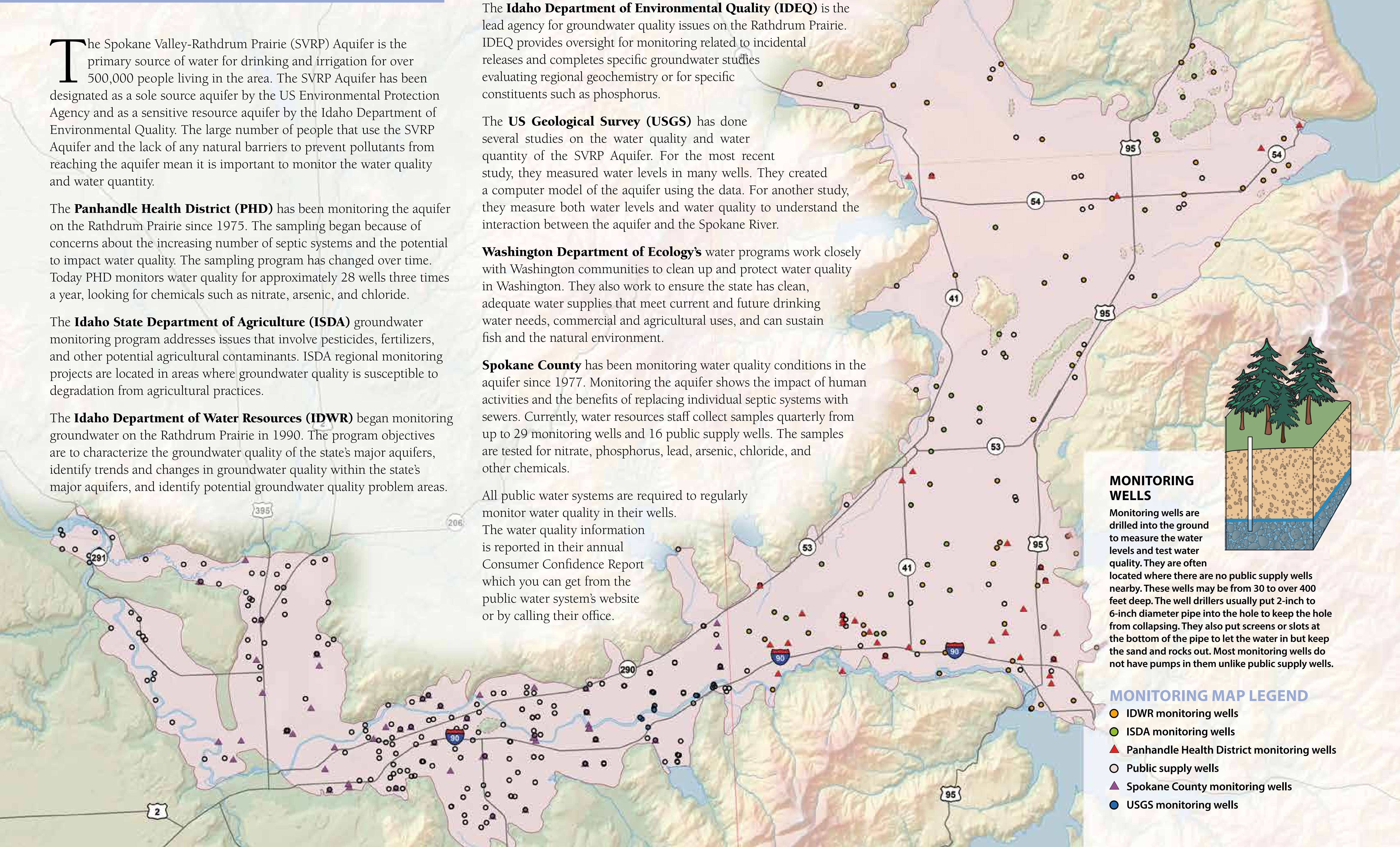
The **Idaho Department of Environmental Quality (IDEQ)** is the lead agency for groundwater quality issues on the Rathdrum Prairie. IDEQ provides oversight for monitoring related to incidental releases and completes specific groundwater studies evaluating regional geochemistry or for specific constituents such as phosphorus.

The **US Geological Survey (USGS)** has done several studies on the water quality and water quantity of the SVRP Aquifer. For the most recent study, they measured water levels in many wells. They created a computer model of the aquifer using the data. For another study, they measure both water levels and water quality to understand the interaction between the aquifer and the Spokane River.

Washington Department of Ecology's water programs work closely with Washington communities to clean up and protect water quality in Washington. They also work to ensure the state has clean, adequate water supplies that meet current and future drinking water needs, commercial and agricultural uses, and can sustain fish and the natural environment.

Spokane County has been monitoring water quality conditions in the aquifer since 1977. Monitoring the aquifer shows the impact of human activities and the benefits of replacing individual septic systems with sewers. Currently, water resources staff collect samples quarterly from up to 29 monitoring wells and 16 public supply wells. The samples are tested for nitrate, phosphorus, lead, arsenic, chloride, and other chemicals.

All public water systems are required to regularly monitor water quality in their wells. The water quality information is reported in their annual Consumer Confidence Report which you can get from the public water system's website or by calling their office.

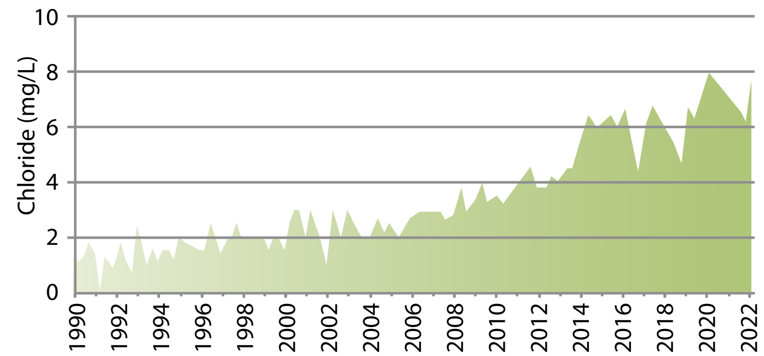


Chloride Trends

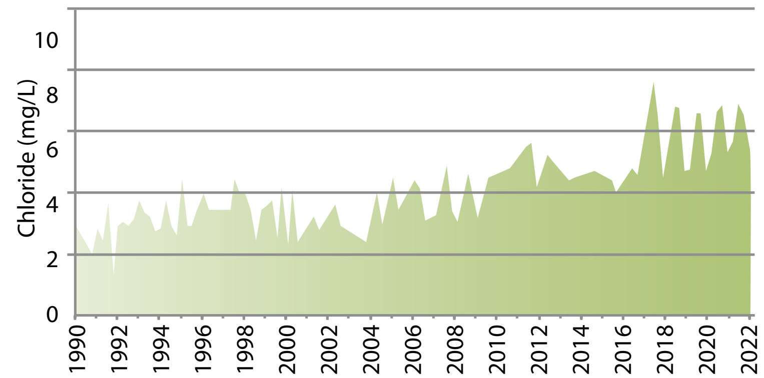
Measuring and monitoring levels of chloride in our aquifer can indicate the increased presence of human activities that impact water quality. Chloride, not to be confused with chlorine that is added to drinking water, enters groundwater naturally when it dissolves from rocks and soil. Human sources of chloride are found in wastewater, septic drainfields, leaking landfills, industrial waste, fertilizer and deicer. One of the largest human sources is the salt used for deicing roads, parking lots, and sidewalks. During the winter season hundreds of pounds of salt are used for every mile of road to make them safer for driving. Once dissolved in water, chloride moves very easily through the ground to the water table and through the aquifer.

CHLORIDE CONCENTRATIONS

ID - CITY OF POST FALLS, WELL #3



WA - ORCHARD AVE. IRRIGATION WELL #1



Since the mid-1990s, chloride concentrations have increased slightly, most often in areas with higher populations. The lowest concentrations in the SVRP Aquifer are less than 1 milligram per liter (mg/L) and the highest levels have been found to be near 30 mg/L. Fortunately chloride concentrations are still significantly below the drinking water standard of 250 mg/L. Nevertheless, increasing trends in chloride indicates that more work can be done to reduce human impacts on our region's drinking water. The graphs above illustrate increasing chloride concentration trends in the water from two wells on the SVRP Aquifer. The increasing chloride concentrations tend to be in areas with higher populations. The graphs show the chloride concentrations in the water from two wells in the SVRP Aquifer with increasing chloride trends.

Phosphorus

Phosphorus is an important nutrient required for plant growth. Too much phosphorus in a lake or river can lead to excessive algae and aquatic plant growth. Excessive plant growth in lakes and rivers can make the water unsafe for swimming or reduce dissolved oxygen for fish.

Local efforts to reduce phosphorus pollution since the 1970s have led to reductions of phosphorus in household products such as laundry detergent, dishwasher detergent, and turf fertilizer. Keeping phosphorus out of these products helps protect groundwater, surface water, and the environment.

Spokane County collects groundwater phosphorus samples from the SVRP Aquifer to better understand how phosphorus concentrations vary by location. The phosphorus concentrations in SVRP Aquifer water flowing into the Spokane and Little Spokane Rivers are very low.

Emerging Contaminants

The Spokane Valley-Rathdrum Prairie Aquifer is monitored for water quality by several agencies in both Washington and Idaho. Water quality records date back to the 1970s and are taken in numerous well locations.

As part of normal water quality surveying, some local agencies also explore potential impacts from emerging contaminants of concern (ECCs). These are chemicals or related contaminants that were previously unknown to cause environmental health risks, or they are highly suspected to be a risk to water quality but the current evidence of their impact is still unknown or inconclusive. While the investigation of these constituents is performed, some water providers are preemptively sampling for their presence in SVRP Aquifer waters.

