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Ministry for the  
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# Environmental Linked Features Interoperability Experiment

105th OGC Technical Committee

Palmerston North, New Zealand

David L. Blodgett [dblodgett@usgs.gov](mailto:dblodgett@usgs.gov)

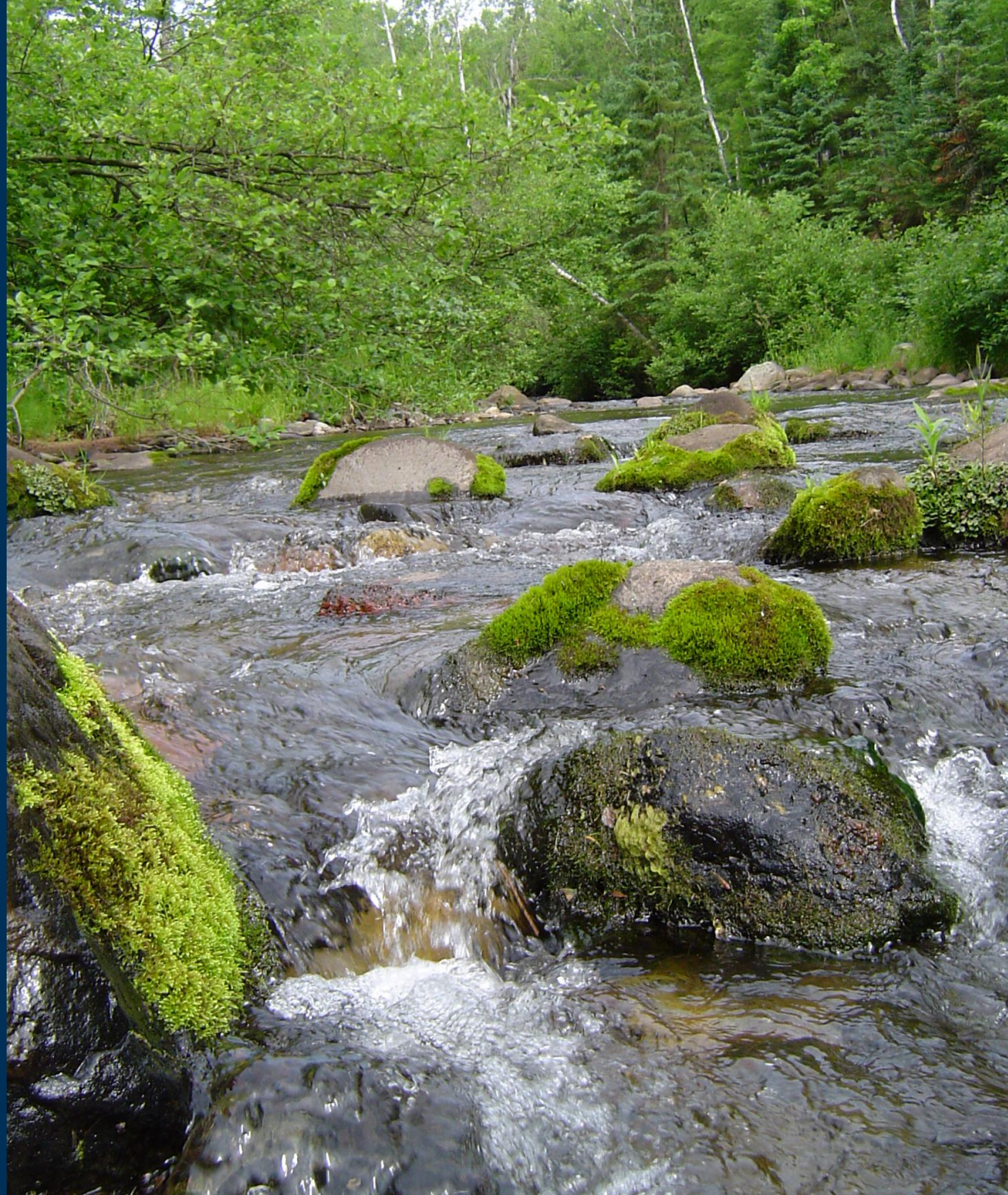
6 December 2017

# Presentation Plan

- **What is an Environmental Feature?**
- **How do we describe them?**
- **What's the problem we want to solve?**
- **What are the best practices we can leverage?**
- **What gaps do we need to fill with new work?**
- **What are the next steps?**



