



Klamath Basin Decision Support System (DSS)

November 12, 2009

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Houston Engineering, Inc.

Presented to:

Klamath County
Advisory Committee

In Association with:

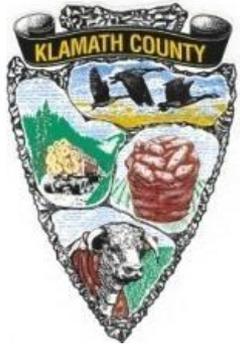
Dan Keppen P.E.
Dan Keppen and Associates



Presentation Agenda

- County Vision
- What is a DSS?
- The project and HEI contract obligations
- Role of the DSS Advisory Group
- Framework & structure for DSS development
- Product status
- Demonstrations (2)
- Feedback items
- Next steps

The Vision – How did we get here?



County Board of Commissioners wishes to begin and facilitate a process to resolve water and resource management issues in the Klamath Basin and thereby lessen the social and financial impact County residents through the creation of a decision support system.

Elements of a Decision Support System (DSS)

- Common access point or "portal" to data
- Allows the integration of distributed spatial and non-spatial data
- Data about water, resources, and people
- Common base of information (for discussion)
- Decision making is based on same data
- Acceptance by Stakeholders
- Result is support of decision making

Klamath County Project

- Six Phases
 - DSS needs assessment / design document
 - Initial development and deployment of the DSS
 - Integration of hydrologic forecasting and water balance tools
 - Integration of Irrigation District Features, Structures and Automated Reporting
 - Integration of Ecologic, Social and Economic Data and Metrics for Decision Making
 - Maintenance

Project Phase I & II Milestones

- Stakeholder briefings on DSS concept May 2008
- Shared examples including use for decision making
- County Board of Commissioners request for concept and technical approach May 2008
- Draft concept and technical approach completed June 2008 and provided to County
- WebEx demonstration July 2008
- Contract executed October 2008
- DSS development October 2008 – October 2009
- Beta testing November 2009
- Initial deliverable wrap-up December 2009

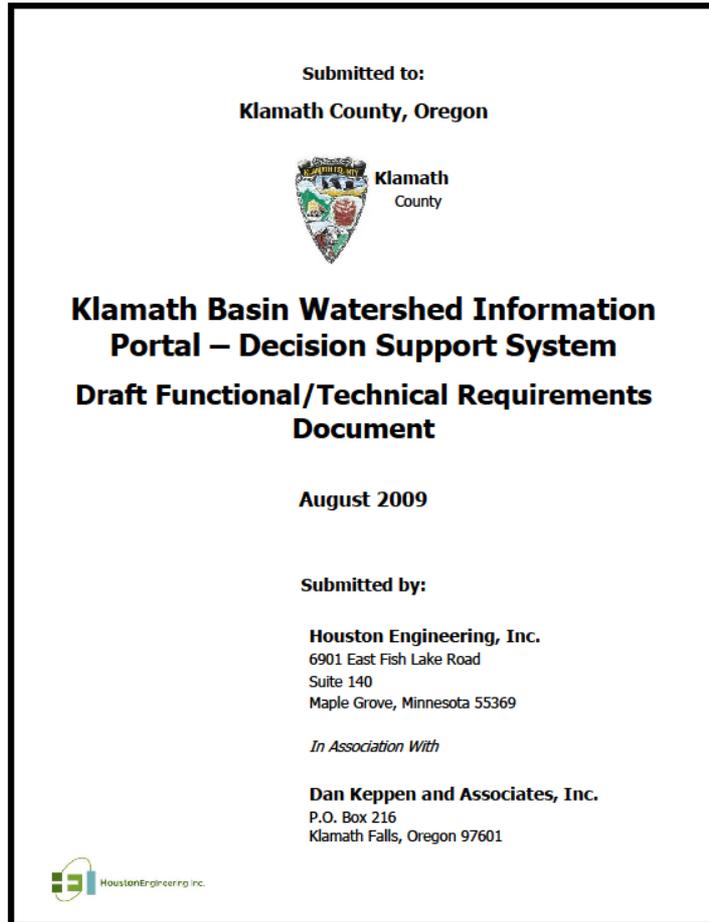
Ph. I & II Contract Obligations & Deliverables

- Functional Requirements Document for DSS
 - Includes engaging stakeholders and developing use cases
- Web page and applications
 - Klamath Map***
 - Klamath Basin DSS web page
 - Watershed viewer
- Conduct Stakeholder Meetings
 - Initial and Final

Advisory Committee Role

- Identify resource issues lacking information
- Present ideas for incorporating into the DSS
- Developing / reviewing Use Cases
- Identify, provide and maintain (your) data
- Feedback
 - DSS vision
 - Usefulness
 - Testing / comments
- Help guide development
- Fund / develop add-on applications