Notable examples of ECCs that have already been studied in the SVRP Aquifer are poly alkyl fluorinated alkanes (PFAS) microplastics, and pharmaceuticals/personal care products (PPCPs). Contaminants that may be candidates in future sampling endeavors are: Polybrominated Diphenyl Ethers (PBDEs) which are used in flame retardants in a wide variety of furniture, upholstery, and electrical equipment and Polybrominated Biphenyls (PBBs) which is no longer produced in the US but served similar flame retardant purposes as PBDEs;

Polychlorinated Biphenyls (PCBs)

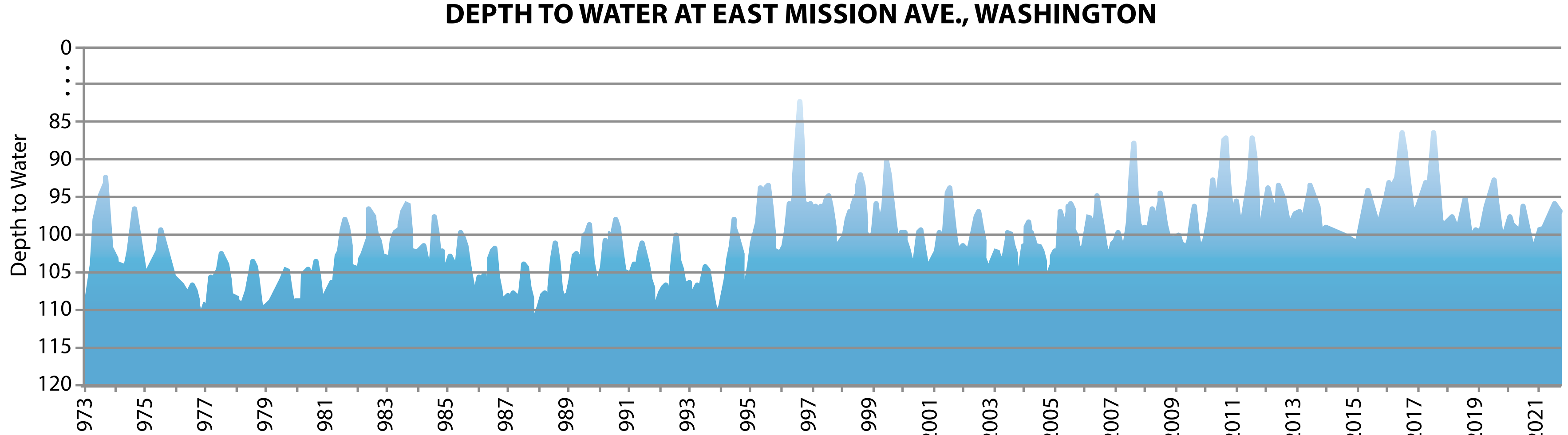
Polychlorinated Biphenyls (PCBs), a group of persistent organic pollutants, have been given special attention in the Spokane River since 2012 when a concerted effort was launched to address sources of PCBs in the river.

In 1979, production of PCBs was banned in the United States. Nevertheless, the impact remains in many places today. The most common use of PCBs was, and is, as a dielectric and coolant in electrical equipment, most notably in transformers. On top of that, we can find legacy PCBs in products and materials like oil-based paints, oil used in motors and hydraulic systems adhesives, tapes, carbonless copy paper, floor finish, fluorescent light ballasts, etc. (EPA, 2022).

When PCBs end up in our lakes and rivers, they persist and travel up through the food chain, in some cases having significant health risks to humans and in the environment. Low concentrations in the river can build up and some bioaccumulate to higher concentrations in fish. This is a health risk not only for aquatic life but also for people that consume fish from these water bodies. Populations that are high fish consumers, such as Native American tribes, Asian Pacific Islanders, and recreational fishers, are at greater risk.

The WA Department of Ecology has done extensive work regarding impacts of PCBs to the Spokane River Basin. Additionally, the Spokane River Regional Toxics Task Force (SRRTTF) has led efforts to identify and reduce toxic compounds in the Spokane River. Learn more at **SpokaneRiverPCBfree.org.**

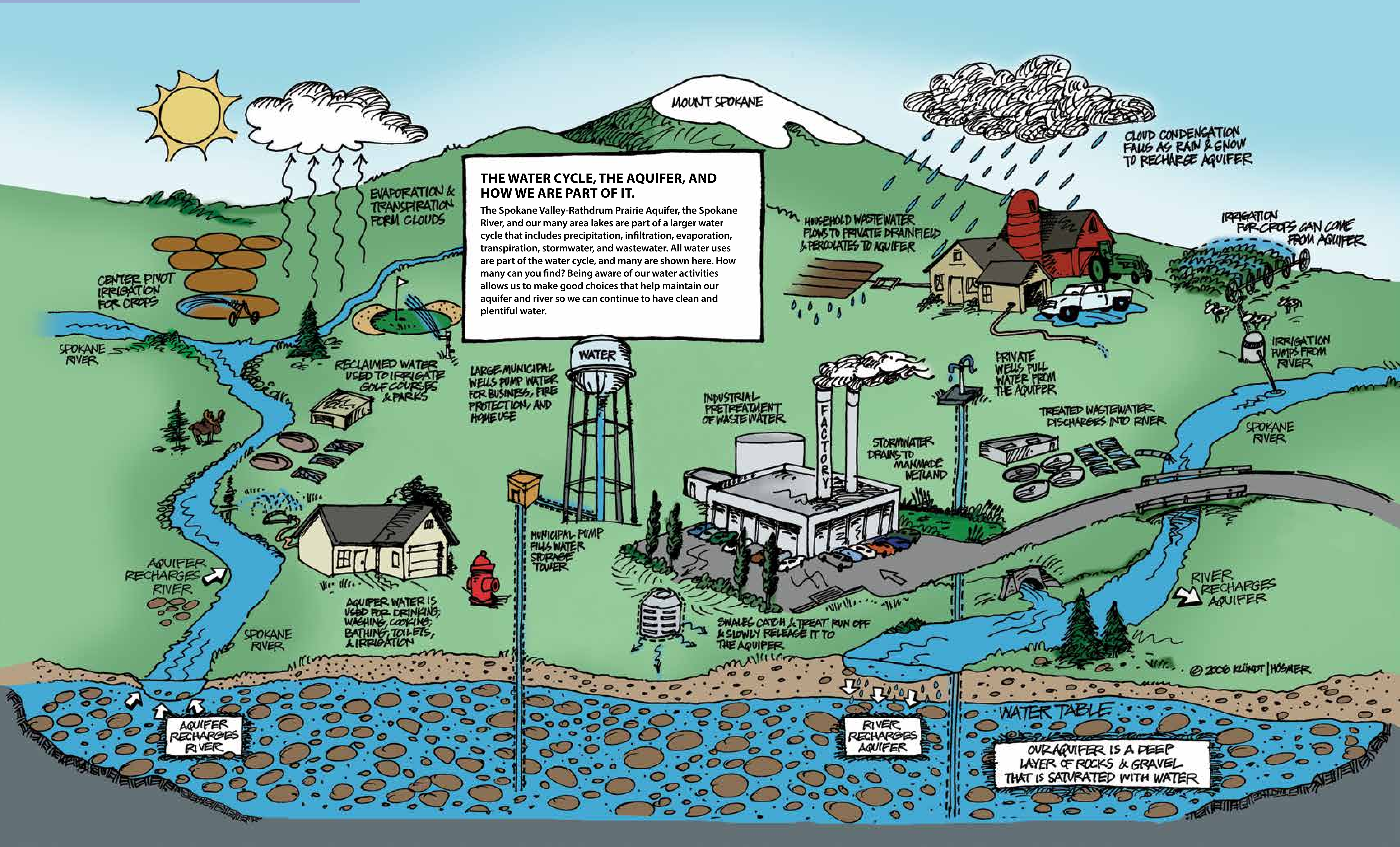
DEPTH TO WATER AT EAST MISSION AVE., WASHINGTON



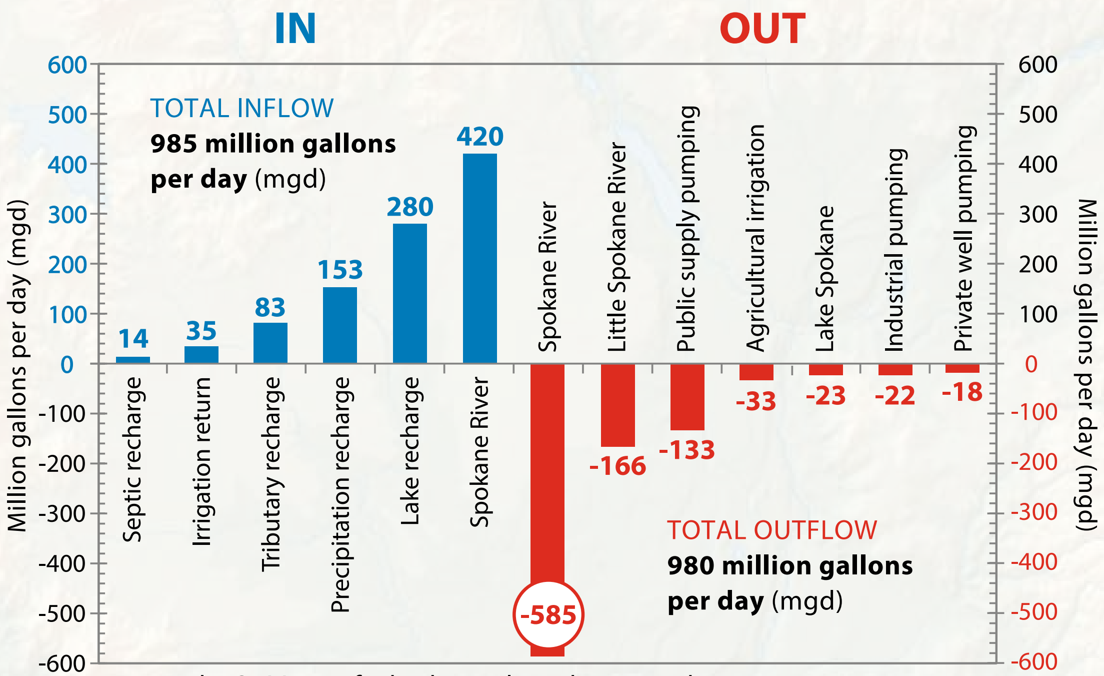
The SVRP Aquifer is unconfined and has no protective layer above it to keep pollutants out. Monitoring water quality and water levels (see depth to water level graph on left) demonstrates human impacts on the aquifer over time.

THE WATER CYCLE, THE AQUIFER, AND HOW WE ARE PART OF IT.

The Spokane Valley-Rathdrum Prairie Aquifer, the Spokane River, and our many area lakes are part of a larger water cycle that includes precipitation, infiltration, evaporation, transpiration, stormwater, and wastewater. All water uses are part of the water cycle, and many are shown here. How many can you find? Being aware of our water activities allows us to make good choices that help maintain our aquifer and river so we can continue to have clean and plentiful water.



Balancing the water budget.



The SVRP Aquifer budget values shown on this page represent average conditions of all days in the years 1995 to 2005.