# What is an Environmental Feature?





# Observations and Measurements

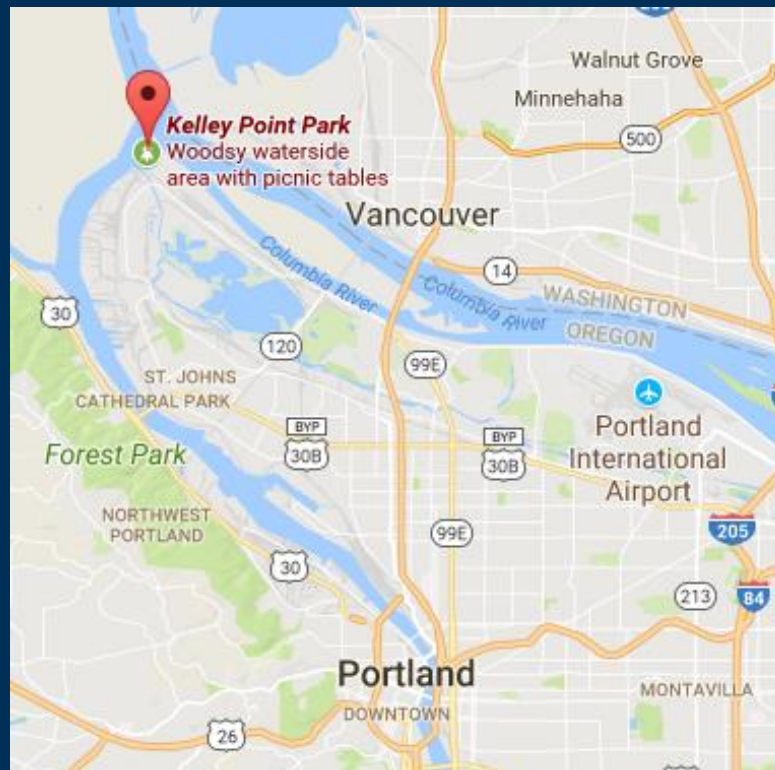


- **Observation:** Stream Gage Visit
- **Feature of Interest:** River
- **Sampling Feature:** Cross Section
- **Procedure:** Manual Acoustic Velocity Measurement.
- **Observed Property:** Flow Rate
- **Result:** X cfs at time Y

**Environmental Features can be the Feature of Interest in O&M**

# How do we describe Environmental Features?

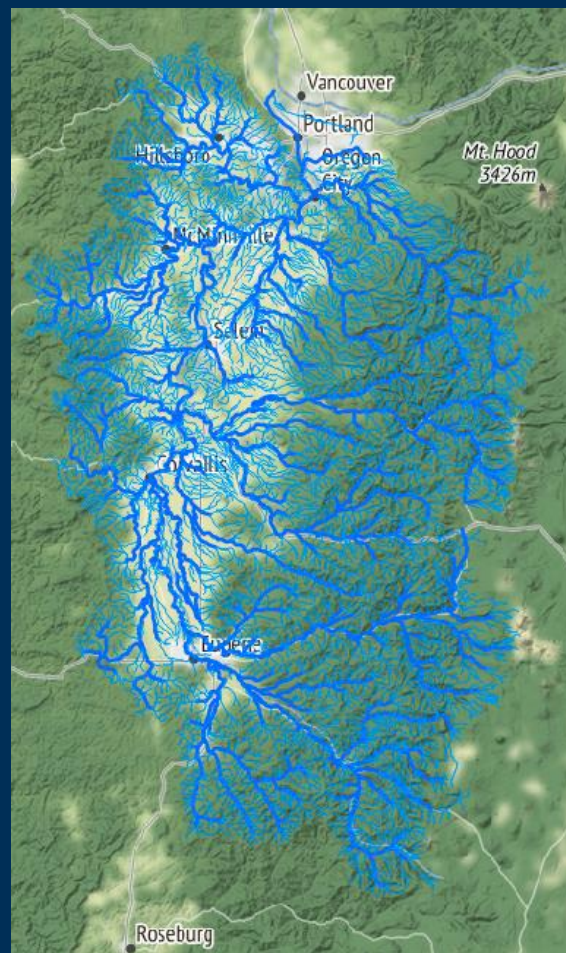
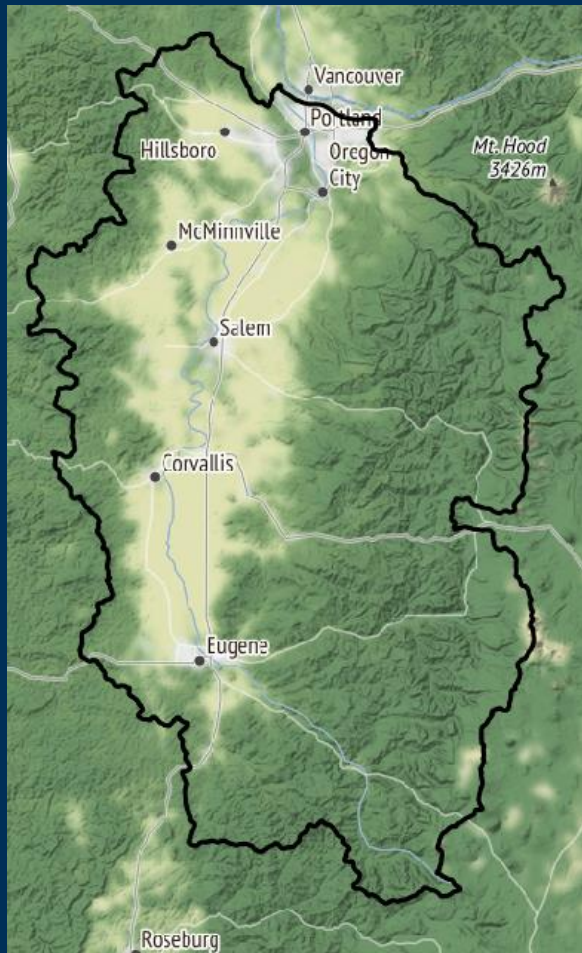
- Feature Identity (Name and Topology)
  - The Willamette River flows into the Columbia River at Kelley Point Park