Functional Requirements Document



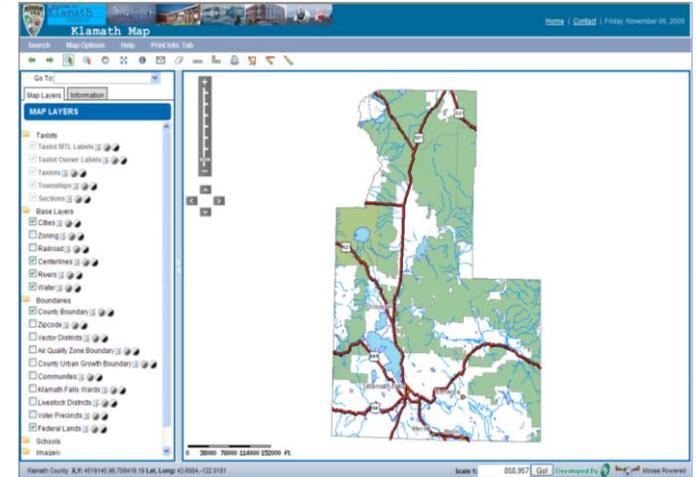
- Completed in August 2009
- Guides DSS development and future applications

Under Development, Pending & Ideas

- Under Development (by County)
 - Watershed Viewer
 - Restoration Viewer and database
- Pending (by County)
 - Water Supply Forecast Tracking Tool
 - Drainage area auto delineation / discharge tool (streamstats)
- Ideas
 - Upper Klamath Lake Water Level Forecast Tool
 - Water Supply Forecast Improvements
 - Water right upstream / downstream query and report
 - Real-time crop water demand

Demonstrations

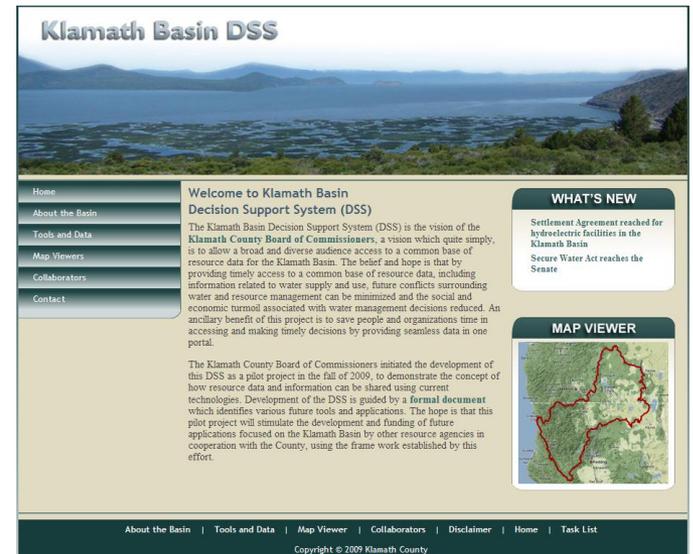
- Klamath Map (on your own)



<http://klamathcounty.houstoneng.com/klamathmap/klamathmap.html>

- Klamath Basin DSS
 - Watershed Viewer
 - Restoration Viewer

<http://www.klamathdss.org/>



Watershed Viewer

Klamath Basin DSS Watershed Viewer

Home Layer Information Disclaimer Help

Print Sketch Tools

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Legend:

- Landscape Physical Features
- Water Management Features
- Restoration and Conservation
- Land Management and Ownership
- Basemaps
- Google Terrain
- Google Street
- Google Hybrid
- Google Satellite
- Printable Basemap
- Oregon Orthos
- USGS DOGs
- USGS Topo Quads

Powered by Google

GeoMOOSE 2.0 Lat, Lon: 42.618, -119.773 Scale: 1:1733376

Klamath Basin DSS

Home

About the Basin

Tools and Data

Map Viewers

Collaborators

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Welcome to the Klamath Basin Watershed Information Map Viewer

The Watershed Information Portal (WIP) is a basic Map Viewer focused on water and resources affecting and affected by water, within the Klamath Basin. Information about the amount of flow in a river, the elevation of water within a reservoir, the amount of moisture in the snow pack, and climate data, can be accessed through this Map Viewer. Water rights data can be layered with other information including tax lot boundaries and land ownership. All of these data can be accessed without physically leaving the web page. (now embed the WIP map viewer in a frame)

[Open the Watershed Information Map Viewer](#)

Photo Courtesy Klamath Water Users Association

- Source Data
- Viewer Help

About the Basin | Tools and Data | Map Viewer | Collaborators | Disclaimer | Home | Task List