Water entering the SVRP Aquifer

Water leaving the SVRP Aquifer

The Spokane Valley-Rathdrum Prairie (SVRP) Aquifer is dynamic with water flowing into and out of the system. Like a household budget, a water budget is an accounting of the amount and source of water recharging the SVRP Aquifer, and the amount and destination of water discharging from the SVRP Aquifer. This water budget is organized into two categories: inflow (water that recharges or flows IN to the SVRP Aquifer) and outflow (water that discharges or flows OUT of the SVRP Aquifer). In any successful budget, the IN and OUT numbers should match. More data could narrow the small gap in this budget.

The Spokane River plays a key role in the aquifer water budget: the river provides about 43% of the SVRP Aquifer inflow, and it receives almost 60% of the SVRP Aquifer outflow. The lakes near the SVRP Aquifer contribute about 28% of the inflow.

Human uses are only about 21% of the SVRP Aquifer outflow. Look on page 14 to find out how much SVRP Aquifer water people in Idaho and Washington use.

153 mgd enter the aquifer from precipitation that lands on the ground above the aquifer.

Lake Pend Oreille adds 43 mgd

Spirit Lake adds 36 mgd

Twin Lakes add 26 mgd

Agricultural and golf course irrigation returns 35 mgd

Tributary basins add 83 mgd

Irrigation only wells pump 33 mgd

Hayden Lake adds 45 mgd

Hayden Lake recharge

Subsurface flow to Lake Spokane takes 23 mgd

This is Waikiki Spring discharging to the Little Spokane River.

Newman Lake adds 15 mgd

Hauser Lake adds 13 mgd

166 mgd discharge to the Little Spokane River

Public supply wells pump 133 mgd

The Spokane River adds 420 mgd

Domestic wells pump 18 mgd

Fernan Lake adds 10 mgd

Public water systems pump, store, and deliver SVRP Aquifer water.

585 mgd discharge to the Spokane River

Industrial wells pump 22 mgd

Coeur d'Alene Lake adds 89 mgd

Liberty Lake adds 4 mgd

Septic systems add 14 mgd

Water that goes down a storm drain is included with the precipitation that lands on the ground.

The information on this page is adapted from USGS Scientific Investigations Report 2007-5044.

What is stormwater?

Rain and snowmelt are important for healthy wildlife habitat, recreation, and replenishing groundwater supplies in the Spokane Valley-Rathdrum Prairie Aquifer. However, when we replace the natural landscape with rooftops, parking lots, and streets, the water no longer soaks naturally into the ground. Instead, it flows across these hard surfaces as stormwater runoff.

Stormwater facilities are designed to help control flooding. They are not disposal systems for handling waste or trash.

Check out the photos below to learn about the many different places storm drains lead, including the SVRP Aquifer!

POLLUTION IN STORMWATER

Water will carry a bit of everything it touches. Stormwater runoff becomes a really big problem for our rivers, lakes, and aquifer when pollutants from our everyday activities like lawn care, car maintenance, and dog walking are left on the ground for stormwater to wash away.

Other things left in the street can clog storm drains and cause the flooding that the storm drain was meant to prevent.

It's important for local governments and businesses to manage runoff as quickly as possible to prevent flooding, erosion, and water pollution. In our region, storm drains, dry wells and swales are used to handle stormwater runoff and can easily be placed in the curb or gutter during road and parking lot construction.

Where Does Stormwater Go?

In an urban environment:

- Stormwater is collected in pipes and discharged to the Spokane River, streams or other surface water bodies, and/or wastewater treatment facilities.
- Stormwater is directed to swales and dry wells and infiltrated into the ground, eventually reaching the Spokane Valley-Rathdrum Prairie Aquifer.

Stormwater Drains

Stormwater systems have drains along the roads that can flow to streams, rivers, lakes, or wastewater treatment facilities. Most stormwater in our region does not receive treatment and flows directly into a nearby water body. A common phrase to remember is "Only Rain Down the Drain."

Illicit Discharge

Anything other than stormwater that goes into a storm drain or on the ground is called an illicit discharge. There are only a few exceptions to this rule, including discharges from emergency firefighting operations. If you see an illicit discharge, such as a spill or discharge of pollutants, please call your local water or wastewater provider to report the illicit discharge.

Swales: The natural way to capture stormwater.

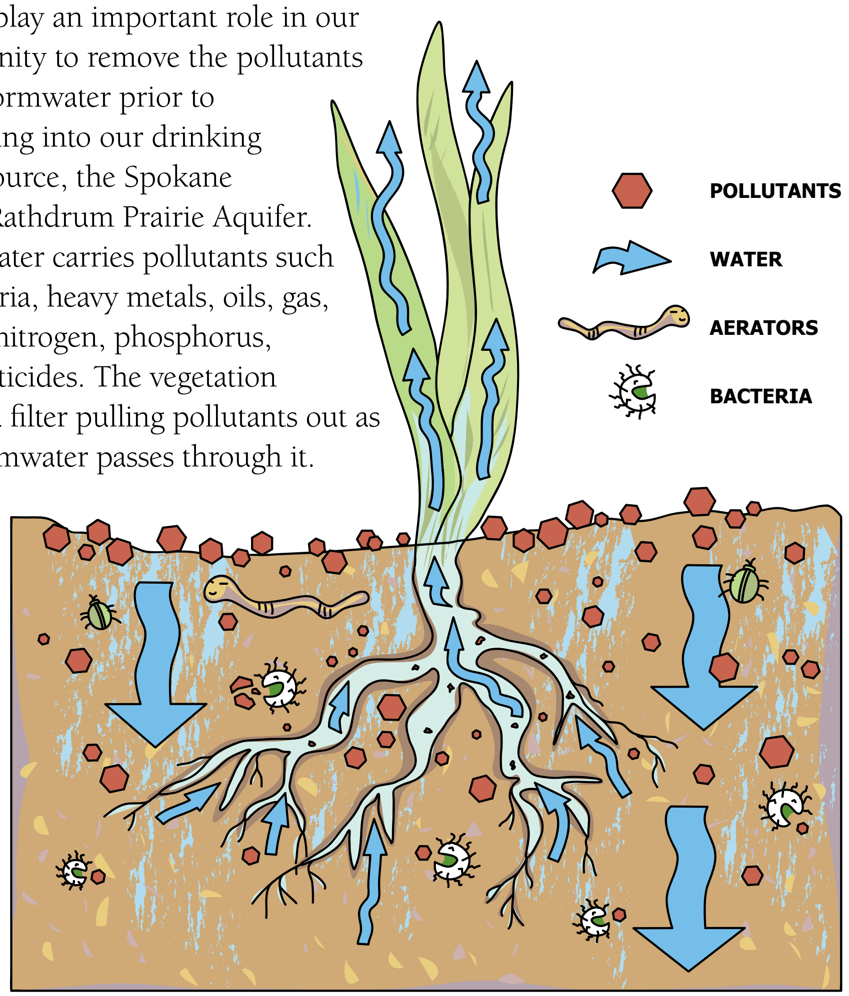
When it rains, the water runs over pavement and other hard surfaces, picking up pollutants along the way. Much of this polluted stormwater runoff historically flowed only to storm drains, which ultimately emptied into rivers, lakes, or infiltrated to the SVRP Aquifer.

In recent years, local governments have been turning to swales rather than storm drains and dry wells 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.

How Do Swales Work?

Swales play an important role in our community to remove the pollutants from stormwater prior to infiltrating into our drinking water source, the Spokane Valley-Rathdrum Prairie Aquifer. Stormwater carries pollutants such as bacteria, heavy metals, oils, gas, grease, nitrogen, phosphorus, and pesticides. The vegetation acts as a filter pulling pollutants out as the stormwater passes through it.

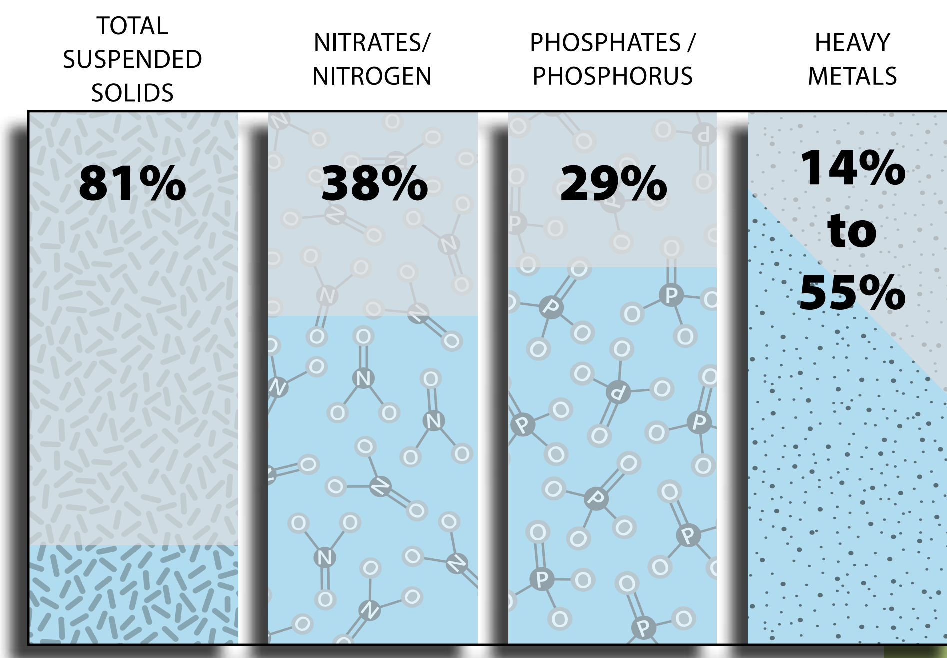


Swales have significant filtering capabilities. As the stormwater flows through a swale, the solid particles settle out and the plants act as a filter to remove contaminates in the water.

Four Important Functions of Swales

- **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.

HOW MUCH POLLUTION CAN SWALES REMOVE FROM STORMWATER?



Low-Impact Development: Naturally Reducing Stormwater Runoff

Low-impact development (LID) preserves and creates natural landscape features. This minimizes hard surfaces and creates functional and appealing site drainage that uses 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.