# How do we describe Environmental Features?

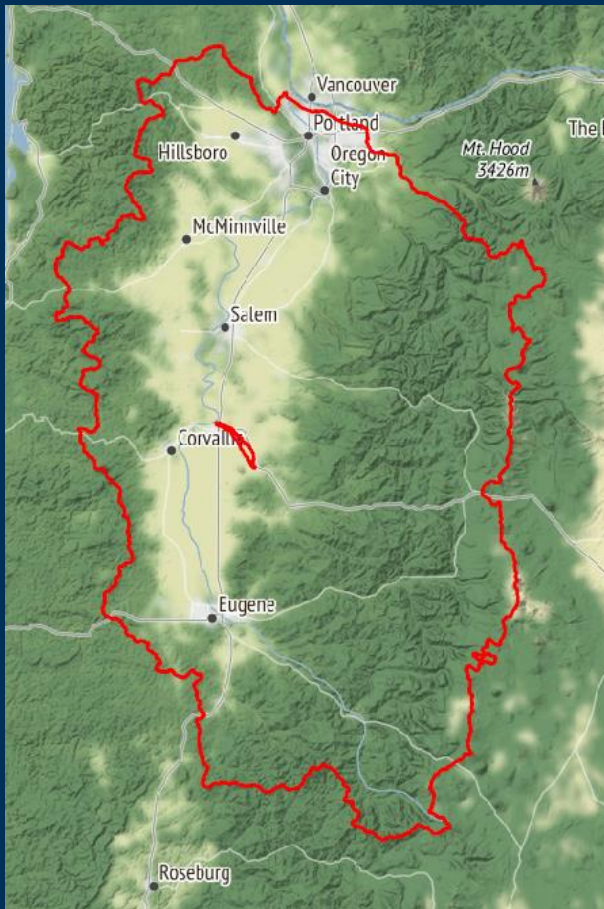
- Different “models” of a given type of feature
  - The Willamette is recognizable as a divide, or waterbody network, or catchment network ...





# How do we describe Environmental Features?

- Different representations of a given “model”
  - The Willamette River’s drainage divide is represented differently by the WBD and the NHDPlus datasets.



**NHDPlus in red**

**WBD in black**

# What's the Problem we Want to Solve?





Portland Airport



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## Portland International Airport

[www.flypdx.com/](http://www.flypdx.com/)

Passenger Services · Airlines · Arrivals and Departures · Nonstop Destinations · Intrastate Air Service · International Arrivals · Travel Tips · Lost and Found · Concourse Connector · **Airport Safety and Security** · Related Links · Parking and Transportation · Parking · Ground Transportation · Directions and Map · Bicycle ...

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PDX arrivals and departures for current day, previous and next ...

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PDX Terminal Map, General Facilities at Portland ...

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PDX airlines serving Portland International Airport, includes ...

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## Portland International Airport - Wikipedia

[https://en.wikipedia.org/wiki/Portland\\_International\\_Airport](https://en.wikipedia.org/wiki/Portland_International_Airport)

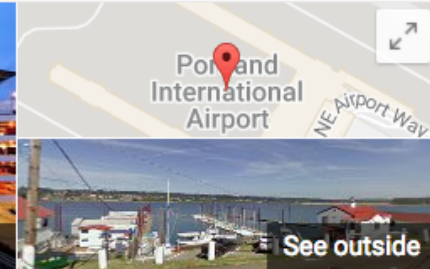
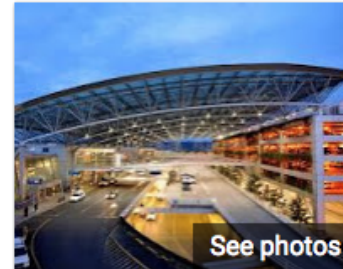
**Portland International Airport** is a joint civil-military airport and the largest airport in the U.S. state of Oregon, accounting for 90 percent of passenger travel and more than 95 percent of air cargo of the state. It is located within **Portland's** city limits just south of the Columbia River in Multnomah County, 6 miles (10 kilometers) by ...

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## Port of Portland - Shops and Restaurants Map

<https://www2.portofportland.com/PDX/map>

Nov 28, 2017 - Passenger Services · Airlines · Arrivals and Departures · Nonstop Destinations · Intrastate Air Service · International Arrivals · Travel Tips · Lost and Found · Concourse Connector · **Airport Safety**



## Portland International Airport ★

4.5 ★★★★★ 1,523 Google reviews

Airport in Portland, Oregon

[Website](#)

[Directions](#)

Portland International Airport is a joint civil-military airport and the largest airport in the U.S. state of Oregon, accounting for 90 percent of passenger travel and more than 95 percent of air cargo of the state. [Wikipedia](#)

**Address:** 7000 NE Airport Way, Portland, OR 97218

**Code:** PDX

**Elevation:** 30'

**Phone:** (503) 460-4234

**Owner/operator:** Port of Portland

**Serves:** Portland-Vancouver-Beaverton, OR-WA Metropolitan Statistical Area

**Hub for:** Alaska Airlines, Ameriflight, Horizon Air

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### Willamette River - Wikipedia

[https://en.wikipedia.org/wiki/Willamette\\_River](https://en.wikipedia.org/wiki/Willamette_River)

The **Willamette River** is a major tributary of the Columbia River, accounting for 12 to 15 percent of the Columbia's flow. The Willamette's main stem is 187 miles (301 km) long, lying entirely in northwestern Oregon in the United States. Flowing northward between the Oregon Coast Range and the Cascade Range, the river ...

