The Role of Climate and Water Resources Data in Societal Decisions

Within the Klamath Basin of Oregon and California

A Template for the Western United States

NOAA Climate Program Office SARP Webinar
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Photo: Klamath Lake, Oregon

Presentation Outline

- Understanding the use of climate & water data when making daily decisions across a large & diverse stakeholder community?
- Research results identifying types of climate and water data relied upon for decision making.
- Simple examples to enhance understanding and improve data use:
  - Criterion people use for action
  - Comparison to known conditions
  - Integrate forecast / measurements
- Present web concept as solution.

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U.S. Fish & Wildlife Service

OSU Oregon State University

Houston Engineering Inc.

National Weather Service

U.S. Department of the Interior Bureau of Reclamation

Klamath Water Users Association

MBK Engineers Consulting Engineers

The Klamath Tribes

Klamath Water and Power Agency KWAPA

National Oceanic and Atmospheric Administration U.S. Department of Commerce NOAA

Dan Keppen & Associates

State of Oregon Water Resources Department WRD

Klamath County

NOAA Fisheries Service

NRCS

Decision Reliance on Climate and Water Data - Lack of Data or Use?

Question: Is the use of climate and water data in daily decision-making a function having access to "the correct data" or more about providing the data (we have) in an interpretable and usable manner?

Supposition: There is a lack of understanding about how a broad range of stakeholders rely upon, use and interpret the available climate and water data when making decisions.

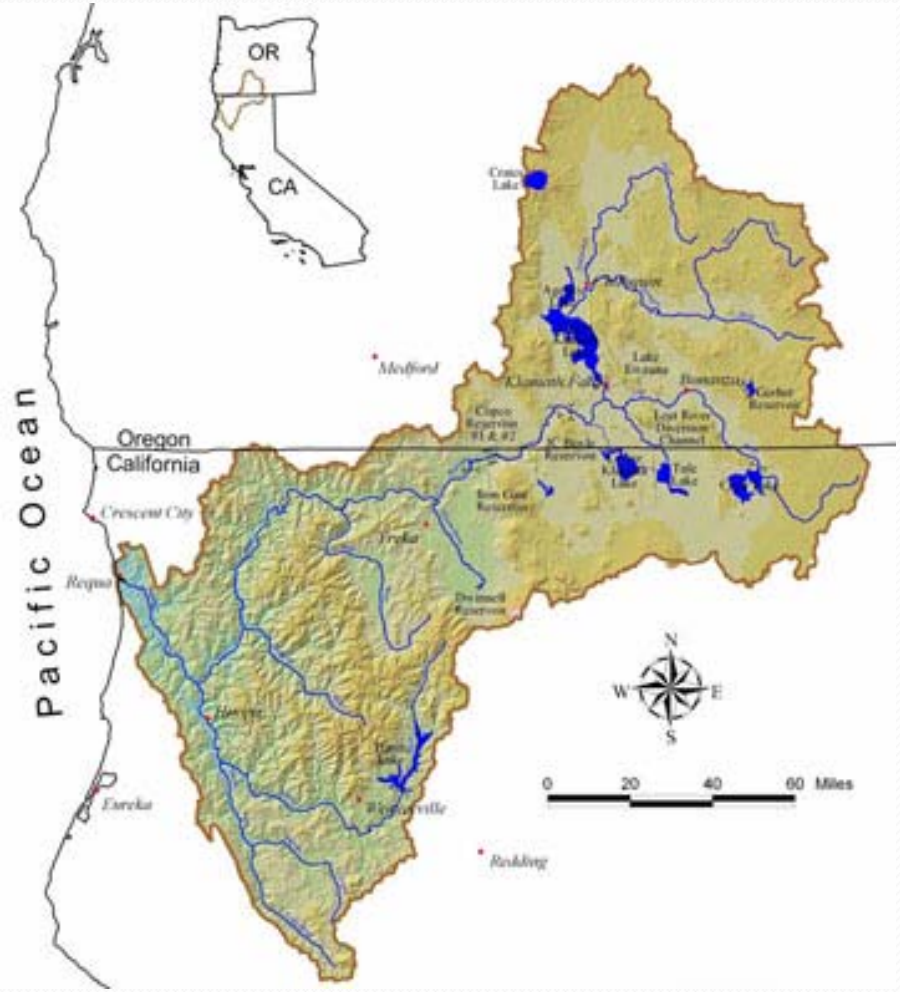
Our Research

From Fisheries Manager to Family Farmer: Improved Products for Communicating Water Supply and Drought Risk for Daily Decision Making within the Klamath Basin, California and Oregon, USA

Results at:
http://www.klamathdss.org/noaagrant.php

Photo of Klamath Falls, OR from Hogsback Mountain

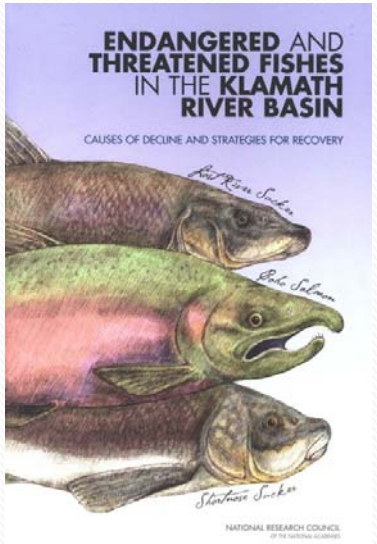
Basin Location



- Using the Klamath Basin as the geographic focus
- Results intended to be generalized to the Western US

Basin Climate and Water Data Dependent Issues

- Water for agriculture
  - Economic engine for basin
  - Federal project
- Threatened and endangered species
  - Salmon in river
  - Suckers in lake
- Water quality and TMDLs
- Surface water – ground water interaction
- Water rights / adjudication
- Tribal interests