Bioretention facility in Spokane

LID Over the SVRP Aquifer

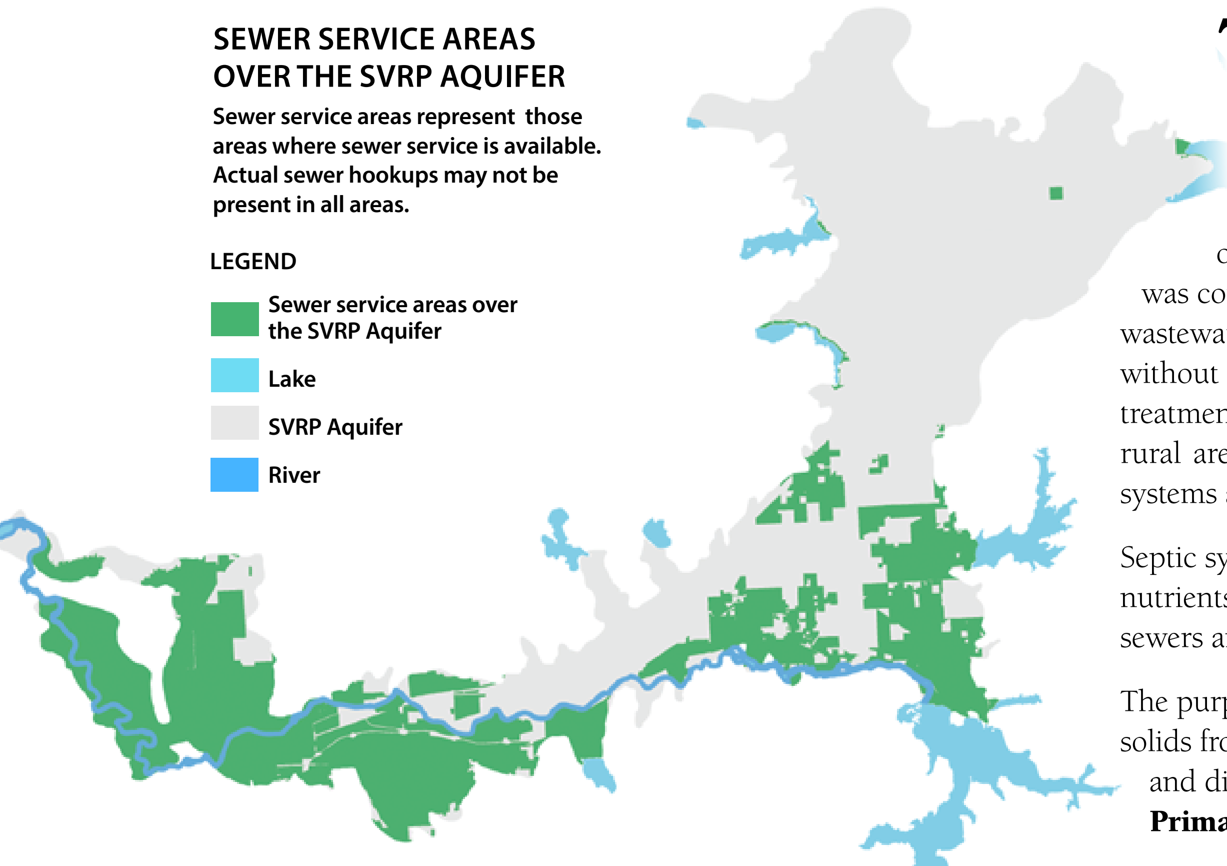
You can spot LID facilities over the SVRP Aquifer in many places, including the Panhandle Health District in Hayden, Coeur d'Alene High School, Broadway Avenue near Maple in Spokane, and Country Homes Boulevard in Spokane County. You can even see rain barrels in residential yards!

SWALE MAINTENANCE TIPS

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.

Shallow dry wells should be installed away from curb cuts in order to pre-treat the water before infiltrating into the well.



Over 80 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 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 use septic systems, which allow some treatment of household wastewater as it percolates through the soil. Many rural areas continue to use septic systems for wastewater disposal; these systems are safe and efficient when properly built and maintained.

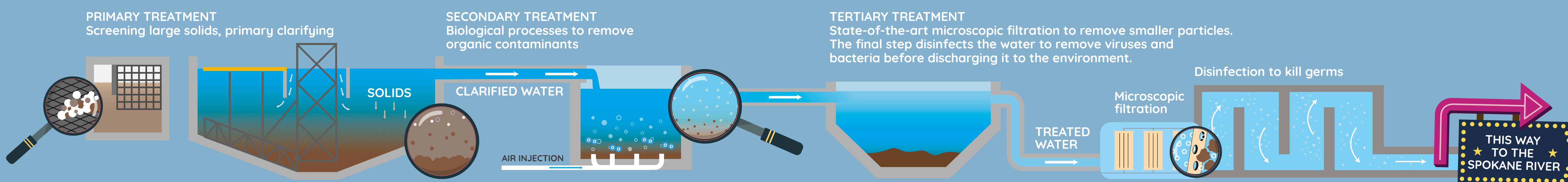
Septic systems in high density population areas led to increases in nutrients in the SVRP Aquifer. Over time, local municipalities have built sewers and modern treatment facilities to clean and dispose of wastewater.

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 waste stream 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** then uses biological processes to remove the organic contaminants from the water. **Tertiary treatment** is 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 and many are now required to use tertiary treatment to meet water quality standards intended to increase dissolved oxygen levels and support aquatic life in Lake Spokane and the Spokane River.

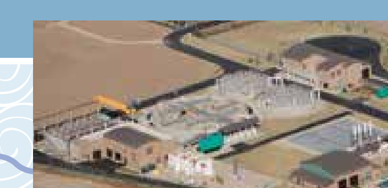
Recycled Water

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.









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

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

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

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

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

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

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

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

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

2017
Liberty Lake Sewer and Water completed its addition of tertiary treatment.

2021
The City of Spokane unveiled its Next Level Treatment Facility—capable of filtering 50 million gallons of wastewater daily.

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

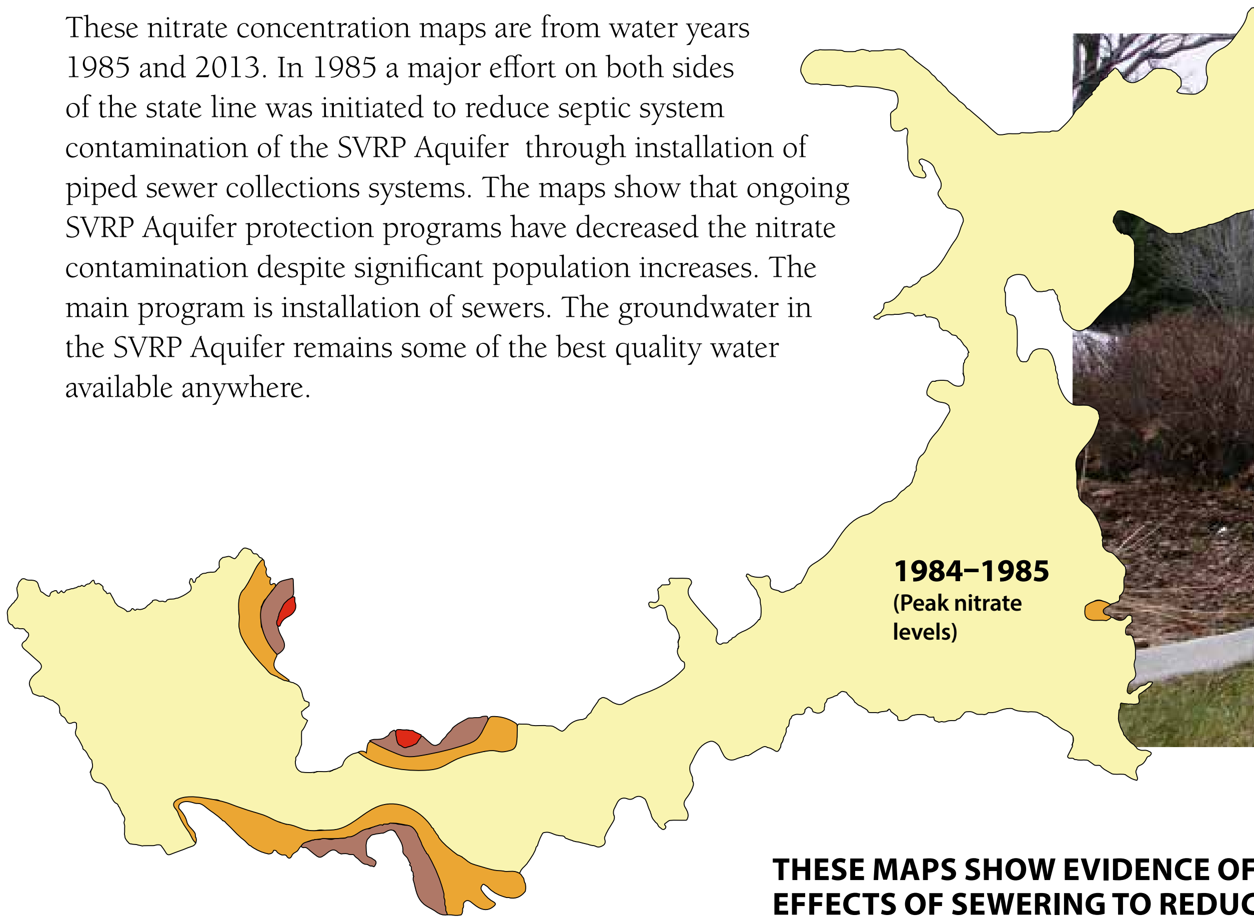
The effects of sewering.