Course of the Willamette River · Coast Fork Willamette River · Johnson Creek

### Course of the Willamette River - Wikipedia

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The **Willamette River** is a 187-mile (301 km) tributary of the Columbia River in the U.S. state of Oregon. The upper tributaries of the Willamette originate in mountains south and southeast of Eugene and Springfield. Formed by the confluence of the Middle Fork **Willamette River** and Coast Fork **Willamette River** near ...

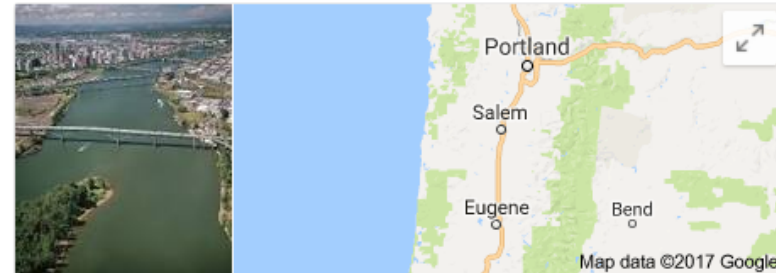
**Mouth:** Columbia River      **Length:** 187 mi (301 km)  
**Source:** Confluence of Middle Fork Willamette ...      **Basin:** 11,100 sq mi (28,700 km<sup>2</sup>)

### Willamette River - The Oregon Encyclopedia

[https://oregonencyclopedia.org/articles/willamette\\_river/](https://oregonencyclopedia.org/articles/willamette_river/)

Oct 2, 2017 - The **Willamette River** and its extensive drainage basin lie in the greater Cascades geological province, extending from British Columbia to northern California. The river and its principal tributaries drain 11,478 square miles (12 percent of Oregon), with the basin's runoff fluctuating dramatically between the ...

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## Willamette River

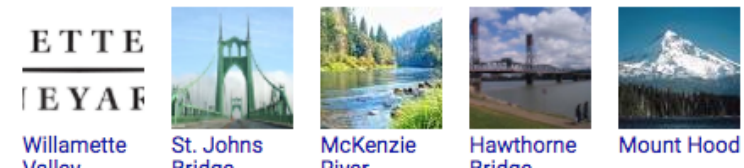
Tributary in Oregon

The Willamette River is a major tributary of the Columbia River, accounting for 12 to 15 percent of the Columbia's flow. The Willamette's main stem is 187 miles long, lying entirely in northwestern Oregon in the United States. [Wikipedia](#)

**Length:** 187 mi  
**Discharge:** 32,950 cubic feet per second  
**Mouth:** Columbia River  
**Basin:** 11,478 sq mi (29,730 km<sup>2</sup>)  
**Sources:** Middle Fork Willamette River, Coast Fork Willamette River  
**Bridges:** St. Johns Bridge, Hawthorne Bridge, Steel Bridge, MORE

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Willamette River



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### Willamette River - Wikipedia

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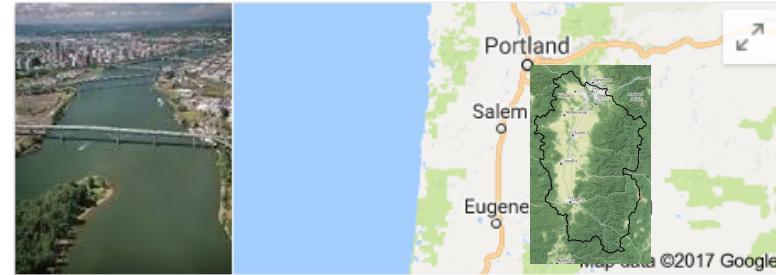
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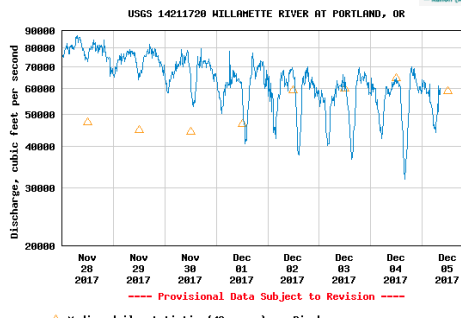
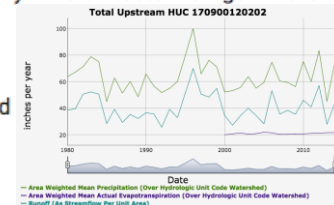
## Willamette River

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[ork Willamette River](#)  
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# Willamette River Data Resources Linked here!!!

# What best practices can we leverage?

## Spatial Data on the Web Best Practices

SDW-BP provides a refinement of DWBP for spatial data. We start with this perspective in ELFIE as an OGC spatial data interoperability experiment

- [Best Practice 1](#): Use globally unique persistent HTTP URIs for Spatial Things
- [Best Practice 3](#): Link resources together to create the Web of data
- [Best Practice 4](#): Use spatial data encodings that match your target audience
- [Best Practice 9](#): Describe relative positioning
- [Best Practice 10](#): Use appropriate relation types to link Spatial Things
- [Best Practice 11](#): Provide information on the changing nature of spatial things
- [Best Practice 12](#): Expose spatial data through 'convenience APIs'