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Overview of Features

- Disclaimer
- Link to source data (data transparency)
- Google Map look and feel
- Viewer page organization
- Layer content (scale dependent)
- Preview of viewer tools
- Organization of data layers
- Map layer functionality

Key Issues

- Web page content
- Long-term maintenance***
- Printable layers
- Parcel attributes
- Wish list (stream stats implementation)

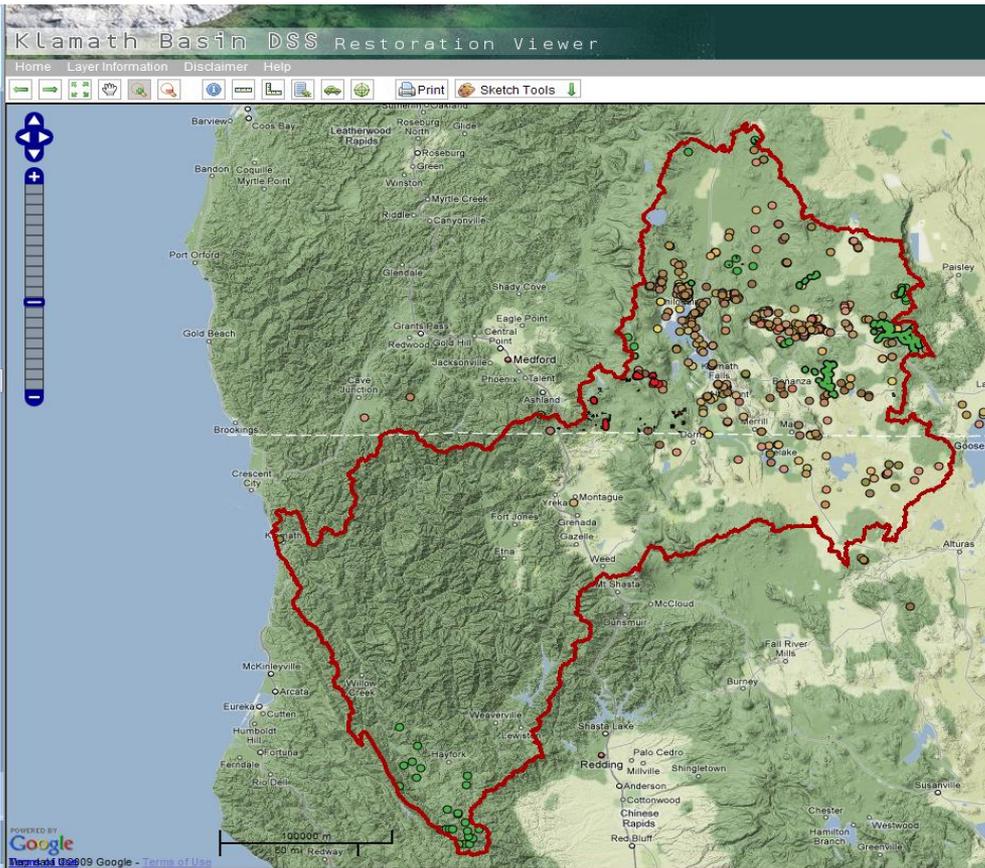
***Long-term Maintenance and Hosting

- Update layers when new info is available
- Anticipated schedule
 - Water and Weather Observation layers (A)
 - Water Rights (SA)
 - Water Features (A)
 - Landscape Physical Features (A)
 - Water management features (A)
 - Land management and ownership (SA)
 - Basemap data (N)

(A) Annual
(SA) Semi-annual
(N) None

Maintenance ~ 32
hours per year
plus hosting

Restoration Project Viewer



Klamath Basin DSS

Home

About the Basin

Tools and Data

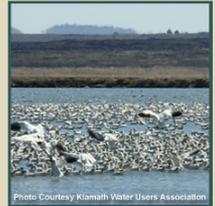
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Welcome to the Klamath Basin Restoration Map Viewer

The genesis for this restoration tool is a general belief among resource managers that few living outside of the Klamath Basin realize the progress, which is being made to restore the natural resources and conserve water, within the Basin. Many different organizations, which range from the individual landowner to the farmer irrigator, to watershed councils, and local, state and federal government agencies, are actively involved in restoration activities in the Klamath Basin. No single source or location which integrates basic information about restoration efforts is available, which tends to hamper a coordinate restoration effort.



- Source Data
- Viewer Help

A "use case" is simply a written description of a concept application. The Functional Requirements Document for this DSS included several use cases and one of those focused on the development of a "restoration tool." In the spring of 2009, Klamath County staff, with Forest Service support, submitted a Secure Rural Schools Title II grant proposal to the Fremont-Winema Resource Advisory Committee (RAC). The RAC and the Forest Service, agreed to fund the development of the restoration tool by awarding a grant to Klamath County in the fall of 2009.