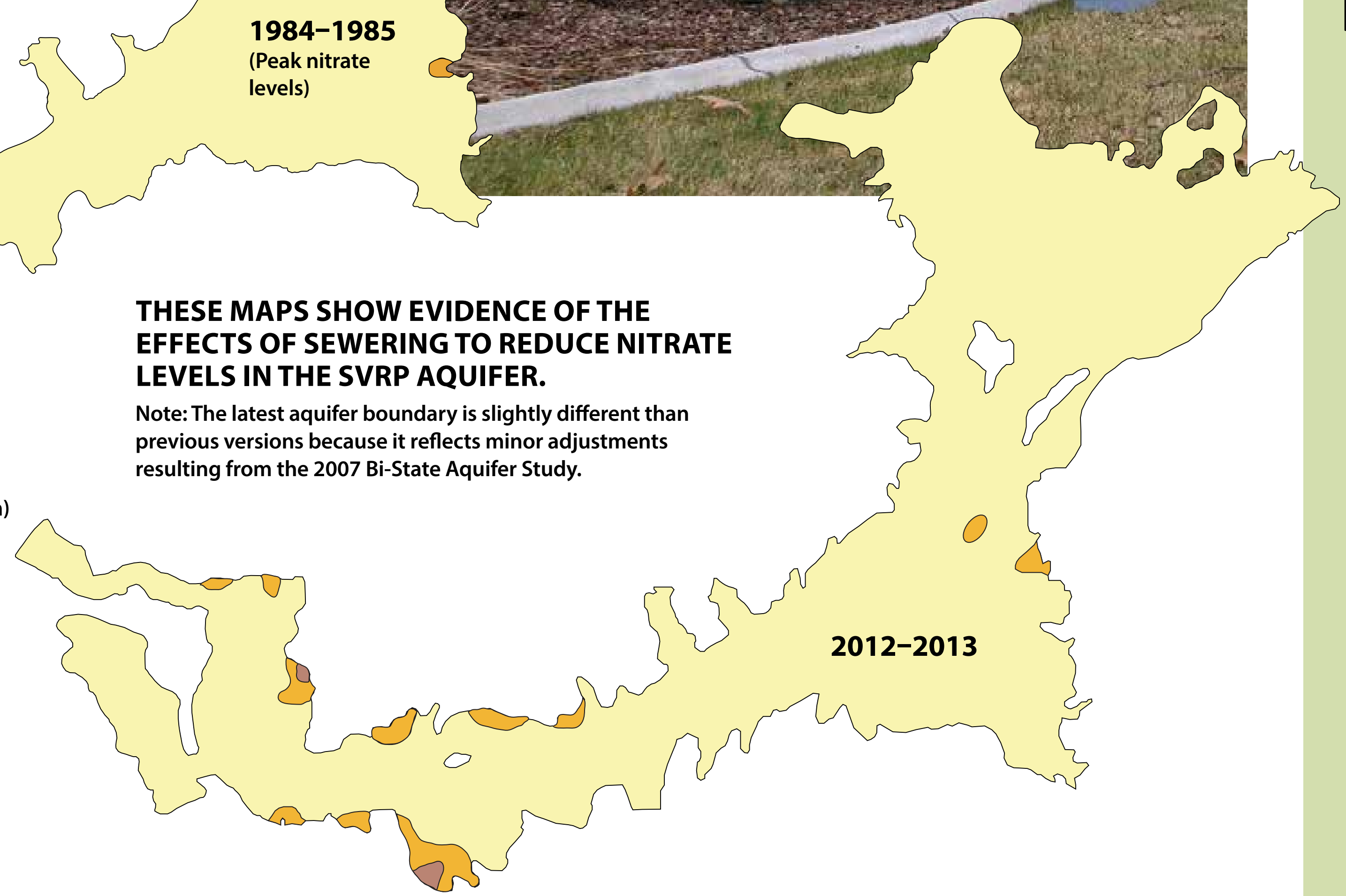
The illustrations on this page show reduced concentrations of nitrate in the Spokane Valley-Rathdrum Prairie (SVRP) Aquifer through time. Under natural conditions in our aquifer, nitrate occurs in low concentrations, typically 1 to 2 parts per million (ppm). Nitrate in drinking water above 10 ppm may 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 collections systems. The maps show that ongoing 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.

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, pharmaceuticals, and industrial chemicals. Traces of some of these other contaminants have occasionally been found in local wells. Ongoing monitoring and protection programs are essential to protect the high quality of aquifer water.





THESE MAPS SHOW EVIDENCE OF THE EFFECTS OF SEWERING TO REDUCE NITRATE LEVELS IN THE SVRP AQUIFER.

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

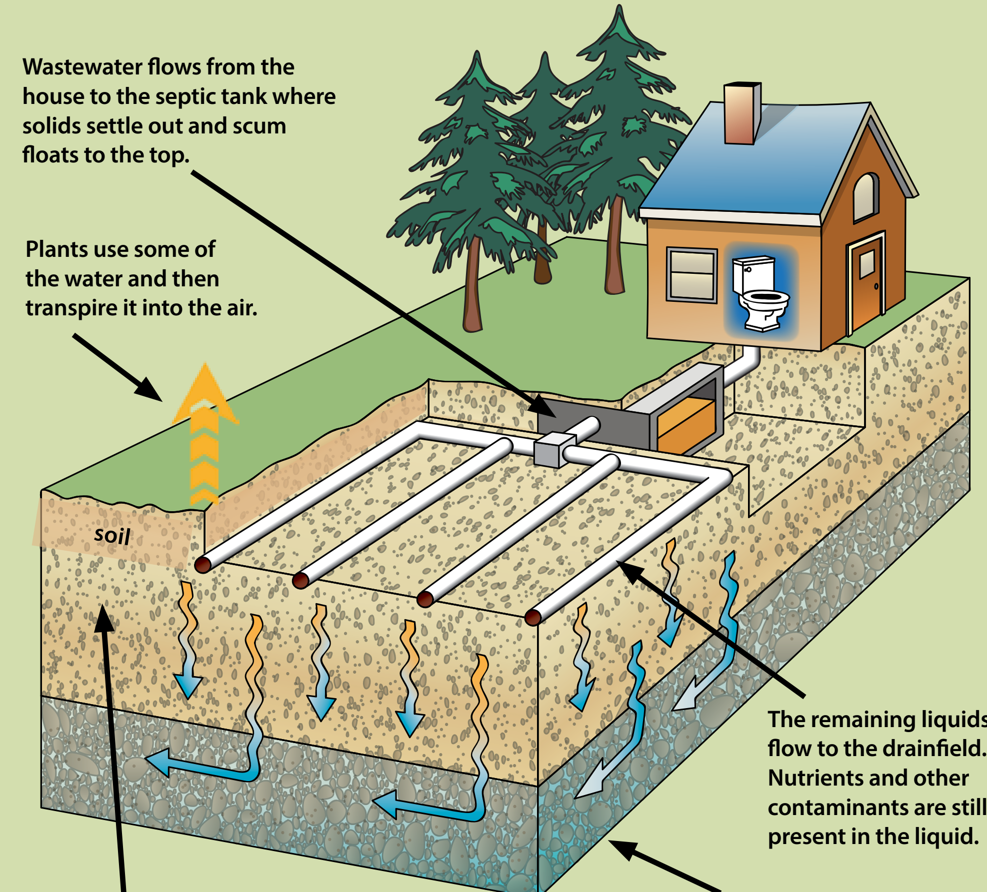
LEGEND

Colors represent nitrate levels in parts per million (ppm)

- < 3 ppm
- 3 - 5 ppm
- 5 - 10 ppm
- > 10 ppm

Nitrate levels extrapolated from Spokane County and Panhandle Health District water sampling data (12-month average).

Septic System Operation and Aquifer Impacts



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.

Business risks & best management practices.

We are fortunate to have many types of businesses in our area including: aerospace, agriculture, vehicle maintenance and fueling, machining, manufacturing, metal fabrication, bulk storage, 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.

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 four main sources of contamination: chemical storage and handling, process wastewater, underground storage tanks, and contaminated stormwater.

Local, State and National Organizations Working with Businesses to Protect the Aquifer

Public Health
Prevent. Promote. Protect.
Panhandle Health District

The Critical Materials Program is administered by Panhandle Health District and serves to protect the Idaho portion of the Spokane Valley-Rathdrum Prairie Aquifer. Environmental Health Specialists conduct biennial facility inspections and provide technical assistance to business owners who handle and store chemicals over the aquifer.

Enviro Certified

EnviroCertified, in Spokane County, certifies businesses who conserve resources and properly manage their hazardous waste. EnviroCertified is administered by the Spokane Regional Health District and the Spokane River Forum.

SAJB

The Spokane Aquifer Joint Board conducts an annual Potential Contaminant Source Inventory of WA businesses that use hazardous materials and notifies them of potential risks to the aquifer.

United States Environmental Protection Agency

The Environmental Protection Agency (EPA) mandates the implementation of the General Pretreatment Regulations, 40 CFR 403, by all businesses that may affect a city's water treatment facility. Pretreatment programs protect the community from pollutants that can interfere with treatment facility processes, damage equipment, or may not be removed effectively before being released into receiving waters such as the Spokane River.


Chemical containers outside, without proper containment

Chemical Storage

Tens of millions of gallons of chemicals are stored over our SVRP Aquifer. Storage containers may leak, or their contents can be displaced by stormwater if left unprotected outside. Chemicals stored outside should be covered to keep out stormwater and should be placed in a containment device that can hold 110% of the total volume in case of a spill.

CHEMICAL STORAGE WITH SECONDARY CONTAINMENT

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.


Concrete containment


Poly-geotextile containment


Plastic containment pallets for totes


Metal containment for drums/tanks

Did You Know?

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

Chemical Handling

Sometimes chemicals such as deicer, pesticides, fertilizers, and herbicides are intentionally applied to the ground for our benefit. They may present a risk especially if unintentionally released, misapplied, or overused.

Transferring chemicals between containers or to a vehicle presents a risk of a spill and release to the ground, i.e., magnesium chloride (road deicer), gasoline, oil, and antifreeze.


Liquid deicer application


Golf course pesticide application

Gasoline spill before clean-up

Gasoline spill cleaned up

Uncovered, spills go off pad onto ground, no grit chamber/blind sump

New pad, under cover, with grit chamber/blind sump

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.

Evaporative pond permitted by IDEQ

Approved wastewater retention pit with mechanical evaporator

Did You Know?

Tens of millions of gallons of chemicals are stored over our SVRP Aquifer.

Improper Disposal of Process Wastewater

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.

Carpet cleaning wastewater may have dangerous pH levels or high temperatures and contain toxic chemicals and carpet fibers which should never be discharged to storm drains, drywells, swales, gutters, parking lots, lawns, ditches, groundwater or surface water.

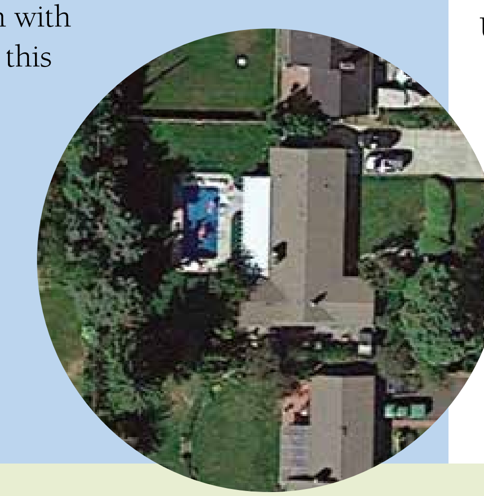
Boat washing wastewater should not discharge to the ground

Vehicle wash water should not flow off washpad or discharge to the ground

Overflowing truck washout basin at a concrete plant

Surface mining, concrete, and asphalt facilities are large complex businesses with a potential for failure in critical material handling systems. Issues include heavy use of solvents and chemicals, and the storage, transfer or generation of large volumes of oils, waste oils, and wastewater. Pumps and hoses have multiple points of potential failure and if wastewater containment and washout basins are inadequately designed they may overflow. It is important for these facilities to be monitored and properly maintained.