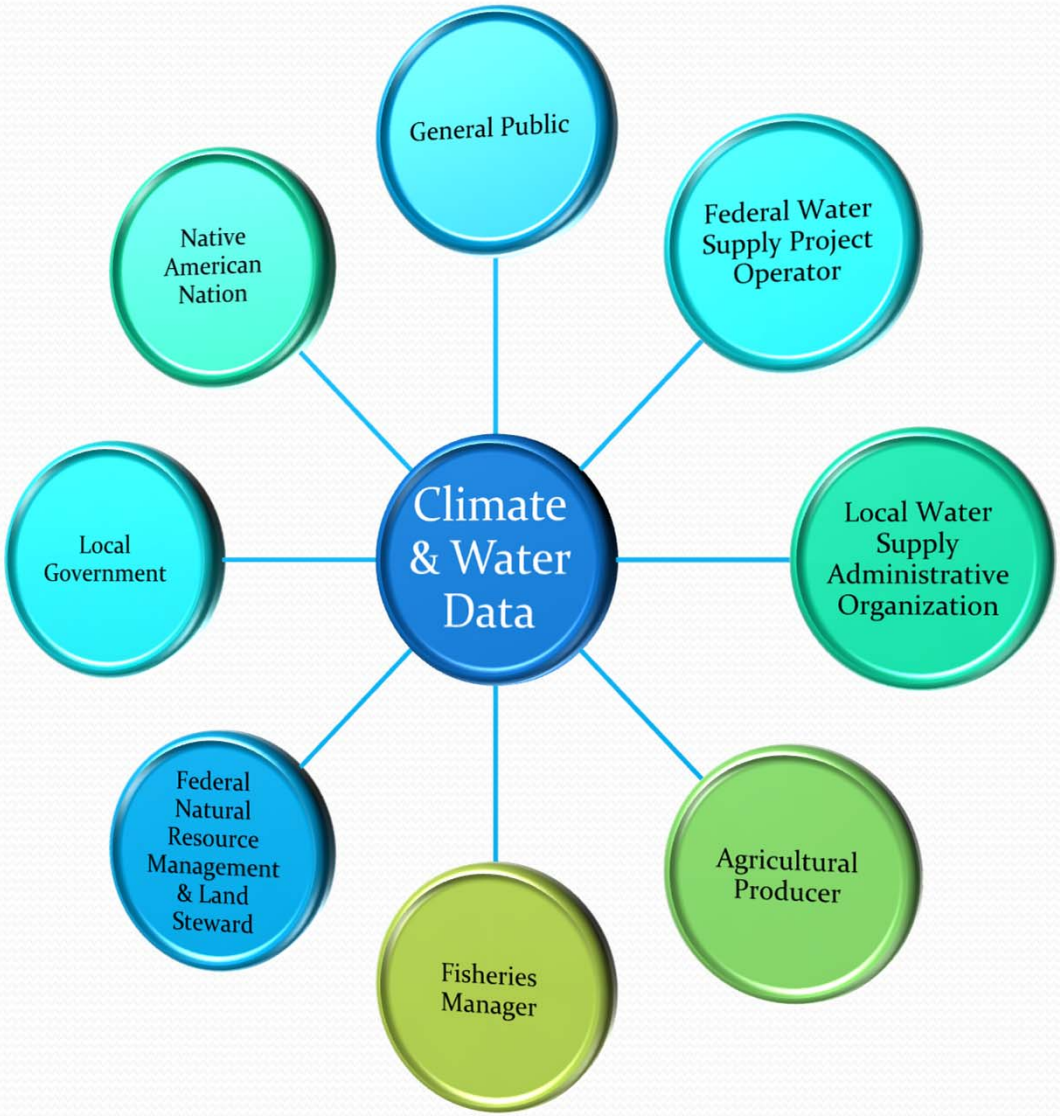


Just "google" Klamath Basin

Use of Climate and Water Data in Decision-Making

Linking Data, Questions, Decision, and Action

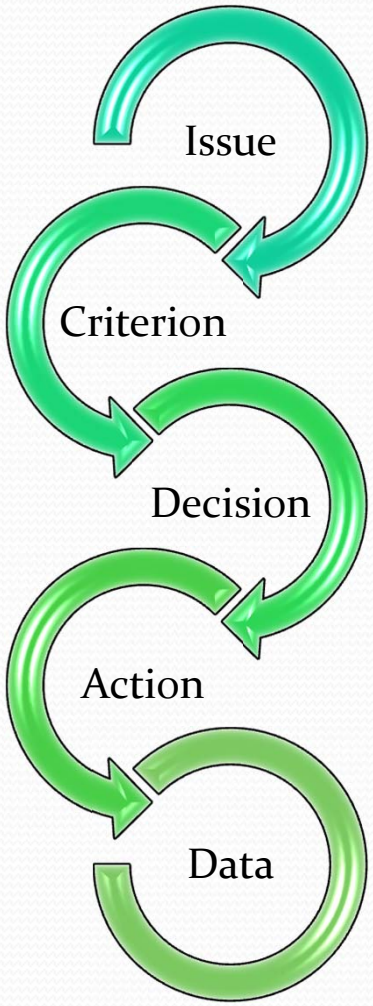
Data Users (Focus Group Categories)



Representative Questions Reliance Upon Climate and Water Data

Decision Maker	Question
Agricultural Producer	Is there enough water in the basin to irrigate my crops?
Local Water Administrator	Magnitude of conservation measures / groundwater use
County Official	Should a drought disaster declaration be issued?
Fisheries Manager	Flow needs for fish
Federal Water Manager	Reservoir and project operational decisions

Documenting Decision Linkage



- Sufficient water for fish in the river
- Average daily discharge (cfs) for month
- Additional release of water from upstream reservoirs
- Change principal spillway opening
- Average daily discharge during month
- Forecast monthly average discharge

DK10

Decision Timelines

Fisheries & Natural Resource Manager & Klamath Tribe

Purpose: Evaluate current and forecast conditions with regard to the existing biological opinions and the quality of ecosystem services.

User skill level: Intermediate

Decision(s): The decisions for this user are expected to be related to whether current water levels, flows, and volumes are presently sufficient or forecast to be sufficient for providing ecological functions and services, largely expressed by specific criteria identified by the National Marine Fisheries Service and the U.S. Fish and Wildlife Service in their joint Biological Opinion.

Information needs: 1. Storage volumes in UKL, Clear Lake and Gerber Reservoirs (see current water level pod on p.1)
2. Current release rate from Link River Dam, A-canal, Gerber Reservoir and Clear Lake
3. Estimated UKL inflow volume (today, cumulative water year) estimated from Williamson below Sprague gage
4. Most recent NRCS seasonal water supply 50% forecast (Mar - September, but the months will change)
5. Flows
6. Cumulative volumes for points of diversion

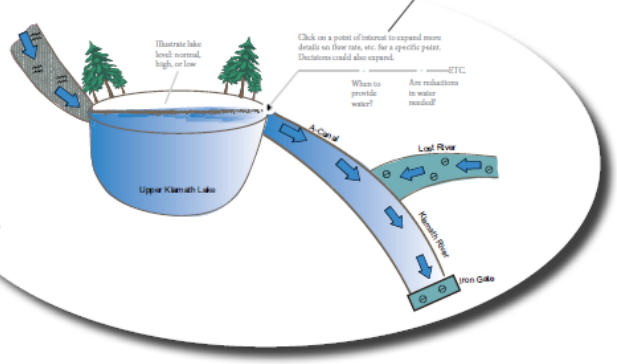
Today's Date: 3/1/14
Station Location:

Drill Down Level 2

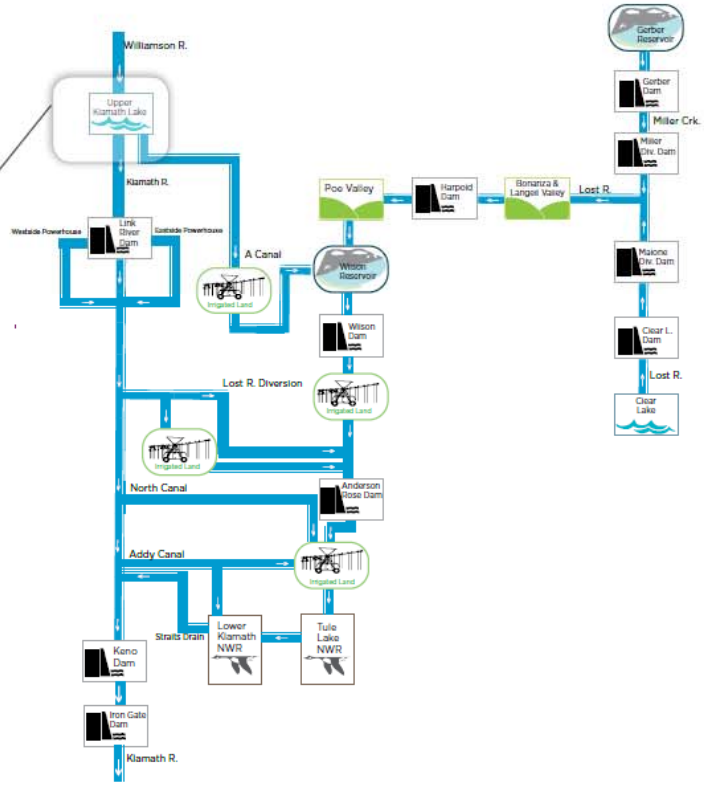
TIME PERIOD: DAILY
DEPTH (IN.): ____
MAXIMUM INTENSITY IN./HR.): ____
PERCENT OF NORMAL: ____
DEPARTURE FROM NORMAL (IN.): ____

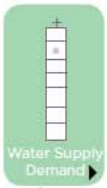
HISTORIC: 1999
DEPTH (IN.): ____
MAXIMUM INTENSITY IN./HR.): ____
PERCENT OF NORMAL: ____
DEPARTURE FROM NORMAL (IN.): ____

User Interface



Note: This timeline would graphically illustrate all areas of interest, how they're related, and what is occurring throughout the basin. User can view the "big picture", but also narrow in on more details for their specific area of interest by clicking their point of interest.





AVERAGE MONTHLY PROJECT DEMAND (KAF): ____
AVERAGE WATER YEAR CUMULATIVE PROJECT DEMAND (KAF): ____
CURRENT MONTH KBRA POINTS OF DIVERSION VOLUME (KAF): ____
IRRIGATION SEASON KBRA POINTS OF DIVERSION VOLUME (KAF): ____
WINTER SEASON KBRA POINTS OF DIVERSION VOLUME (KAF): ____
CURRENT MONTH REFUGE VOLUME (KAF): ____
REFUGE IRRIGATION SEASON VOLUME (KAF): ____
REFUGE WINTER SEASON VOLUME (KAF): ____

Pattern in the river graphic would indicate flow trend: = Flow Rate Increasing = Flow Rate Constant = Flow Rate Decreasing

Slide 13

DK10 I think the figure on this slide will be hard for an audience to make out. If its meant to illustrate complexitty of the timeline, your probably OK as is. If the audience needs to read you might need to focus on a small piece of the timeline.

Drew Kessler, 3/19/2014

DK9

Climate and Water Data Needs

Data Type

- Surface air temperature;
- Precipitation;
- Snowfall (depth);
- Growing degree days;
- Snow water equivalent;
- Streamflow;
- Groundwater elevation;
- Lake/reservoir surface water elevation ;
- Soil Moisture; and
- Evapotranspiration.

Temporal Scale

- Instantaneous (near real-time, generally 15-minute);
- 1-hour;
- Last 1-day;
- Last 7 days;
- Last 14 days;
- Last 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 24, 30, 36, 48, 60, and 72 months, ending on the last day of the latest month;
- Water Year To Date (WYTD); and
- Calendar Year to Date (CYTD).