***Note - Other SDW-BP not cited - for discussion purposes***

- [Best Practice 2](#): Make your spatial data indexable by search engines



# What best practices can we leverage?



## JSON-LD 1.0

A JSON-based Serialization for Linked Data

W3C Recommendation 16 January 2014

**This version:**

<http://www.w3.org/TR/2014/REC-json-ld-20140116/>

**Latest published version:**

<http://www.w3.org/TR/json-ld/>

**Previous version:**

<http://www.w3.org/TR/2013/PR-json-ld-20131105/>

**Editors:**

[Manu Sporny](#), [Digital Bazaar](#)  
[Gregg Kellogg](#), [Kellogg Associates](#)  
[Markus Lanthaler](#), [Graz University of Technology](#)

**Authors:**

[Manu Sporny](#), [Digital Bazaar](#)  
[Dave Longley](#), [Digital Bazaar](#)  
[Gregg Kellogg](#), [Kellogg Associates](#)  
[Markus Lanthaler](#), [Graz University of Technology](#)  
[Niklas Lindström](#)

schema.org

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## Welcome to Schema.org

Schema.org is a collaborative, community activity with a mission to create, maintain, and promote schemas for structured data on the Internet, on web pages, in email messages, and beyond.

Schema.org vocabulary can be used with many different encodings, including RDFa, Microdata and JSON-LD. These vocabularies cover entities, relationships between entities and actions, and can easily be extended through a well-documented extension model. Over 10 million sites use Schema.org to markup their web pages and email messages. Many applications from Google, Microsoft, Pinterest, Yandex and others already use these vocabularies to power rich, extensible experiences.

Founded by Google, Microsoft, Yahoo and Yandex, Schema.org vocabularies are developed by an open [community](#) process, using the [public-schemaorg@w3.org](mailto:public-schemaorg@w3.org) mailing list and through [GitHub](#).

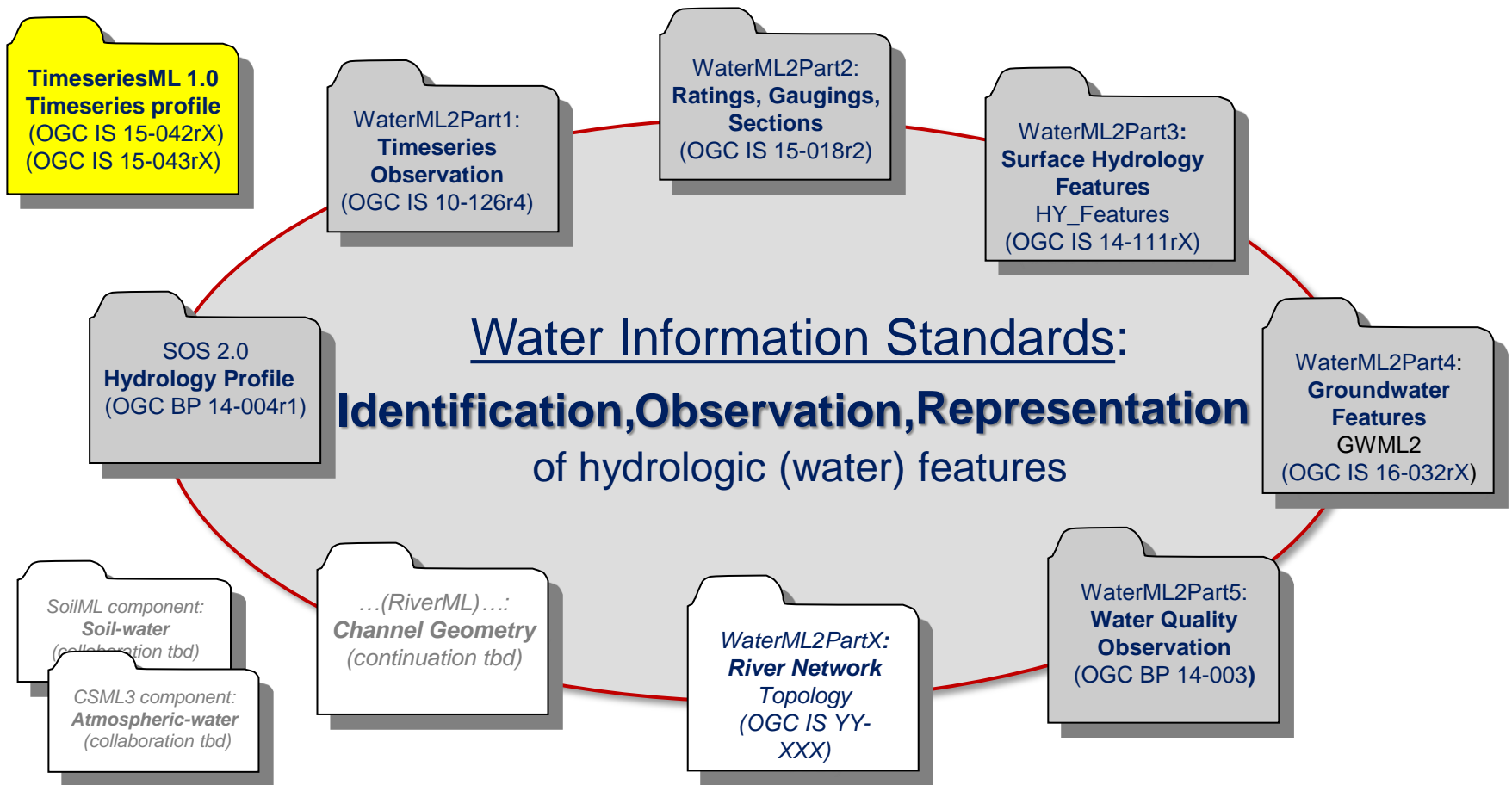
A shared vocabulary makes it easier for webmasters and developers to decide on a schema and get the maximum benefit for their efforts. It is in this spirit that the founders, together with the larger community have come together - to provide a shared collection of schemas.