Before draining a swimming pool, confirm with your local sewer provider that they accept this type of wastewater. Generally speaking, residential pools are recommended to be drained to swales, away from any shallow injection wells and commercial pools should be drained to sanitary sewer. Do not drain pools on streets or into storm drains. Pool chemicals can harm the river and Aquifer.



Underground Storage Tanks (USTs)

USTs are used to store petroleum or other hazardous liquids. There are over 350 active UST sites, often with multiple tanks at each site, operating over the Spokane Valley-Rathdrum Prairie Aquifer.

USTs can leak, and their contents can end up in the SVRP Aquifer.

Every UST facility must be inspected at least once every 3 years. The Idaho Department of Environmental Quality regulates UST's in Idaho and the Washington Department of Ecology regulates UST's in Washington. These programs periodically inspect USTs which helps prevent releases of liquids from the tanks that could potentially pollute the aquifer and our environment.

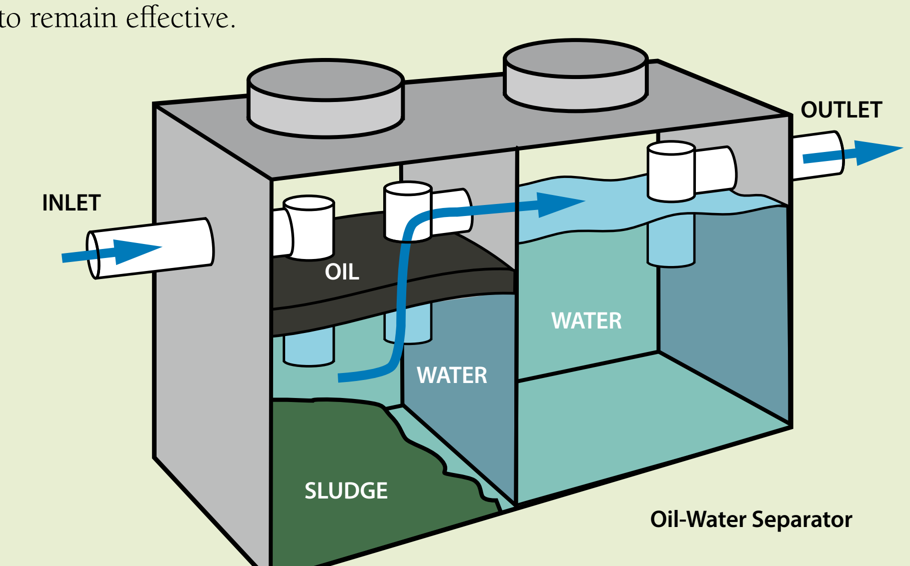
All owners and operators of USTs are required to complete training in how to properly identify, operate, and maintain UST components.

Contaminated Stormwater

Rain and snow can mix with exposed contaminants at industrial sites. Stormwater carries contaminants into storm drains that discharge into lakes, rivers, and the SVRP Aquifer. The most common way stormwater becomes contaminated is at fueling sites where drips, overfills, and drive-offs are common.

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

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



Oil-Water Separator

Protect the aquifer at home.

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.

Do This.

- ✓ 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.

Not This.

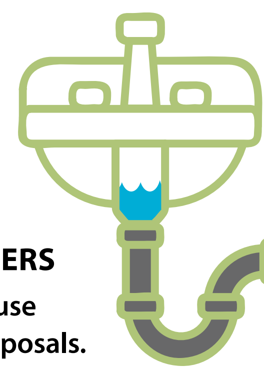
- ✗ Don't throw toxic substances or their containers in the trash.
- ✗ Never pour leftover products down sink drains or into the toilet.
- ✗ Never mix leftover products.
- ✗ Do not dispose household hazardous waste in streams, rivers or lakes.
- ✗ Do not dump toxics into storm drains.

HOUSEHOLD HAZARDOUS WASTE

Some things don't belong in your drain. They can clog pipes and pollute our water!

WATER POLLUTERS

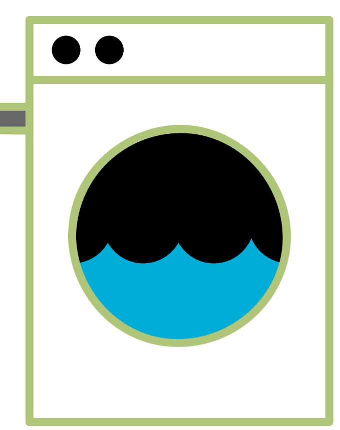
Medications and toxic substances including chemicals, cleaners, degreasers, oils, paints, disinfectants, and pesticides should never be put down the drain.



SINK CLOGGERS

Eliminate the use of garbage disposals.

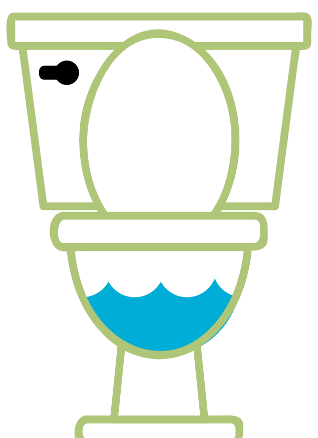
Ground-up garbage does not decompose easily, causes buildup of solids in sewer and septic tanks, and may clog distribution pipes.



LAUNDRY CLOGGERS

Use liquid laundry detergent, and use it sparingly.

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



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!

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	✗ Condoms	✗ Food	✗ Napkins
✗ Bandages	✗ Cotton balls	✗ Grease	✗ Paper towels
✗ Chemicals	✗ Dental floss	✗ Hair	✗ Plastic bags
✗ Cigarette butts	✗ Diapers	✗ Kitty litter	✗ Q-tips
✗ Cleaning wipes	✗ Eggshells	✗ Kleenex	✗ Rags
✗ Coffee grounds	✗ Feminine products	✗ Medications	✗ Wrappers

Conserve Water Around the Home.

- Only water when needed. Depending on the weather or type of plants/turf you may only need to water once or twice a week.
- Water early in the morning or late in the day. Water when the sun is low to minimize evaporation.
- Watch where you are watering. Check sprinkler heads to be sure water is not wasted on driveways, sidewalks, or streets.
- Keep an eye on the weather. If rain is in the forecast, turn your sprinkler system off.
- Use drought-resistant species. Native plants are adapted to the local climate and need less water and maintenance.
- Mulch Beds. Two to three inches of mulch retains moisture and helps prevent weeds.
- Set your mower higher. Mow at 2.5–3.5 inches high to reduce evaporation and protect your lawn from burnout, weeds, insects, and disease.
- Check for leaks and breaks. Inspect your landscaped area regularly to make sure system pipes and sprinkler heads are in good condition.
- Sweep, don't spray. Use a broom instead of a hose to clean patios, decks, and sidewalks.
- Repair leaky pipes, running toilets, and dripping faucets ASAP. Faucets that drip once per second waste over 3,000 gallons a year!
- Car Wash Wisely. Wash your car on the lawn and use a hose nozzle or take it to a car wash.
- Replace old appliances and fixtures with energy- efficient models. Look for the EPA Water Sense and Energy Star logos!
- Convert older toilets to low-flow with a displacement device.

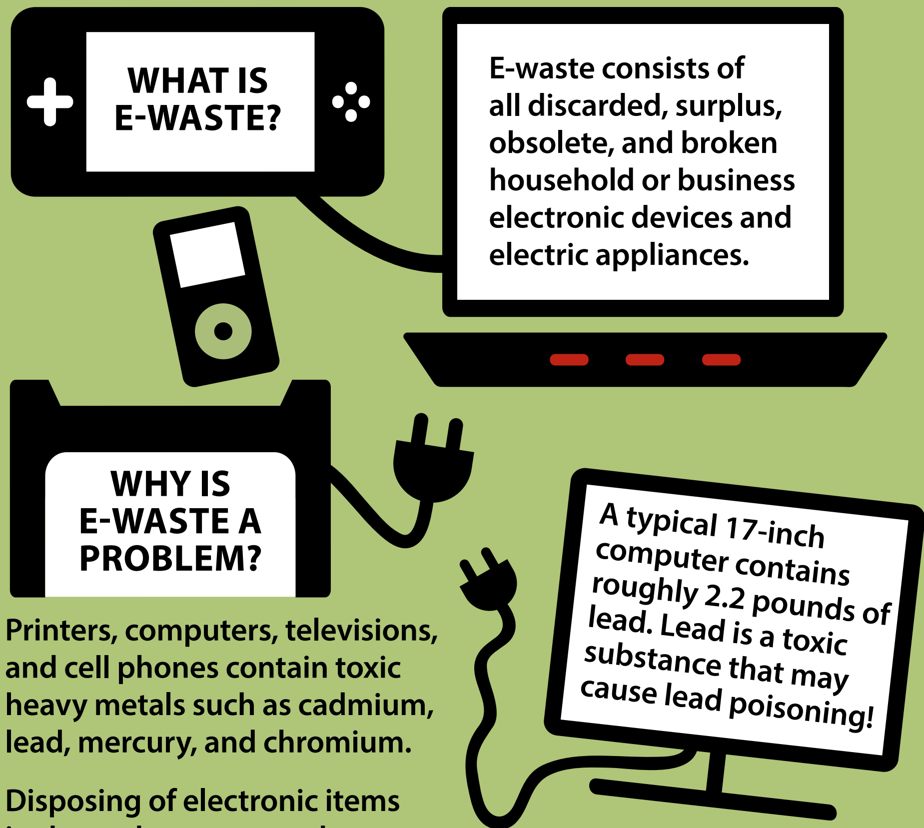
ENERGY STAR

Water Sense · Meets EPA Criteria

"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

The United States dumps 300–400 million electronic items per year. Less than 20% of e-waste is recycled. E-waste represents 2% of trash in landfills, but is 70% of all toxic waste. Visit E-Cycle or the Waste and Recycle Directory for proper e-waste disposal options.