Access is generally from existing web sources on individual data type basis.

Slide 14

DK9 Is this slide supposed to include the link between the type of data and its temporal scale, or does it just illustrate the number for each column?

Drew Kessler, 3/19/2014

Use of Climate and Water Data in Decision-Making

Improving Delivery and Usability

Data Use Challenges

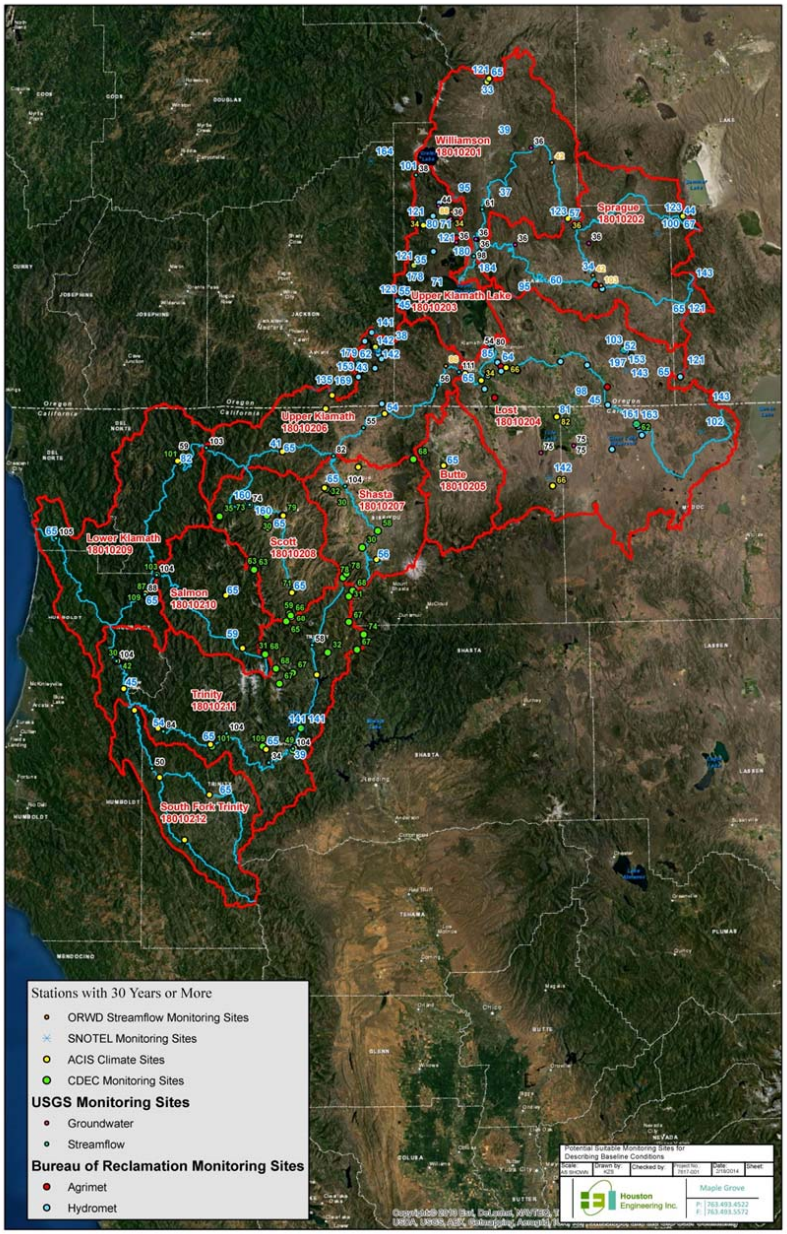
- **Establishing Context Among Diverse Users**
- User Technical Expertise
- User Decision Domain
- Multidisciplinary Resource Decisions
- Communicating Uncertainty
- Integrating Data
- Decision Linkage

Establishing Context

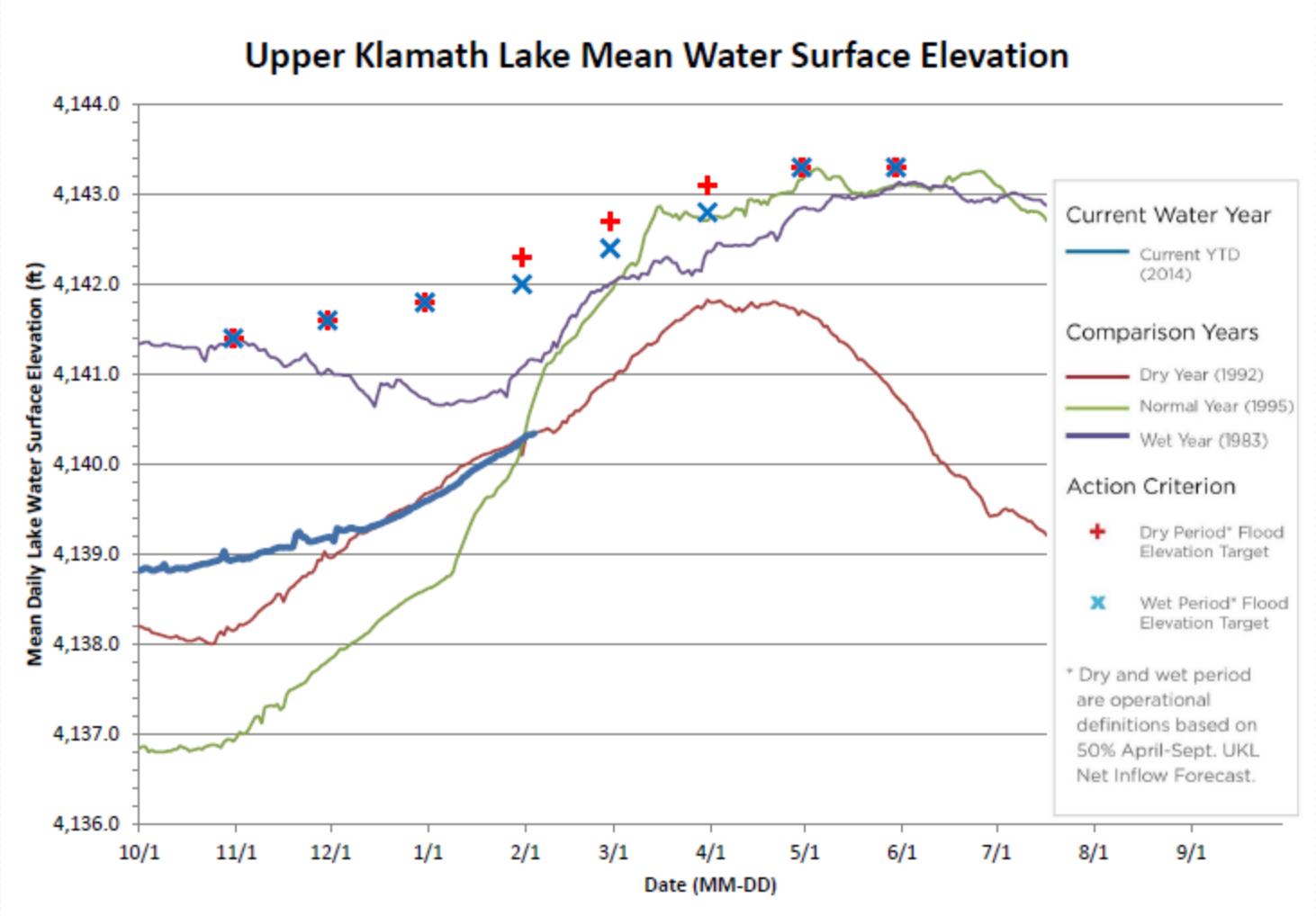
- Compare current time period to some baseline condition
- Show data in comparison to one or more values where the value(s) result in a decision
- Display information for a specific period of time with which the user has firsthand knowledge or experience
- Display information along with historical ranges and percentiles for the period of record
- Integrate measured and forecast information into a single graph
- Provide the opportunity to compare data for inferential purposes

Baseline Conditions for Climate and Water Data

Provide climate and basin condition indices at fine spatial scale (e.g., for drought)