We invite you to [get started!](#)

View our blog at [blog.schema.org](http://blog.schema.org) or see [release history](#) for version 3.3.

# WMO/OGC Hydrology Domain Working Group

## WaterML2 suite







# Soil Data Interoperability Experiment

- Started by the IUSS Working Group on Soil Information Standards
- OGC Initiators
  - CSIRO (AU)
  - Manaaki Whenua (NZ - Initiative Manager and Technical Lead)
  - ISRIC World Soil Information (NL)
- Active Participants
  - Federation University of Australia (AU)
  - USDA Natural Resource Conservation Service (US)
  - Agribiology and Pedology Research Centre (IT)
  - USGS (US)
  - Horizons Regional Council (NZ)
  - Tumbling Walls (US)
- Reconcile five existing standards ...

... into a single standard ...



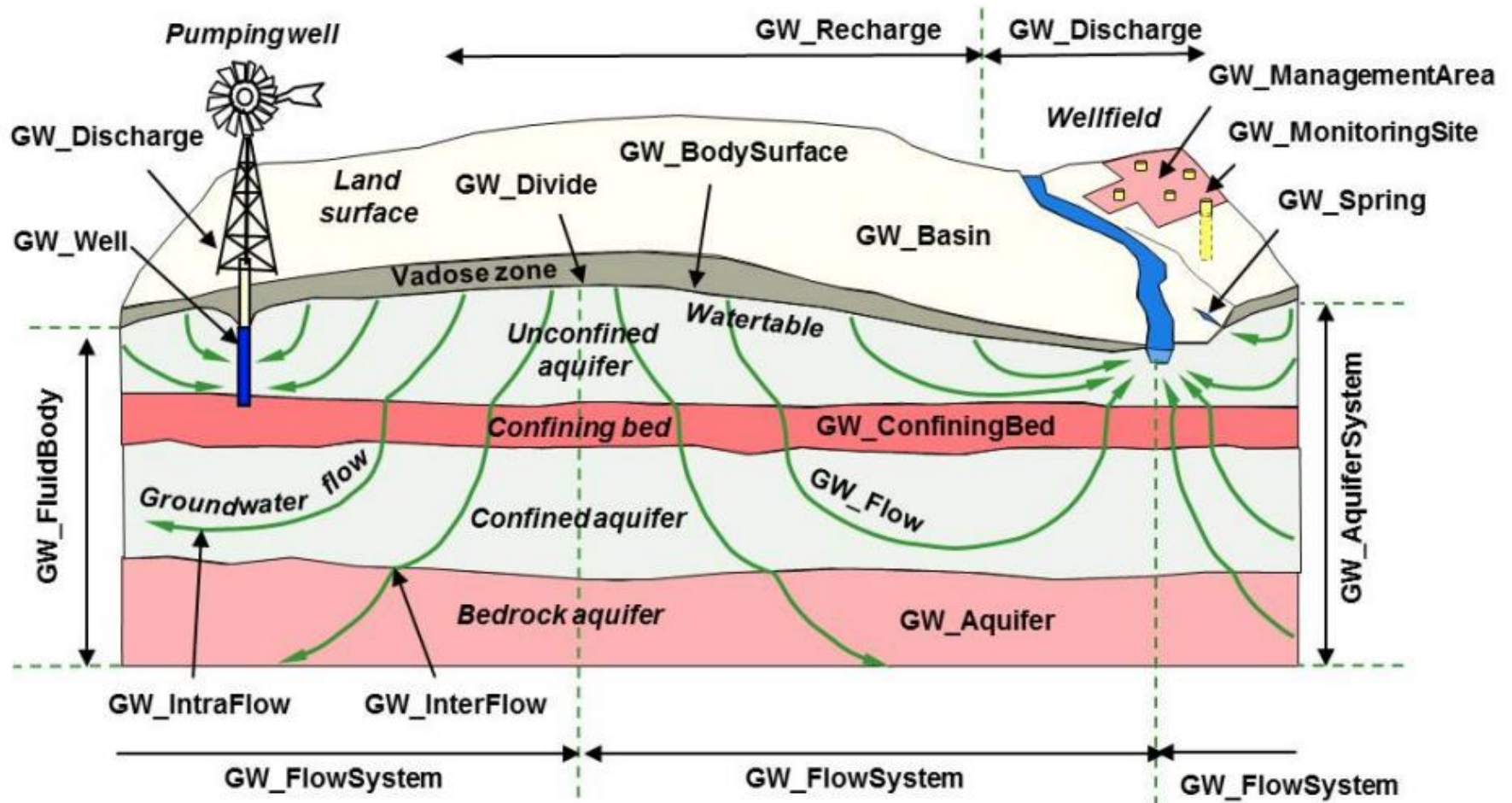


Figure 1: a partial view of GWML2. Labels prefixed with "GW\_" denote GWML2 components.