Let's Pull the Plug on E-Waste!



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 600,000 people.

Local Resources for Waste Management

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

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

Panhandle Health District
phd1.idaho.gov

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

Kootenai County Solid Waste
kcgov.us/departments/solidwaste

Spokane City Solid Waste
spokanecitysolidwaste.com

City of Spokane Valley
spokanevalley.org/solidwaste

Got Waste? Want to Recycle? Put it in the right place!
SpoKane Kootenai **Waste & Recycle Directory**
WORKING TOGETHER TO PROTECT OUR RIVER AND AQUIFER
spokanewastedirectory.org
kootenaiwastedirectory.org

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 assistance.

To visit their website, go to: **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.

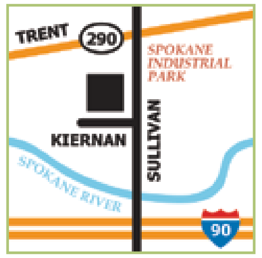
For more details about computers and their impact on landfills, visit: epa.gov/waste

Spokane County Waste Disposal Sites

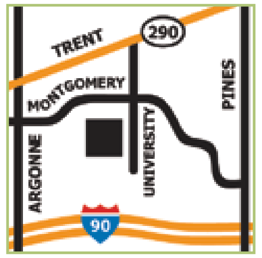
Office: 509-477-3604 Hotline: 509-477-6800

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

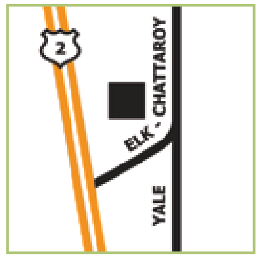
Waste to Energy Facility
2900 S. Geiger Boulevard
Spokane, WA 99224



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



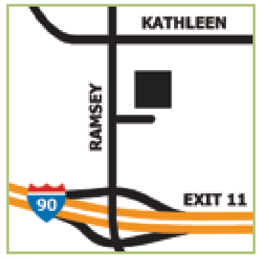
North County Transfer Station
22123 N. Elk-Chattaroy Road
Colbert, WA 99005

It's easy to recycle and properly dispose of waste materials. Just go to any of these locations!
—Recycle Man

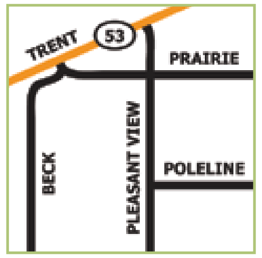
Kootenai County Waste Disposal Sites

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.

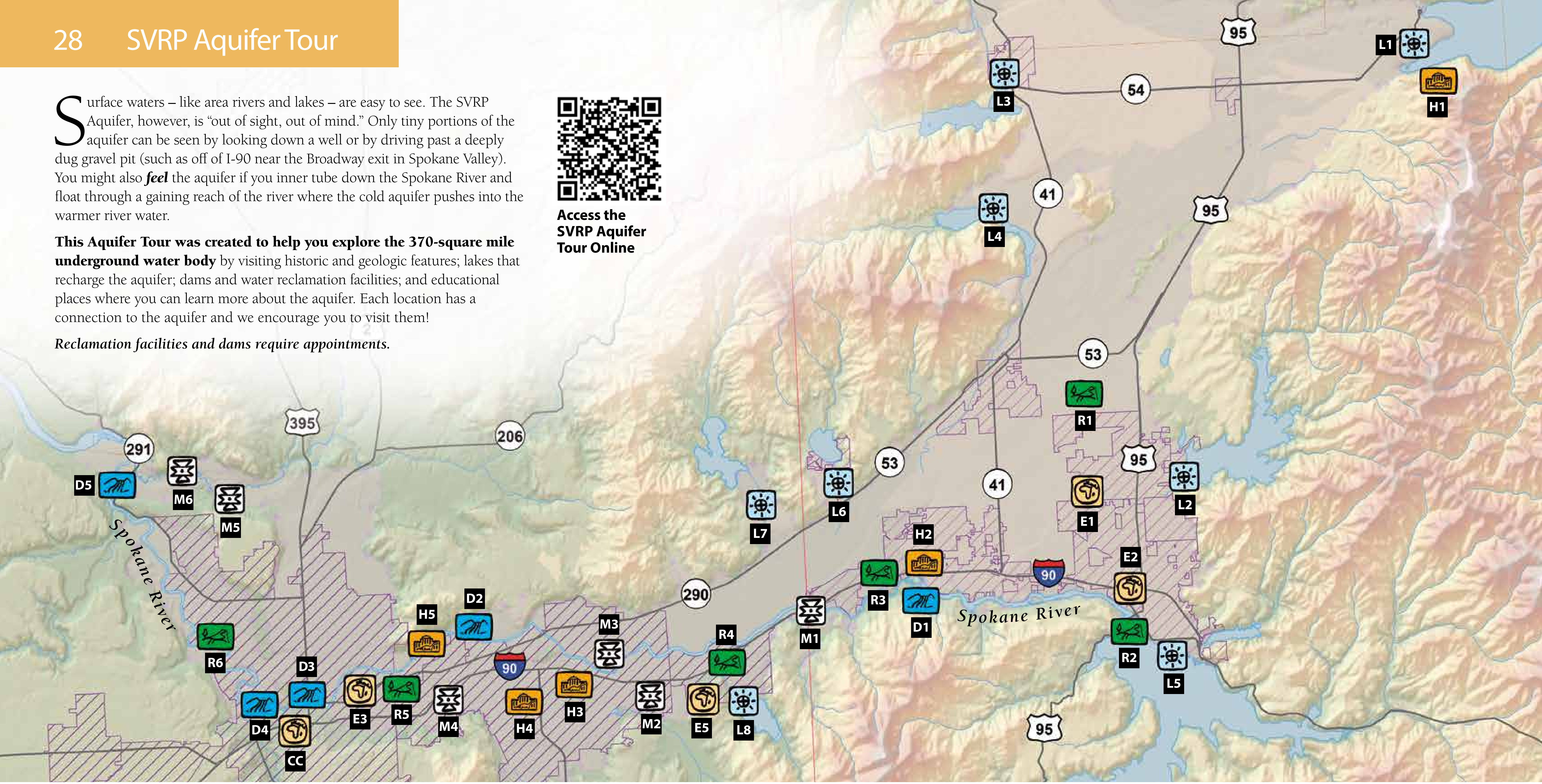
For information regarding solid waste collection facilities within Bonner County, visit: bonnercounty.us/solid-waste

Surface waters – like area rivers and lakes – are easy to see. The SVRP Aquifer, however, is "out of sight, out of mind." Only tiny portions of the aquifer can be seen by looking down a well or by driving past a deeply dug gravel pit (such as off of I-90 near the Broadway exit in Spokane Valley). You might also ***feel*** the aquifer if you inner tube down the Spokane River and float through a gaining reach of the river where the cold aquifer pushes into the warmer river water.

This Aquifer Tour was created to help you explore the 370-square mile underground water body by visiting historic and geologic features; lakes that recharge the aquifer; dams and water reclamation facilities; and educational places where you can learn more about the aquifer. Each location has a connection to the aquifer and we encourage you to visit them!

Reclamation facilities and dams require appointments.

Access the SVRP Aquifer Tour Online



DAMS
- **D1** Post Falls Dam
- **D2** Upriver Dam
- **D3** Upper Falls Dam
- **D4** Monroe Street Dam
- **D5** Nine Mile Dam

EDUCATION
- **E1** Panhandle Health District Building
- **E2** University of Idaho Water Resource Center
- **E3** Spokane County WRC
- **E4** Upriver Dam
- **E5** Dorris Morrison Learning Center

RECLAMATION
- **R1** Hayden Area Regional Waste Water Treatment Plant
- **R2** Coeur d'Alene Waste Water Treatment Plant
- **R3** Post Falls Water Reclamation Fac.
- **R4** Liberty Lake Water Reclamation Fac.
- **R5** Spokane County Regional Water Reclamation Fac.
- **R6** Riverside Park Water Reclamation Fac.

RECHARGE LAKES
- **L1** Lake Pend Oreille
- **L2** Hayden Lake
- **L3** Spirit Lake
- **L4** Twin Lakes
- **L5** Coeur d'Alene Lake
- **L6** Hauser Lake
- **L7** Newman Lake
- **L8** Liberty Lake

HISTORIC
- **H1** Ice Dam Site at Farragut State Park
- **H2** Millrace Head Gate
- **H3** Vera Water District Well (Evergreen)
- **H4** Spokane Valley Historical Museum
- **H5** Original 1907 Well

MISCELLANEOUS
- **M1** Hand Pump
- **M2** Water Tower
- **M3** Sullivan Park Spokane Valley
- **M4** Gravel Pit
- **M5** Spokane Hatchery
- **M6** Painted Rock Gauging Site

Community Tours & Field Trips

Doris Morrison Learning Center (DMLC)

The DMLC provides environmental and cultural education to inspire connection and stewardship between people and the Saltese Flats Wetland Area. The facility is a base for outdoor activities to learn the wetland's unique history, geology, and ecosystem. For more information, visit spokanecounty.org/dmlc.

Riverside Park Water Reclamation Facility (RPWRF)

Sited on the edge of Riverside State Park, the RPWRF treats around 34 million gallons of wastewater per day. The facility tour, tailored to accommodate all age groups, highlights phases of treatment processes – from grit removal to disinfection and discharge. Call 509.625.7900 to schedule.

Spokane County Water Resource Center (WRC)

The WRC education program provides locally-relevant water education to promote the stewardship of water in the Spokane Valley-Rathdrum Prairie Aquifer and the Spokane River. Field trips, tours of the Spokane County Regional Water Reclamation Facility and classroom visits are available year-round. Visit spokanecounty.org/wrc to learn more and book your tour today.

Upriver Dam and Well Station

Find out how water is transported throughout Spokane and the inner workings of hydroelectricity at the City of Spokane's historic water distribution facility. Call 509.742.8141 to schedule a tour.

Spokane Valley-Rathdrum Prairie Aquifer Atlas

FIFTH EDITION

In Collaboration with

City of Post Falls
City of Spokane Water Department
Idaho Dept. of Environmental Quality
Idaho Washington Aquifer Collaborative
Liberty Lake Sewer District
Panhandle Health District
Spokane Aquifer Joint Board
Spokane County Water Resources
Washington State Department of Ecology

Design and Production

Amanda Summers Design

Special thanks to the Spokane River Regional Toxics Task Force for their financial contribution that aided in the design and production of this fifth edition of the Spokane Valley-Rathdrum Prairie Aquifer Atlas.