The restoration tool includes two basic components. The first component is a web enabled database of restoration activities. The intent is not to duplicate the efforts of Oregon Watershed Enhancement Board, but to supplement those efforts by integrating restoration information not previously available to the general public and decision makers. The second component consists of various data and applications intended to aid with the development and evaluation of new restoration activities in the Klamath Basin.

[Open the Restoration Map Viewer](#)

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- DLPR
- by Agency
- Land Management and Ownership Basemaps
 - Google Terrain
 - Google Street
 - Google Hybrid
 - Google Satellite
 - Printable Basemap
 - Oregon Orthos
 - USGS DOGs
 - USGS Topo Quads

Background

- Continuation of Klamath Basin DSS
- Grant received by Klamath County
 - Fremont-Winema USFS
- Klamath County retained HEI for work
- Goal:
 - “Develop and integrate a watershed restoration web application into the existing Klamath Basin DSS”

Use Case / Needs

- Geographic scope (Fremont-Winema National Forest)
 - Potential to expand it to the whole Klamath Watershed
- Portal for searching and viewing restoration activities
 - Interactive map and database
 - Making USFS WIT database accessible to external users
- Integration of external organizations restoration activities
 - Potential stakeholders: USFW, BLM, NRCS, Klamath County, KWP, etc.
 - Tools for entering new activities and projects by external users
- Tools for identifying new restoration site

Project Approach

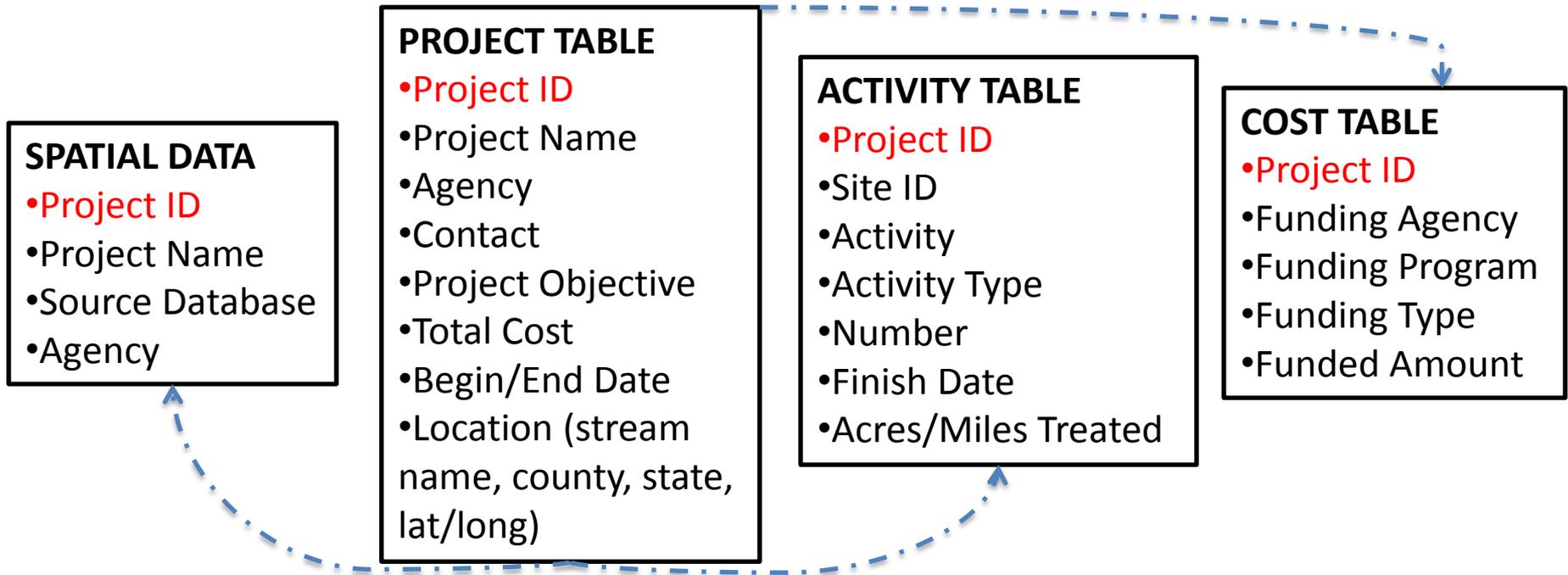
- Automation and procedures for data integration and updates
 - Programming tools and routines for combining WIT database contents together with external data sources
- Programming a beta application
 - User interface and tools for working with the data
- Review and testing beta application
- Final application and closeout meeting
- Hosting and maintenance