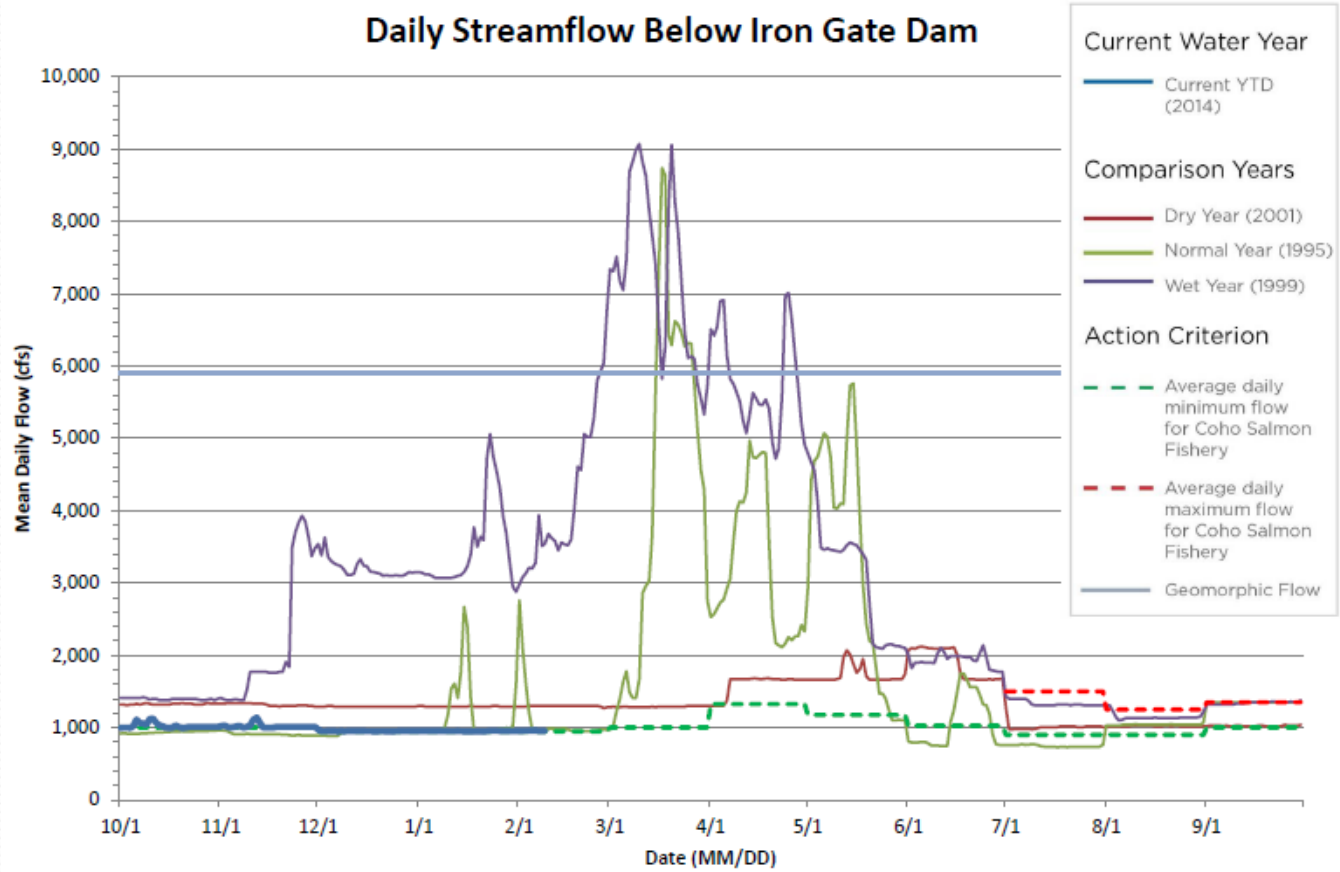


Using Baseline Condition



Compare to dry (drought) year and reservoir operation levels

User Defined Criteria

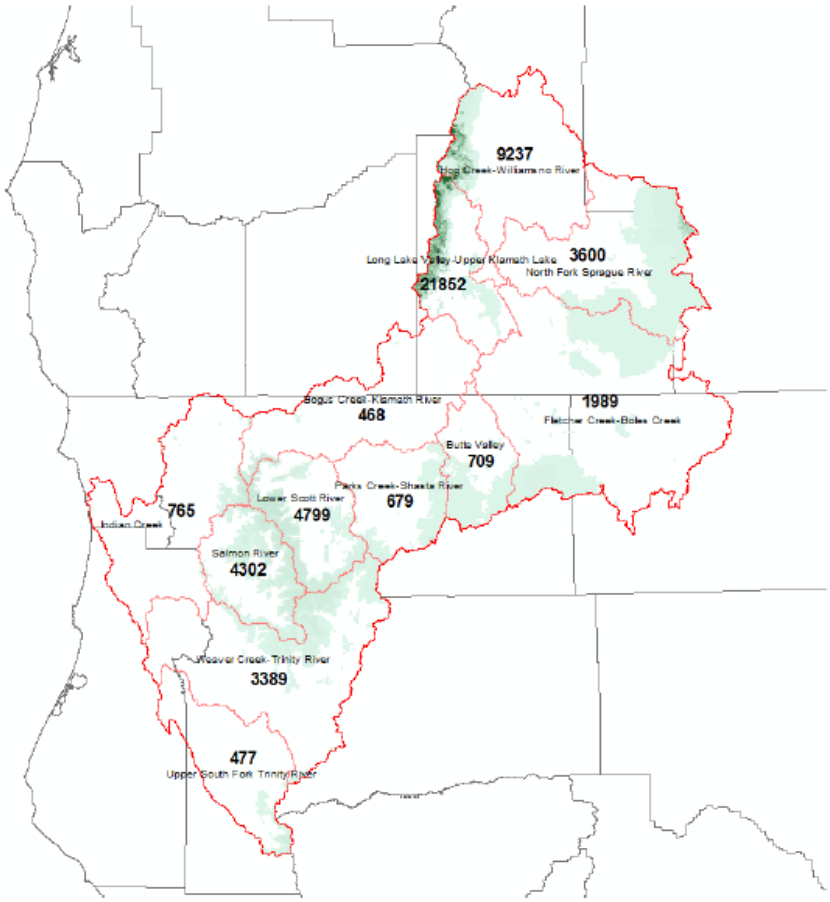


Comparison to dry (drought) year and fisheries action levels which alter water distribution in the basin

Alternative Presentation Methods

- Intensity of Supplemental Water Program
- Compare estimated water volume in snow pack plus volume in storage to seasonal water supply forecast

Simple means of checking water availability in the basin



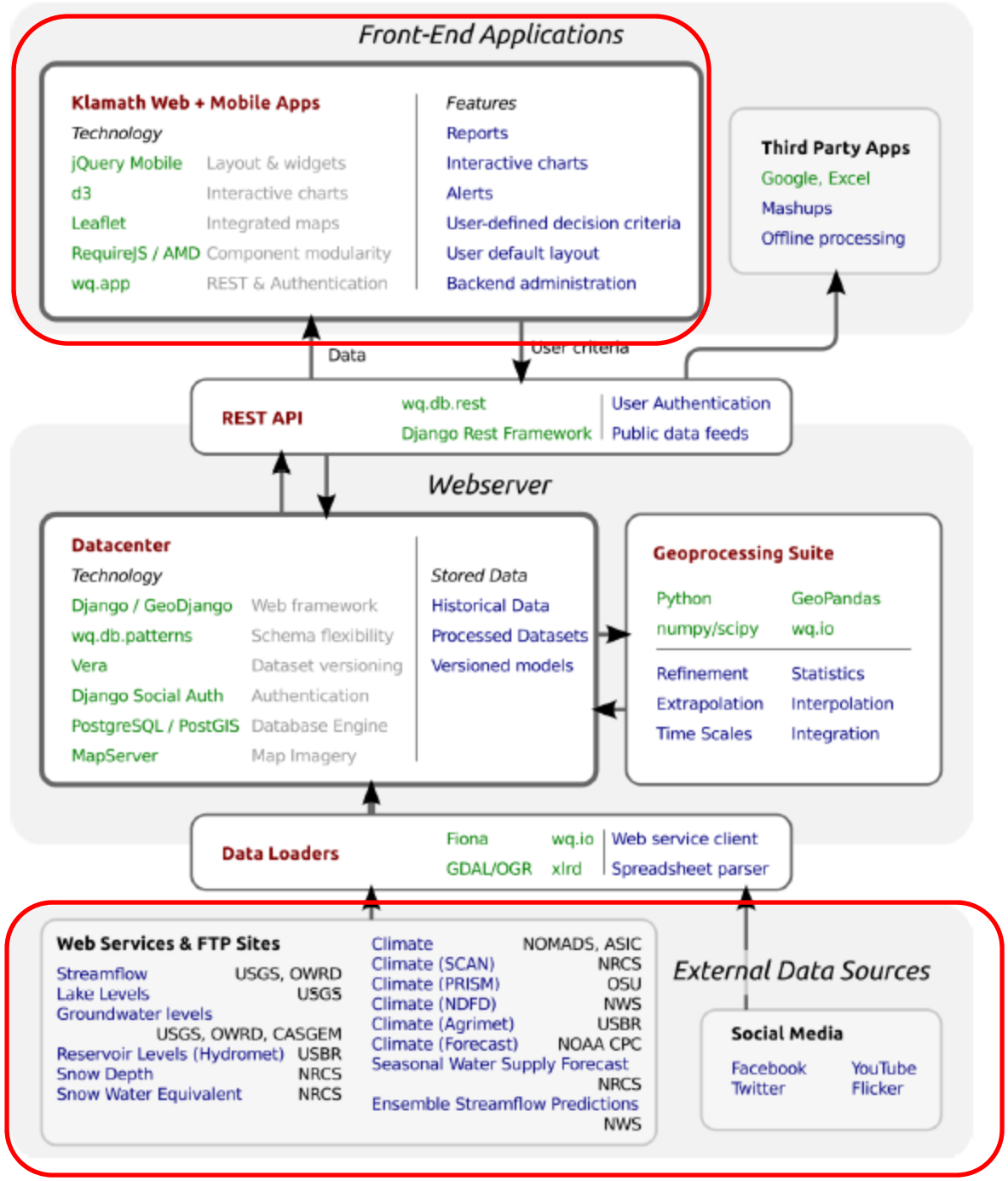
SWE in af on January 31, 2014 (from NOHRSC)