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CREDITS

Front Cover Map: USGS Elevation and hydrography data, Tim Lewis, City of Spokane.

Page 2: Atlas Team

Page 3: Columbia River Watershed Map: ESRI National Geographic Map

Page 4–5: "Plante's Ferry" painting by James Madison Alden, International Boundary Survey, 1860, National Archives, College Park, Maryland (thanks to Jack Nisbet); Modern Irrigation photo, Modern Electric Water Company archives; Washington Water Power Company, 1936, Spokanesman-Review; :Sandy Beach, Liberty Lake, late 1940s Courtesy Washington State Archives; Expo program, Joe Haupt-Flickr.com.

Page 6: Geology Map, Jeremy Jenkins and Gary Stevens.

Page 7: Batholith graphic and Batholith formation graphic, Amanda Summers after Gary Stevens; Kaniksu rock photo, Reanette Boese; lead, Gary Stevens. Columbia River Basalt Extent map: Amanda Summers after ISU Digital geology modified by Gary Stevens; Basalt Formation, Williamborg (Wikimedia Commons).

Page 8: Cordilleron Ice Sheet map, Amanda Summers after USGS SIR 2005-5227; Flood water paths, Reanette Boese based on Bjornstad/Kiver, *On the Trail of the Ice Age Floods – The Northern Reaches*, 2012, figure 3-11.

Page 9: Gravel pit photo, Dr. John P. Buchanan; Glacial erratics photo, Tom Foster; West Bar ripple marks photo, Bruce N Bjornstad; Rhythmites photo, Bruce N Bjornstad; J Harlen Bretz photo, IDEQ website; Bretz's Plaque Photo, by Tom Foster with permission from Barbara Foster.

Page 10: Conceptual cross-section, USGS SIR 2007-5041, SVRP ground water flow map, USGS SIR 2007-5044, Recharge and precipitation graph, Amanda Summers created from information in USGS SIR 2007-5036; Precipitation map, USGS SIR 2005-5227.

Page 11: River gaining and losing reaches graphics, Amanda Hess, modified from USGS Circular 1376; Spokane River gaining/losing reaches graph, Amanda Summers after Gary Stevens; Gaining reach near Sullivan Rd photo, Patrick Cabbage; Losing reach near Greenacres photo, Patrick Cabbage; Spokane River gaining/losing reaches map, modified from USGS SIR 2005-5227.

Page 12: Apple trees photo, Modern Electric Water Company; Otis Brand crate art, Spokane Valley Museum Photo 2005.615.027; Upriver well construction photo, City of Spokane; Rathdrum Prairie, Ca 1952, Museum of North Idaho, Coeur d'Alene, ID.

Page 13: National Child Labor Committee collection, Library of Congress, Prints and Photographs Division; Wooden flume photo, Modern Electric Water Company; Rathdrum Idaho aerial image, Coeur d'Alene MLS.

Page 14: census.gov, County populations; Monthly water use graph, Spokane County Water Demand Forecast Model Report, 2011; Water use graph, Spokane County Water Demand Forecast Model Report, 2011, and Rathdrum Prairie Aquifer 2014 Water Demand Update, 2014.

Page 15: Perennial garden photo, Kristen Zimmer.

Page 16: Map, Reanette Boese, monitoring well graphic modified from Amanda Hess.

Page 17: ID chloride graph data, PHD; WA chloride graph data, WDOE; Depth to water at Mission Ave, USGS, Well monitoring location ID: 47401111707290.

Page 18: Klundt & Hosmer Design, Inc., commissioned by SAJB.

Page 19: In and Out graph and graphics adapted from USGS SIR 2007-5044; water tank photo, Jim MacInnis; Waikiki Springs photo, Mike Hermanson, Aug 2007; HARBS sprinkler photo, Idaho Dept. of Lands; Hayden Lake photo, Gary Stevens; storm drain photo, Amanda Hess.

Page 20: Flooded street photo, YouTube video by Dimka9698; Erosion photo, Spokane County Stormwater Utility; Spokane River photo, City of Spokane; Lake photo, City of Coeur d'Alene; treatment plant photo, City of Spokane; storm drain and drywell graphic, Amanda Hess; swale photo, Reanette Boese; clean out photo, treesonsanpedrostproject.com; pollution graphic, Amanda Hess.

Page 21: Rain garden photo, City of Spokane; swale filter graphic and pollution removal graphic, Amanda Hess from EPA NPDES, 1997; grassed swale photo, Spokane County Stormwater.

Page 22: Sewer service areas map, Lynn Schmidt; wastewater treatment process graphic, Kristen Zimmer, 1958 Spokane treatment plant construction photo, City of Spokane archives; 1982 Liberty Lake treatment plant photo, Liberty Lake Sewer and Water District; HARSB photo, HARSB website; Spokane County facility, Spokane County.

Page 23: Nitrate 1984-1985 graphic, Jim MacInnis, 2009 SVRP Aquifer Atlas; Nitrate 2012-2013 graphic, Lynn Schmidt; Septic system graphic, Amanda Hess.

Page 24: Chemical containers photo, PHD; Types of secondary containment photos, PHD; Deicing truck photo, City of Spokane; Golf course pesticide photo, USDA Agricultural Research Service; Before & After photos, PHD; Spill kit photo, SRHD.

Page 25: Evaporative pond photo, PHD; Mechanical evaporator photo, PHD; Vehicle wash water on ground photo, PHD; Truck washout basin photo, PHD; Contaminated stormwater photo, Ivan Ussach/MRWC; Dumpster photo, PHD; Leaking UST photo, Montana DEQ; Red UST photo, IDEQ; Oil-water separator graphic, Amanda Summers.

Page 26: Pipe graphics, Amanda Hess; Aqua Duck, SAJB, conserve water icons, American Water.

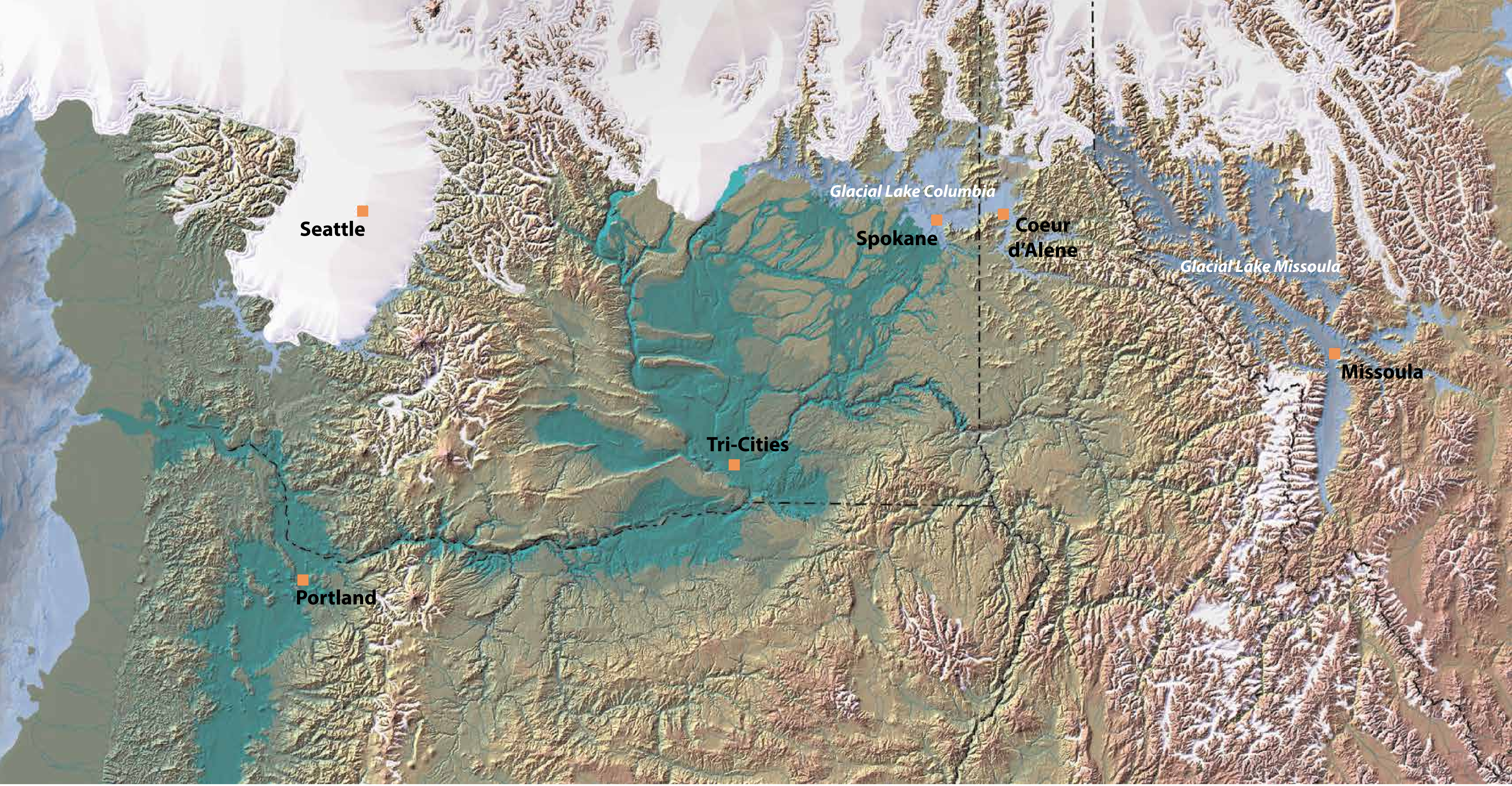
Page 27: Graphics, Amanda Hess; Recycle Man, Spokane Indians Baseball Team.

Page 28: Aquifer Tour map, Reanette Boese.

Back cover: Image Jeff Silkwood's US Forest Service poster, "Glacial Lake Missoula and the Channeled Scablands" Adapted for atlas by Spokane County GIS.

ABOUT THE AQUIFER PROTECTION DISTRICT

The Aquifer Protection District (APD) was approved by Idaho voters and established by the Kootenai County Board of Commissioners in 2007 for the protection of groundwater quality in the Spokane Valley Rathdrum Prairie Aquifer. The APD funds programs and projects that protect the water quality of the aquifer. Kootenai County collects a fee from every parcel of land in within the aquifer and county boundary to fund the APD's work program through Idaho Statute Title 39 Chapter 5.



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.