# Observations and Measurements



- **Observation:** Stream Gage Visit
- **Feature of Interest:** River
- **Sampling Feature:** Cross Section
- **Procedure:** Manual Acoustic Velocity Measurement.
- **Observed Property:** Flow Rate
- **Result:** X cfs at time Y

**Environmental Features are the  
Feature of Interest in O&M**

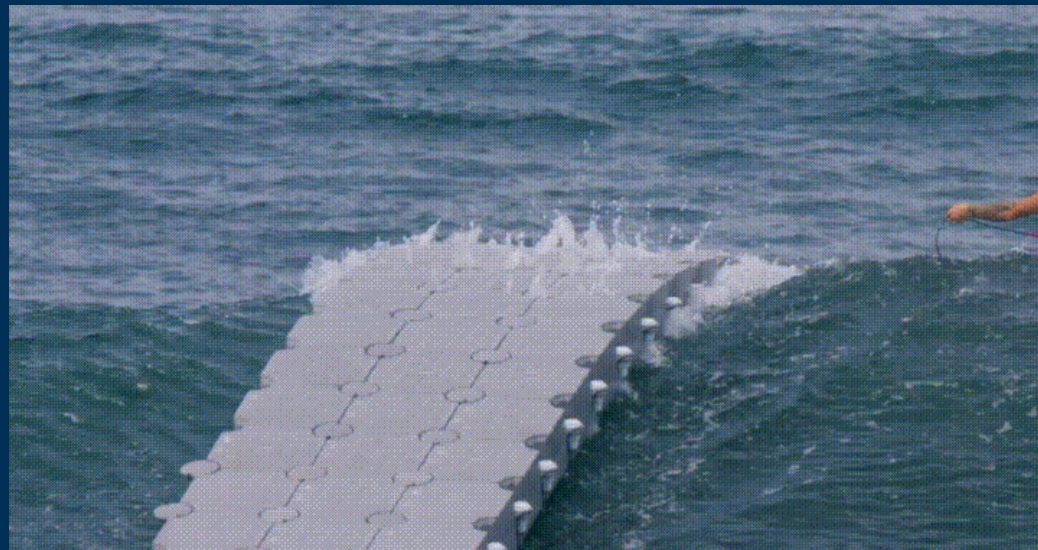


# Gaps to fill?!?

- **Environmental Feature Models are Not “shovel ready” for use in schema.org and microdata.**
  - **Unrewarding technical work required here!!!**
- **More feature modeling needs to be done!**
  - **Flooding**
  - **Ecosystems**
  - **Surface Water / Groundwater**
  - **Water Quality and Constituents**
  - **.....**

# Next Steps

- Show what's possible with demonstration and testing.
- Small steps with big systems.



Map Layers

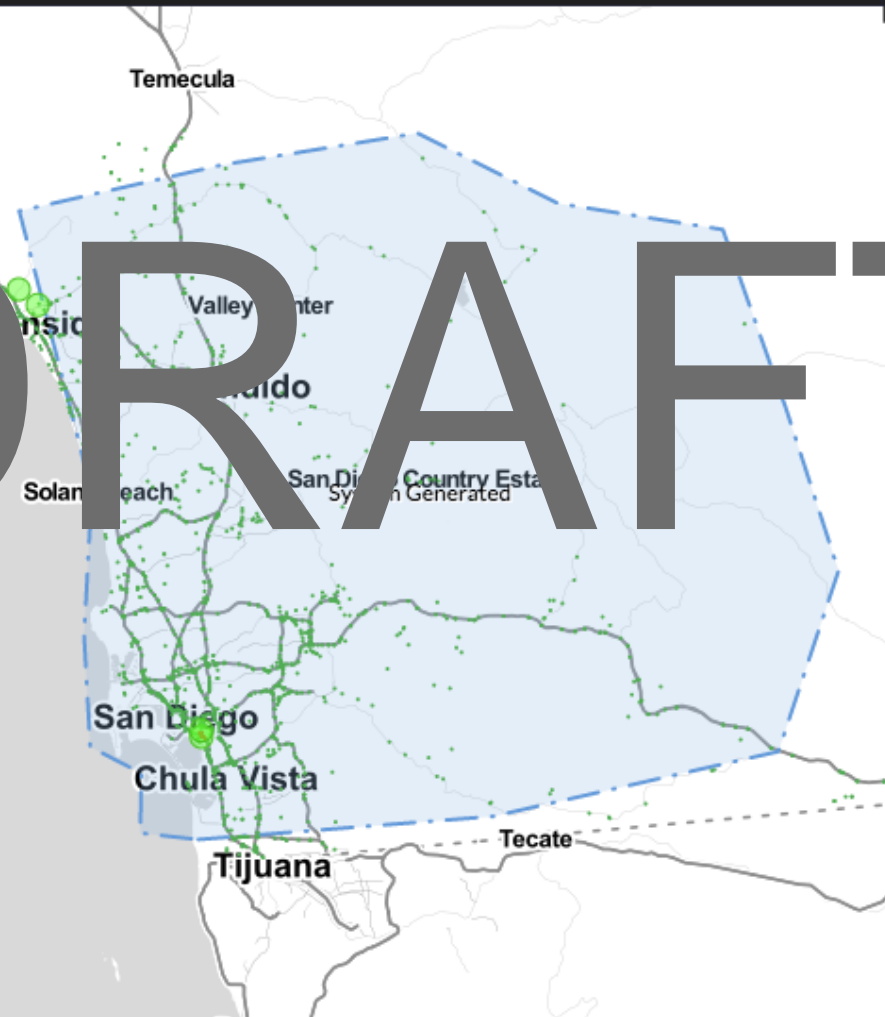
Go to Elfie Extent

Tools

Legend Events Incidents Summary

- River Gages
- Assets
- Incidents
- Events
- Streams
- Action - Roads
- Action - Flood
- Action - Depth
- Moderate - Roads
- Moderate - Flood
- Moderate - Depth
- Major - Roads
- Major - Flood
- Major - Depth