Challenges with Restoration Application

- Defining “Restoration Activities”
- Getting our hands on the restoration activities data
 - Dealing with different formats and contents
- Content of integrated watershed restoration database
- Priorities for user tools (within fiscal constraints)
- Technology used for programming
 - Weighing the pros and cons
- Hosting and maintenance
 - Best long term solution versus cost

Common Database Structure

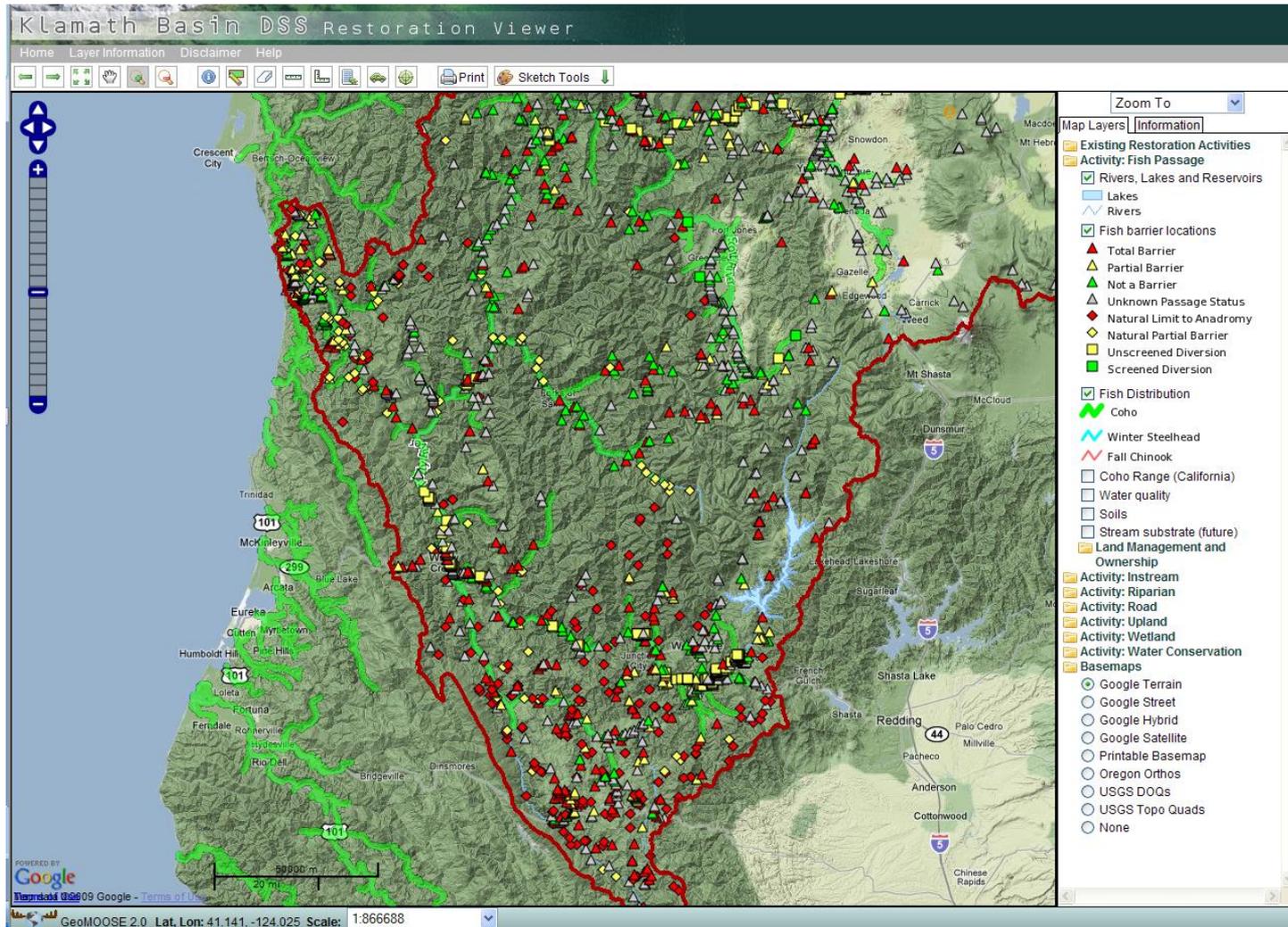
- Collected data from five databases:
 - BLM IRDA, USFS IRDA, OWEB, KFFWO, WIT(?)
- Developed a single database from common fields



Restoration Tools

- Use DSS framework to locate sites
- Numerous options
 - By general activity category (report)
 - By specific activity
- See handout
 - General category
 - Specific categories
 - Associated/helpful data layers

Barrier Tool (Concept)



GENERAL PROCEDURE: DATA PROCESSING

Query flowline to find name of stream

In report, note locational info including: lat/long, stream name, state, and county.