Our Concept – the Solution

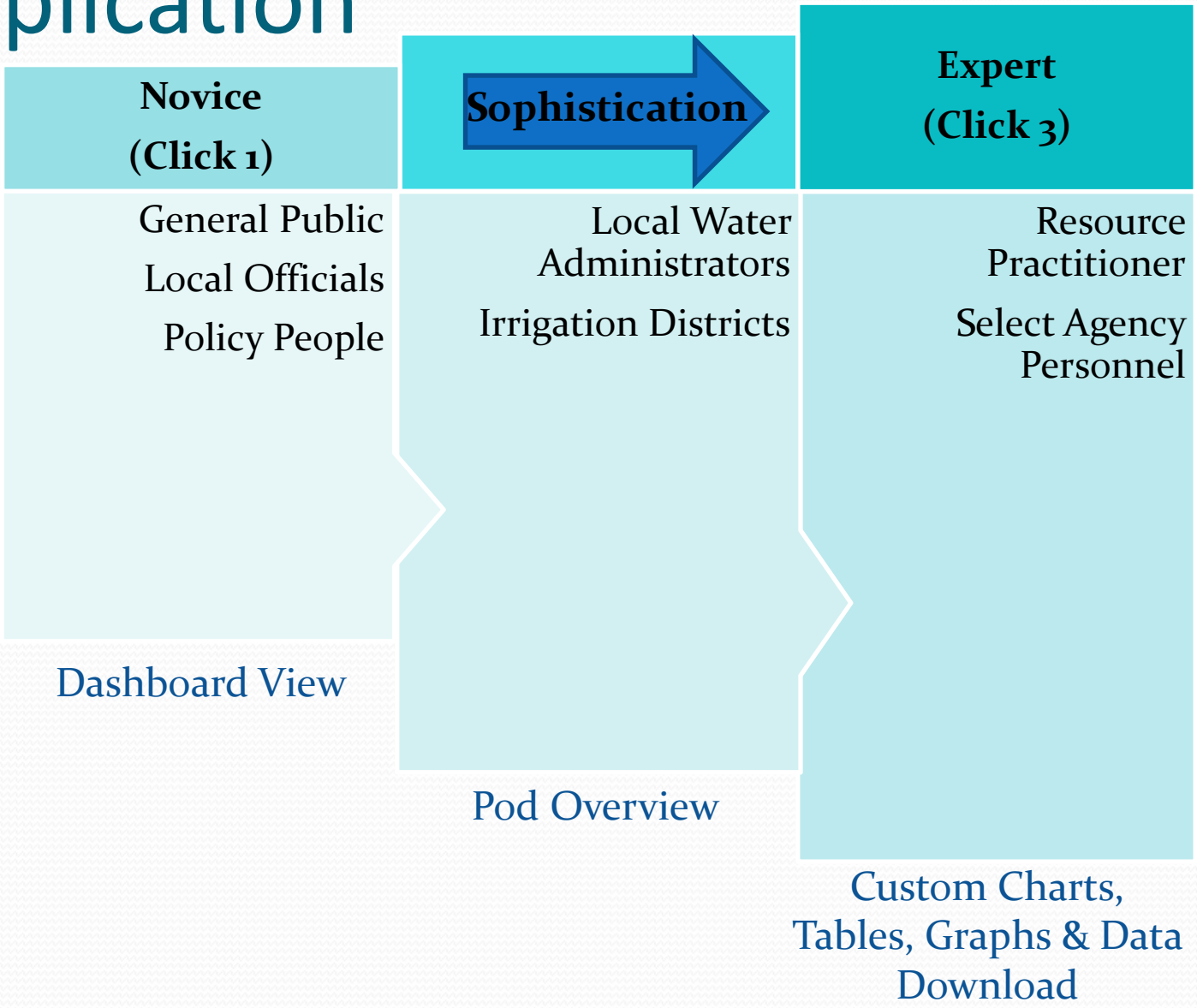
Implementing the Report Recommendations
Designing and Building Robust Tools and Applications