DRAFT

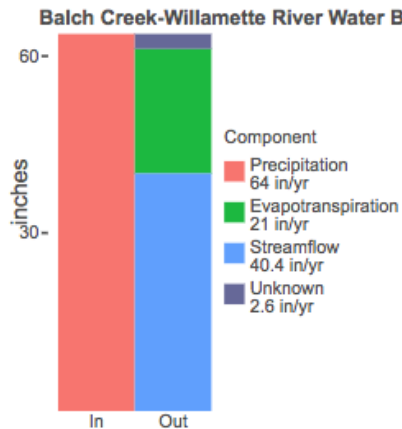
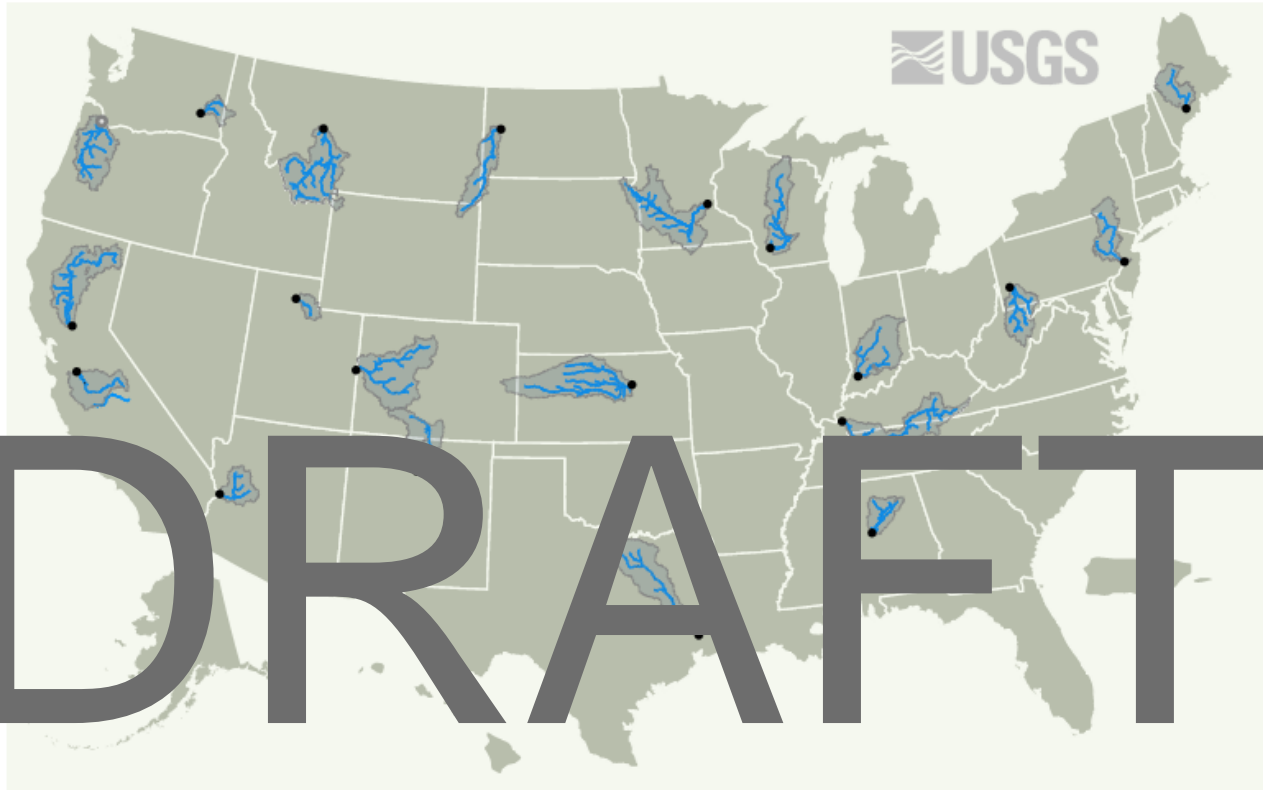


- River Gages**
  - Action
  - Low Threshold
  - Major
  - Minor
  - Moderate
  - Severe Flooding
- Assets**
  - Threatened
  - Monitor
  - No Apparent Threat
- Incidents**
  - Potential
  - Confirmed
  - Response in progress
  - Resolved
  - Not yet defined
- Events**
  - Open
  - Open (System Generated)
  - Closed
  - Not yet defined



# Water Budgets Across the United States

How the water cycle varies across the country



### Balch Creek-Willamette River Characteristics

Drainage area (sqmi): 11206  
Impervious Surface from 2011 (%): 2.99  
Population Density (people/sqkm): 9020.77  
Irrigated agriculture 2012 (%): 3.29  
Number of dams in 2013: 280  
Freshwater withdrawals in (in/yr): 0.655  
More USGS National Water Census data.  
[More USGS National Water Information System data.](#)

Text here would explain the idea of a water budget and that this shows how much variation in water budgets there is across the us. Also explain caveats related to water budget closure and uncertainty in the data we are using. Highlight how we are working to close the water budget and improve data accuracy. Link to the [National Water Census](#)

# Questions???