Query state outlines to determine which State the site is in

If we're in CA, we'll use CA datasources for the following steps; if we're in OR, use OR datasources.

Query county outline to determine which Country the site is in

Query habitat layer to determine if segment upstream is considered to be fish habitat

If yes, note what type of fish habitat in the report.
CA habitat layers: cc_chinook_ch_06_2005.shp,
nc_steelhead_ch_06_2005.shp
OR habitat layers: hfd_anad_gdb93.mdb and a couple point files.

Query distribution layer to determine if fish have historically been there

If yes, note in report what type of fish have been there.

Query barrier layer to note if structure is included

If barrier, place note from barrier layer in report.
CA barrier layer: PAD_May2009.shp
OR barrier layer: odfw_barriers.shp

Trace downstream on flowline and query barrier layer to see if another barrier lies further downstream

If another barrier lies downstream, move down to that location and repeat this process.

ADDITIONAL INFO / RANKING PROCEDURE

Trace upstream until reach end of habitat or hit another barrier; measure length of habitat to be opened up

This procedure will reveal the stream length of habitat to be opened up by replacing the barrier.
Place this info in the report.

Incorporate into some type of ranking?

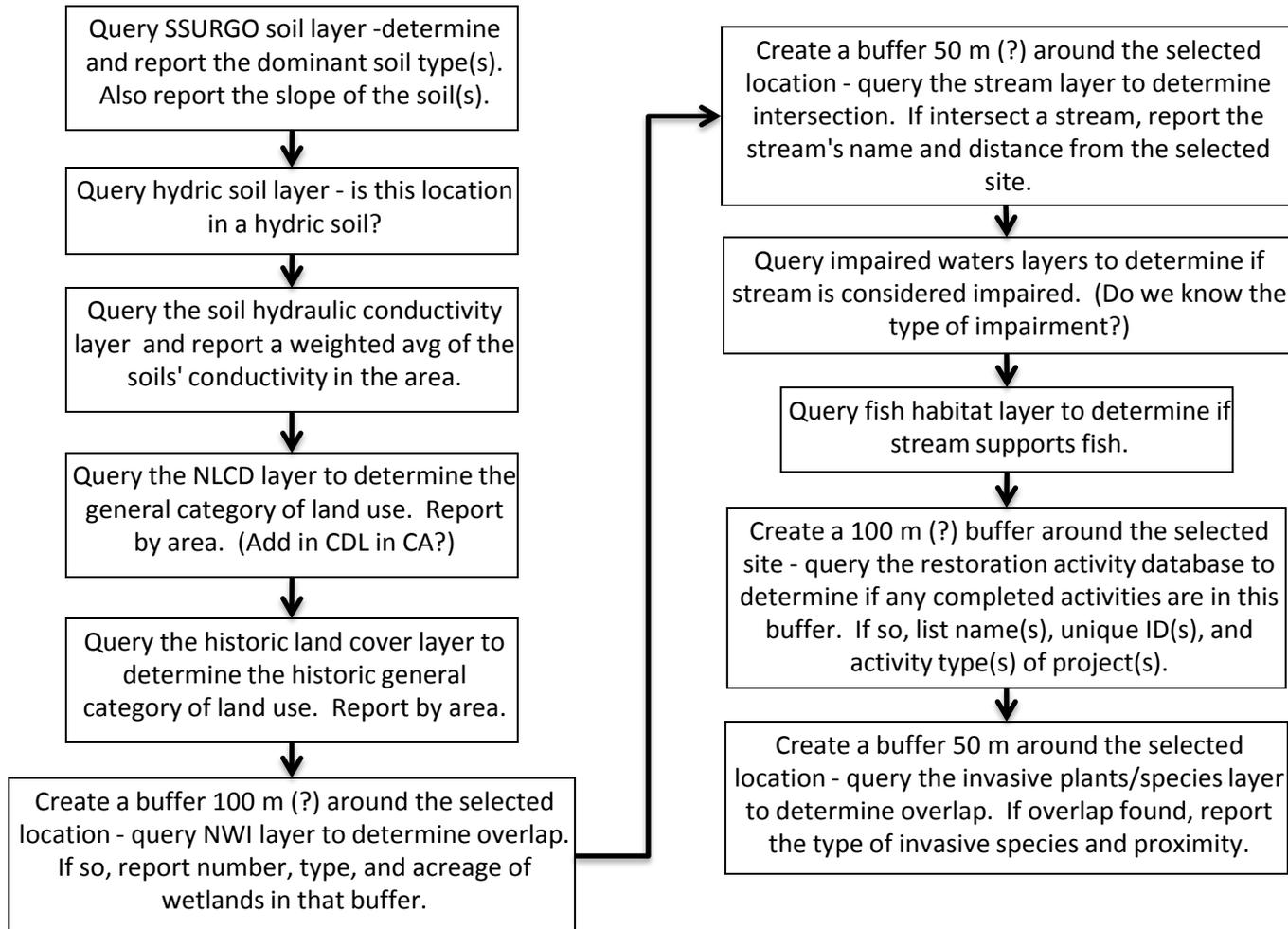
Query the existing restoration activity layers in a 50 m (?) buffer around the site to look for historic restoration activities