1. Robust Tools and Apps
2. Recommended Platform
3. Wireframing the Solution

Recommended Platform

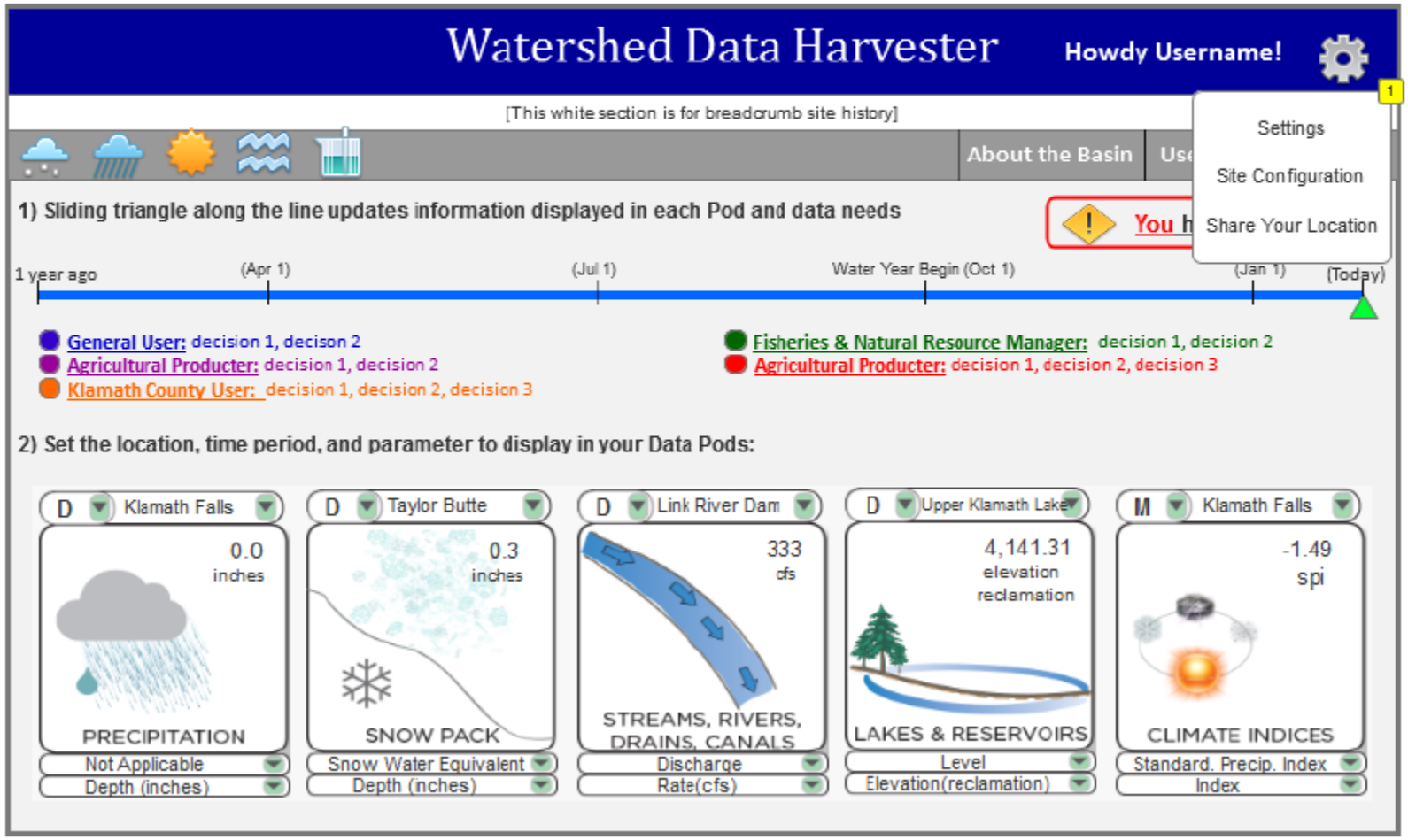


Vertically Integrated Web Application

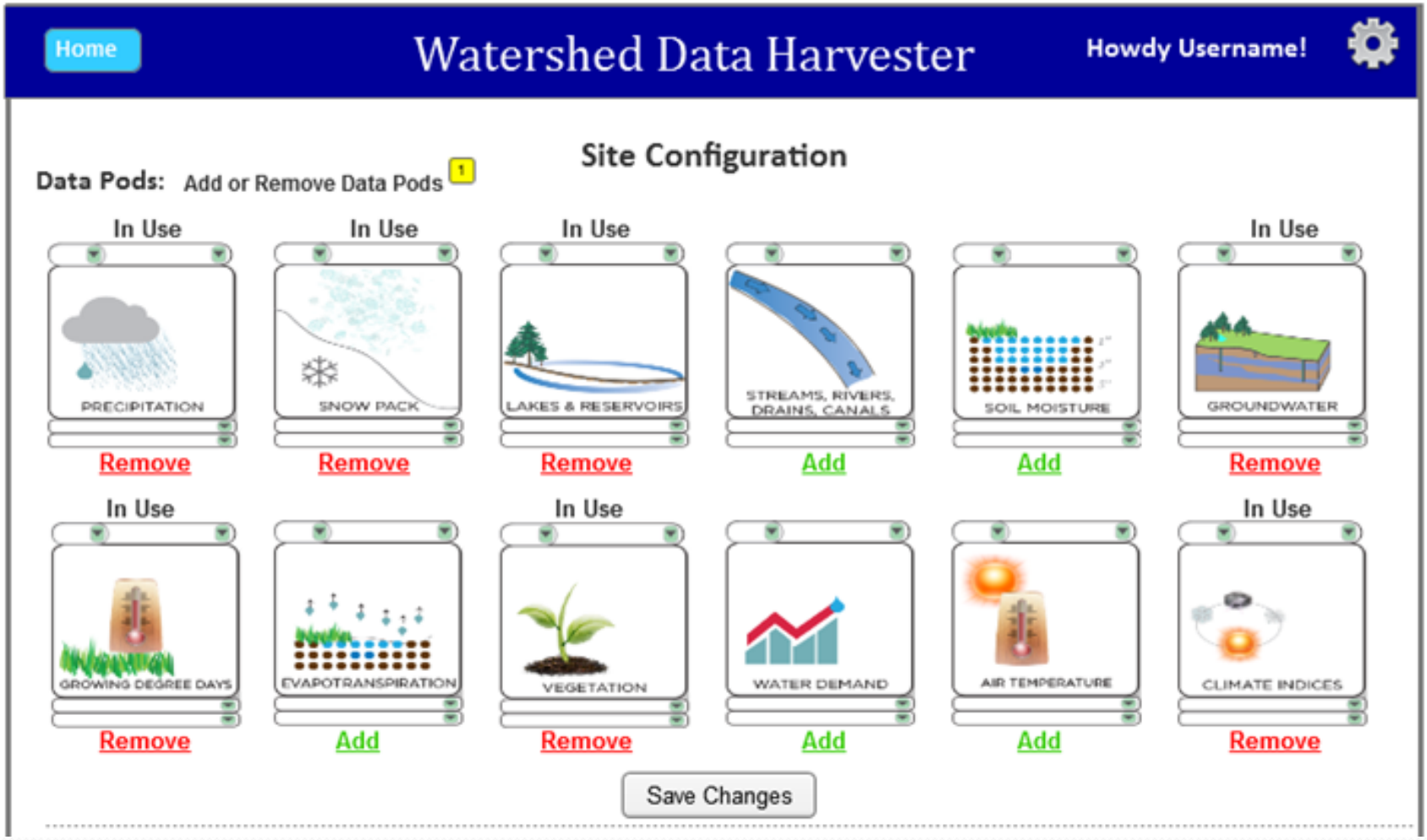


1.6. Dashboard_Config_Menu

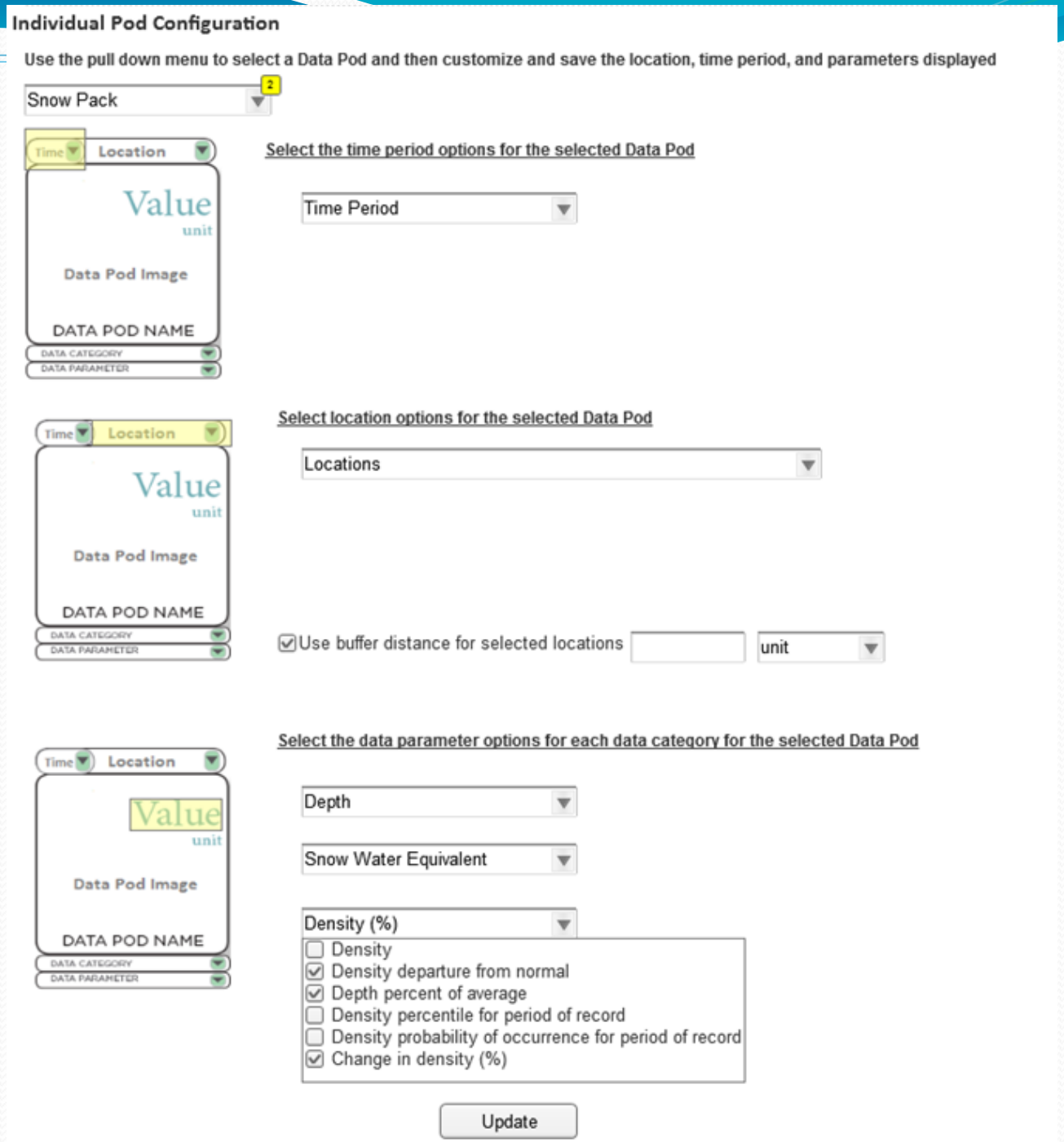
1.6.1. User Interface



Configure Dashboard Pods

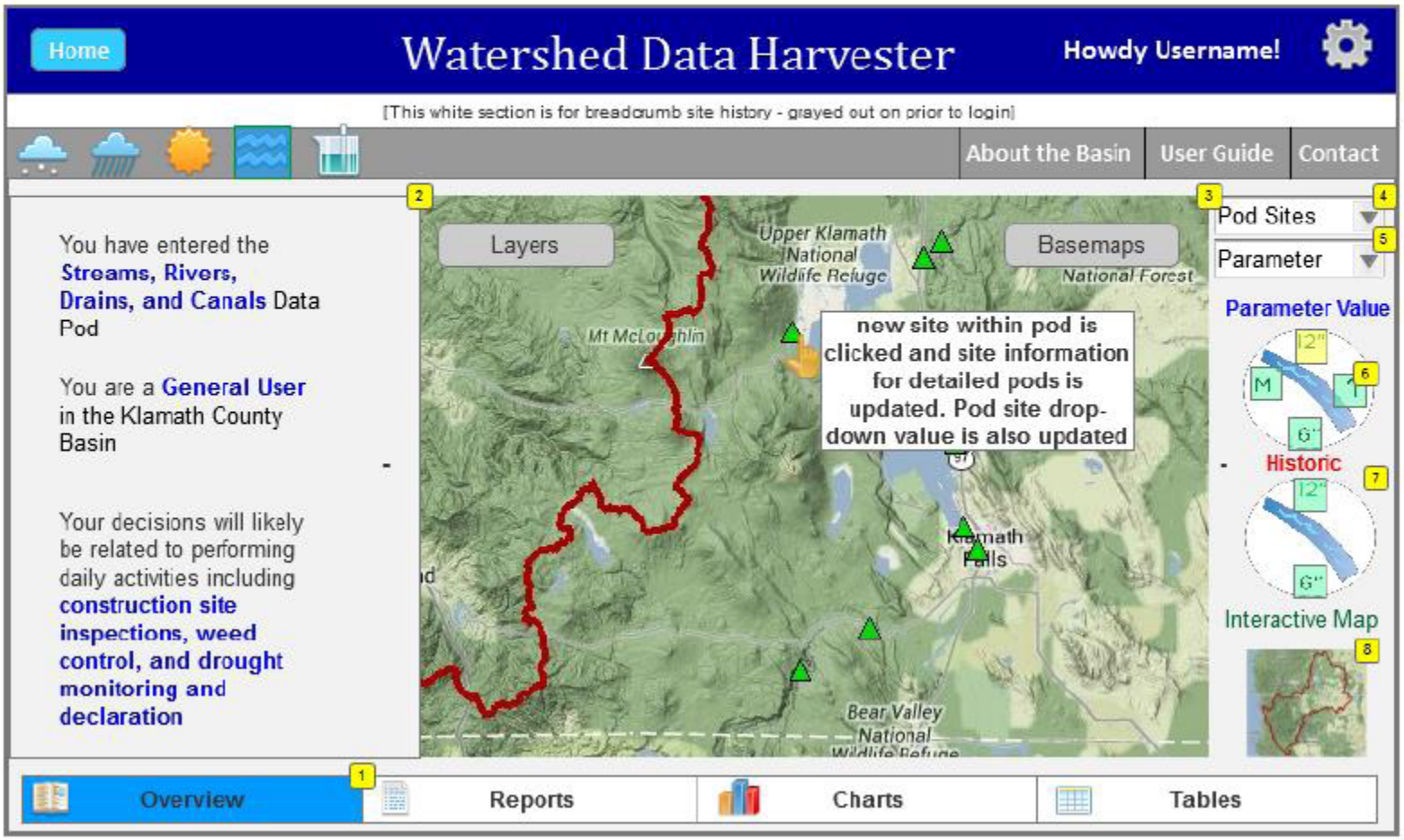


Configure Pod Data



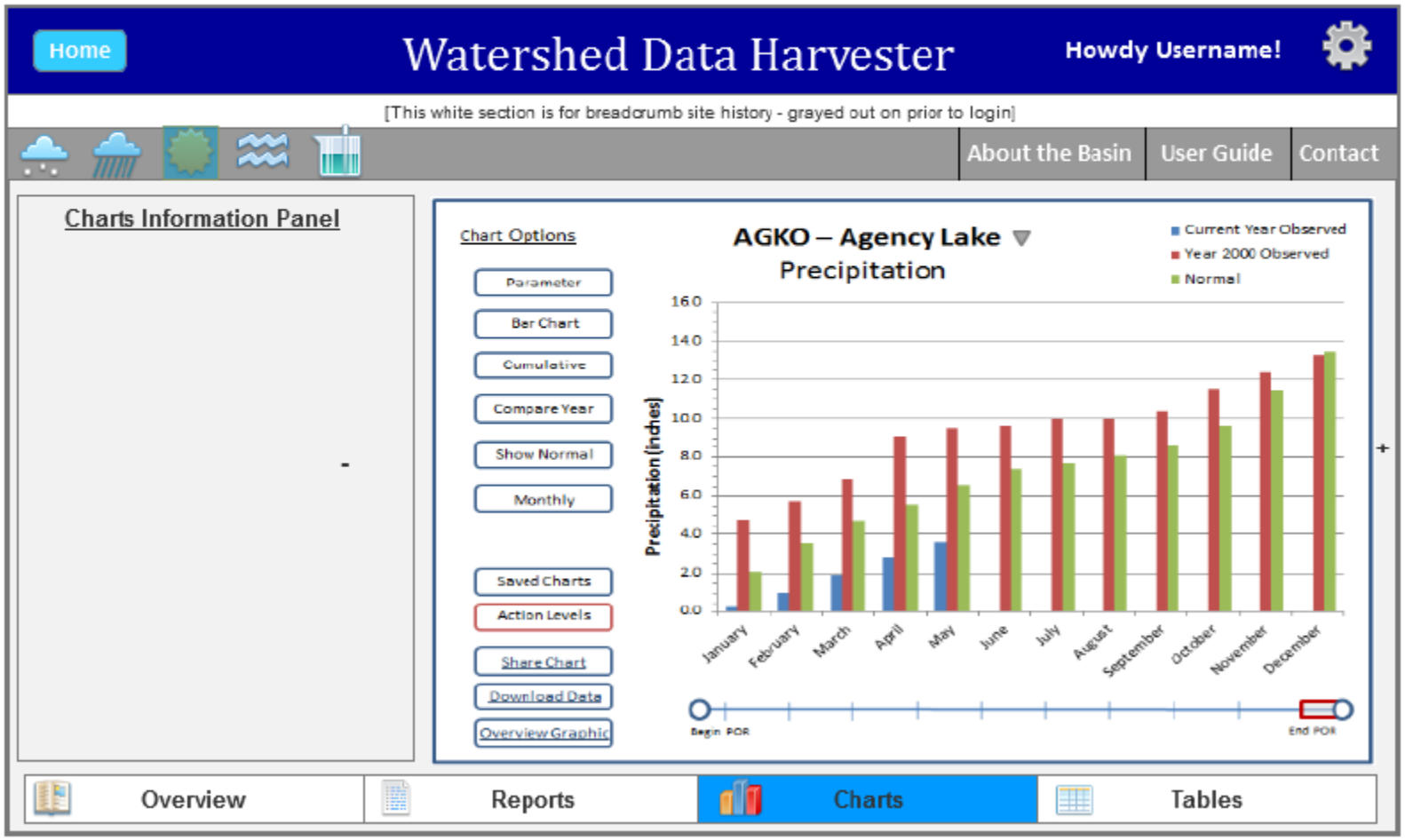
1.12. Streams_overview_page

1.12.1. User Interface



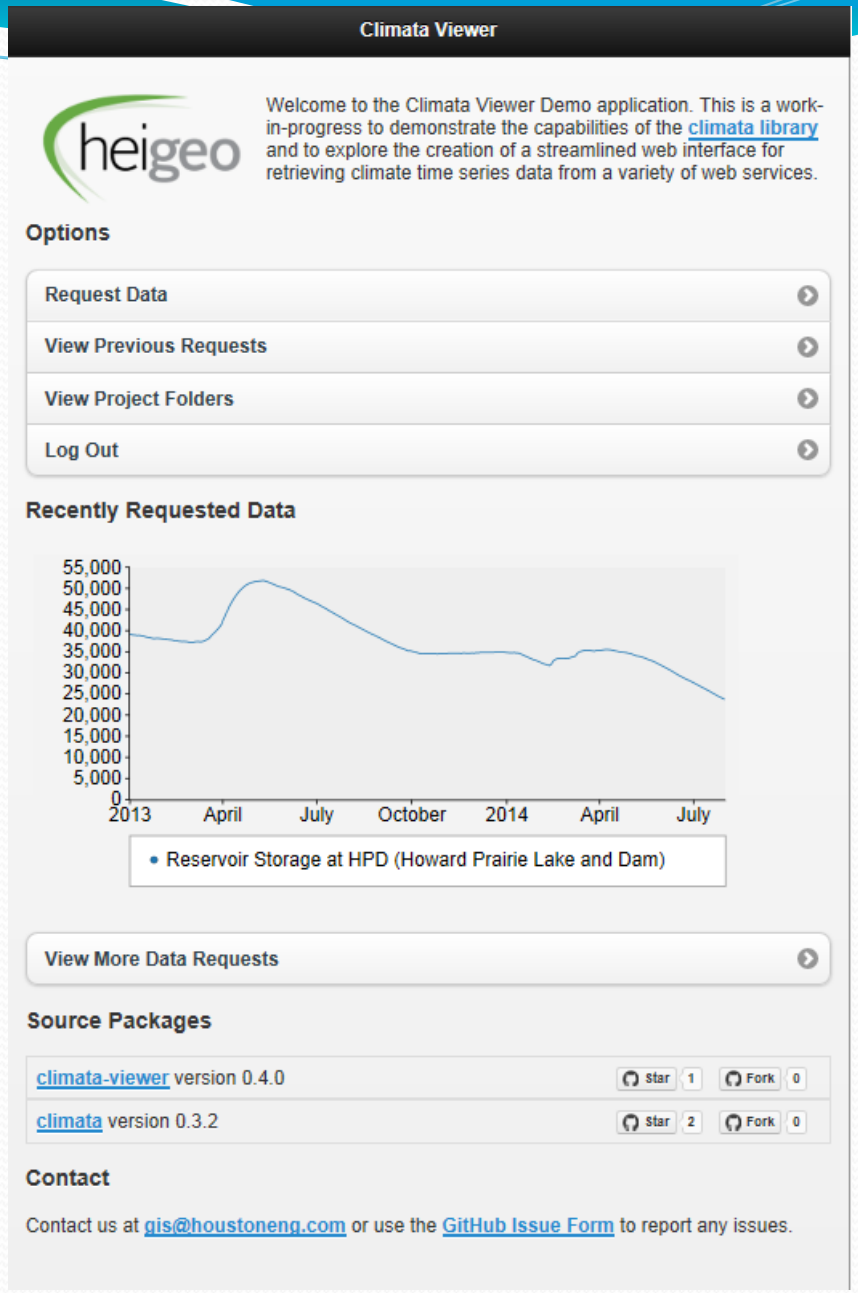
1.23. Detailed Charts Page

1.23.1. User Interface



Retrieving External Data Sources

http://climata.houstoneng.net/



Data Requests

Applied Climate Information System
NOAA Regional Climate Centers

National Water Information System
U.S. Geological Survey

Hydromet & Agrimet
U.S. Bureau of Reclamation

CoCoRaHS
CoCoRaHS

SNOTEL Air-Water Database (Multi-Site)
USDA Natural Resources Conservation Service

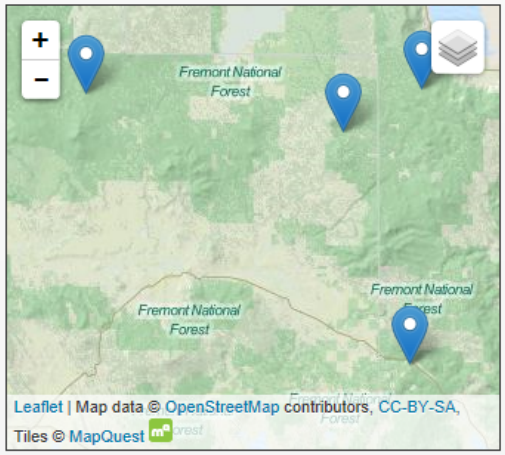
SNOTEL Air-Water Database (Single-Site)
USDA Natural Resources Conservation Service

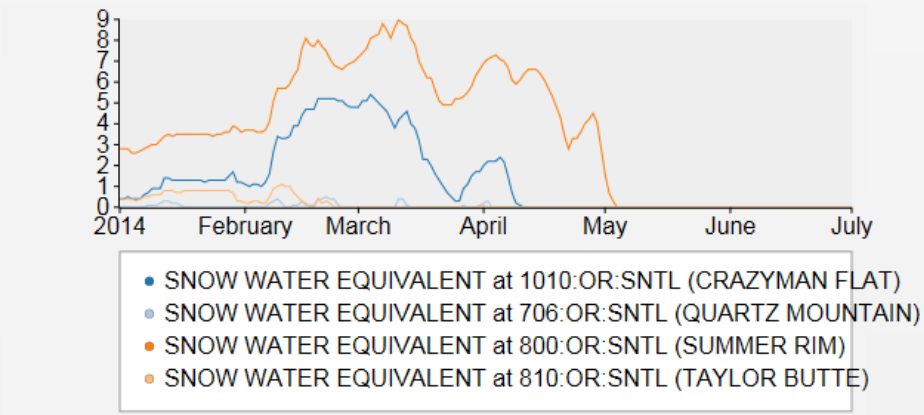
SNOTEL - Import Site List
USDA Natural Resources Conservation Service

NWS Ensemble Forecast
National Weather Service

SNOTEL Air-Water Database (Mult...

Web Service	SNOTEL Air-Water Database (Multi-Site)
Data Range	2014-01-01 to 2014-07-01
Project Folder	Klamath Example
HUC8	18010202 Sprague
Parameter	SNOW WATER EQUIVALENT (in)





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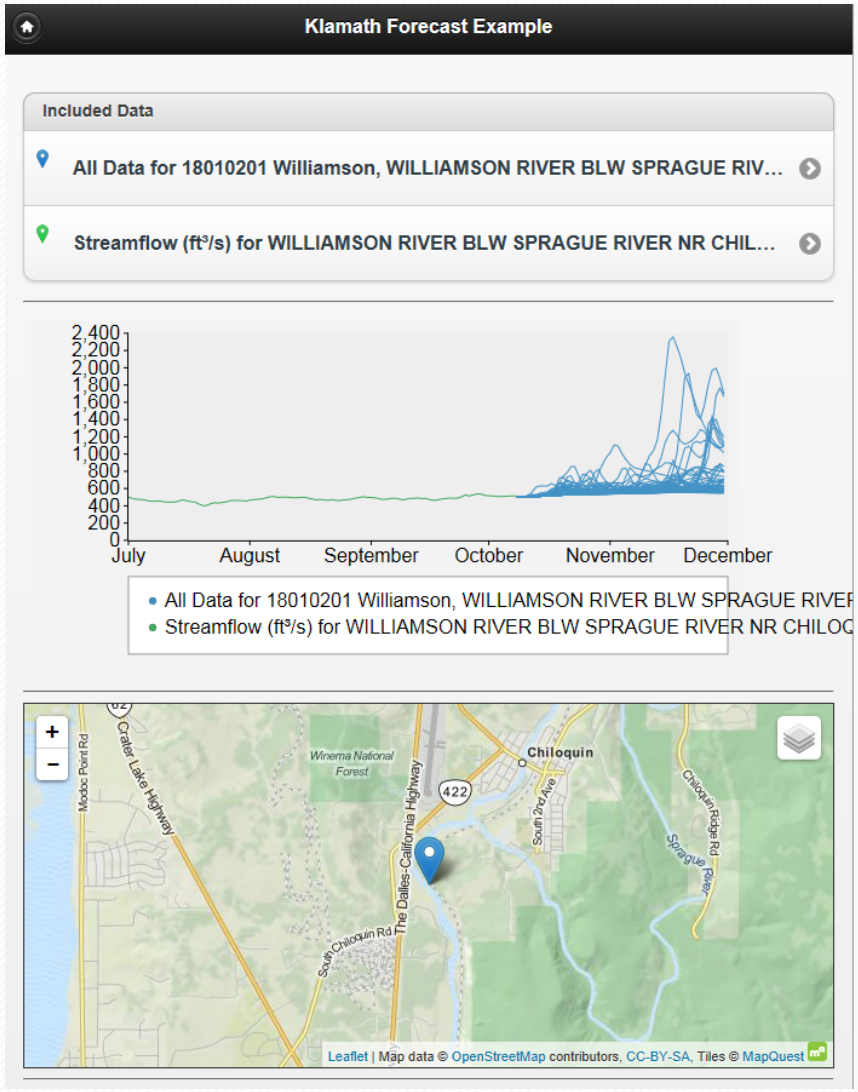
Completed On 2014-08-07 08:09 PM

Python Code Example

Real Time Flow & Forecast Integration



Conclusions

- Existing climate and water data generally sufficient for decision making across large stakeholder community
- Single entry point improves ease of access and use
- Many methods to increase usability
  - Avoid data fatigue (customize to user)
  - Establish data context (not lack of data)
  - Making the data actionable (tied to decision)
  - Alert uses of pending action (mobile integration)
- Requires we UNDERSTAND practitioners work flows and decision processes

Decision Reliance on Climate and Water Data - Lack of Data or Use?

Question: Is the frequency of use and dependence upon climate and water data in daily decision-making a function of "having the correct data" or more about providing the data (we have) in an interpretable and usable manner?

Our challenge is to improve access to and the use of climate and water data by improving the means and methods used to present information in a meaningful and easy to interpret manner (for a broad stakeholder community).

Implementation Recommendations

- Identify and select pilot basin(s) for developing and deploying working prototype
- Do check in with water utility / power industry
- Need proof of concept working prototype to confirm "paper conclusions" in the report
- Integrate data quality messaging
- Aggressively purse known data standard / web service stability at state and federal level
- Use as test bed to clarify and provide guidance about public / private sector boundaries

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Photo Upper Klamath Lake, Oregon