Does this matter? Would a project be more or less attractive if other restoration activities have been completed nearby?

Query the plat and/or federal and state land layers to determine who owes the property around the barrier

There may be access issues or some grants might only be useable in private and/or public lands.

Wetland Siting Tool (Concept)



Water Conservation Tool (Concept)

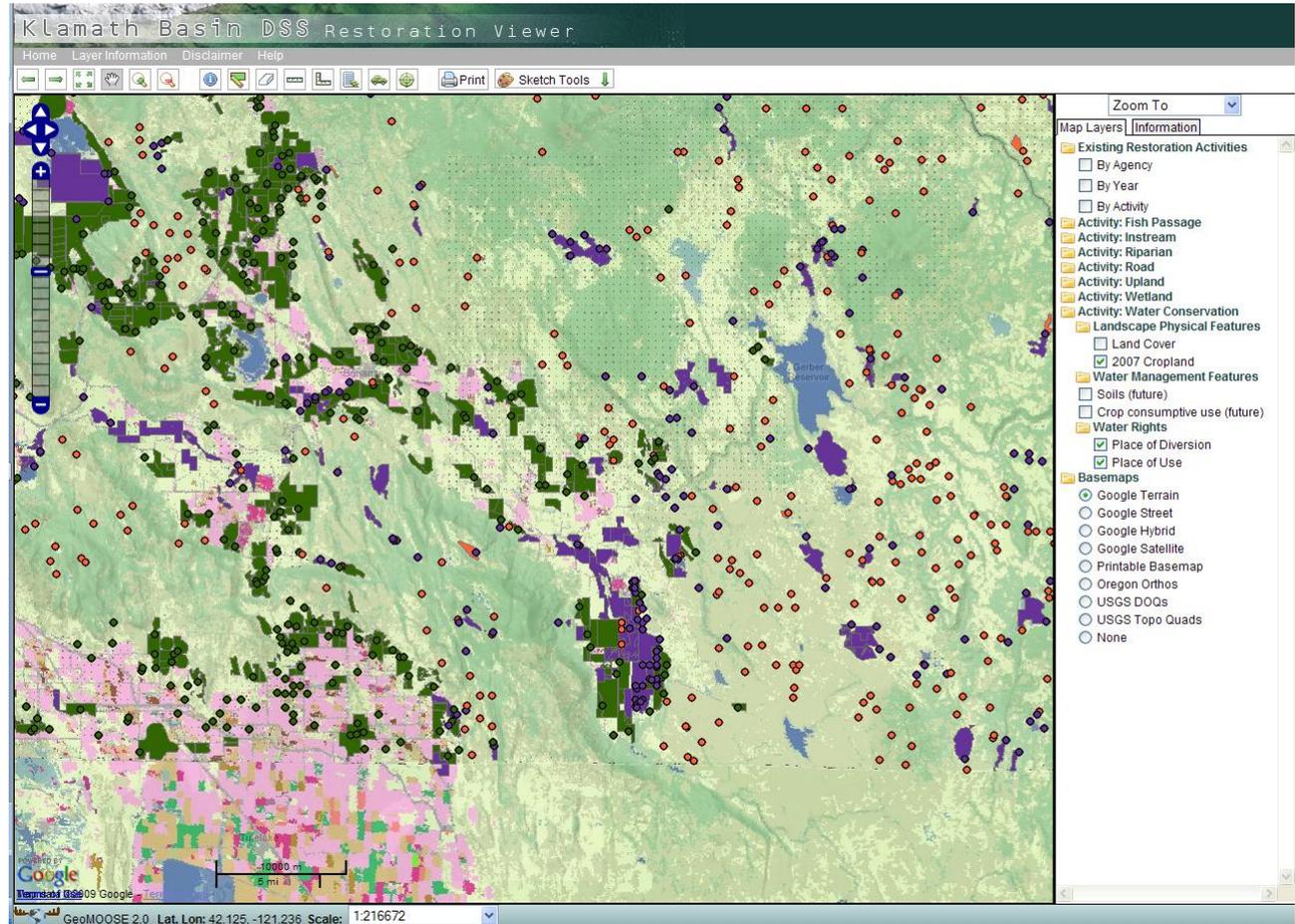
Overlay/merge CDL or other crop data layer on SSURGO soils layer.
Find all unique combinations of crop and soil type.

Compute area of each unique combination.

Place in report.

User fills in required info.

Tool computes water savings.



Conservation Calculator (Concept)

<u>CROP</u>	<u>SOIL TYPE</u>	<u>AREA</u>	<u>CONSUMPTIVE USE</u>	<u>TIME FRAME</u>	<u>WATER SAVINGS</u>
Barley	in Soil xyz:	X acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
Wheat	in Soil xyz:	Y acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
Oats	in Soil xyz:	Z acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
Peas	in Soil xyz:	W acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
Alfalfa	in Soil xyz:	Q acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
Potatoes	in Soil xyz:	T acres	__ in/day	__ days	= __ acre-ft <input type="text" value="+"/>
TOTAL ESTIMATED WATER SAVINGS					= __ acre-ft
COMPUTE WATER SAVINGS					

Key Issues Needing Feedback

- Consistent with vision?
- Rate priorities
 - Database first, tools second (?)
 - Editable database (or similar) for local data
- Restoration database content
- Working out WIT database issues
- Operating system
- Long-term maintenance

Take Away

- Klamath Basin DSS is a grassroots effort started by Klamath County that can be expanded by other organizations
- Klamath County and Winema-Fremont National Forest are looking for Stakeholders to share restoration activity data and give feedback on what external users need to see
- Project is funded by a RAC grant
- Goal is to have an integrated watershed restoration activities database and GIS web viewer
- Contact Amy Gowan or Lani Hickey if you would like to become a stakeholder

Water Supply Forecast Tracking Tool

Klamath Basin DSS

CONCEPT

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- About the Basin
- Tools and Data
- Map Viewers
- Collaborators
- Contact

Water Supply Forecast Tracking Tool (WSFTT) (Under Development)

Water supply forecasts are issued by the Natural Resources Conservation Service (NRCS), **National Water and Climate Center**. The forecasts are issued beginning in January of each year at the first of the month for the water supply season (through September). These forecasts are based upon multiple linear regression models using measured information at various locations throughout the Klamath Basin. The purpose of the WSFTT is to integrate forecast information issued by the NRCS and measured streamflow information (usually collected by the United States Geological Survey), as a qualitative assessment of the forecast information.

Examples of the tool

to enlarge

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Current Forecasts

Streamflow Forecasts

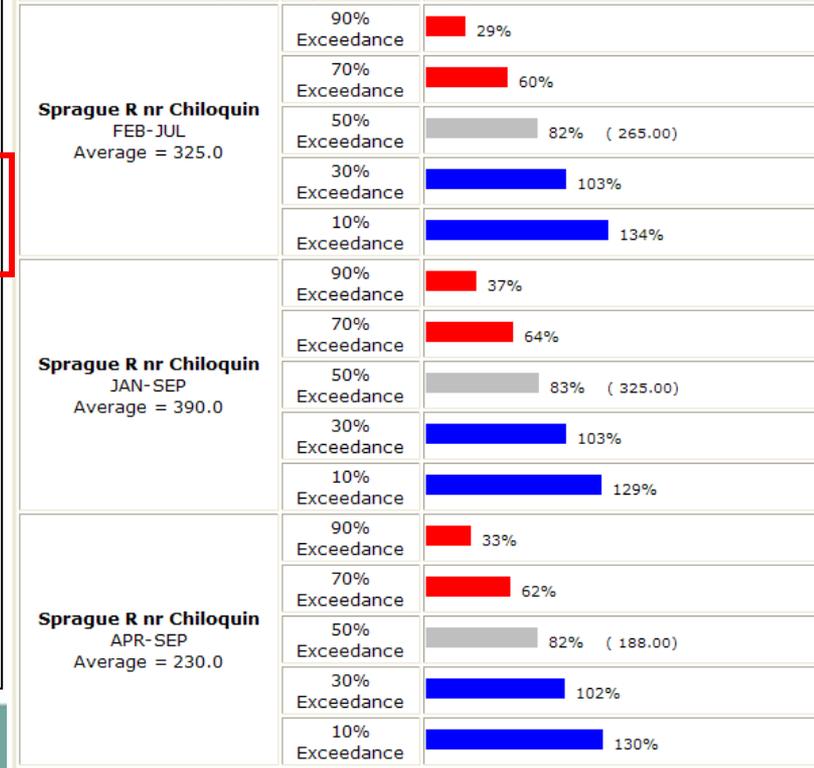
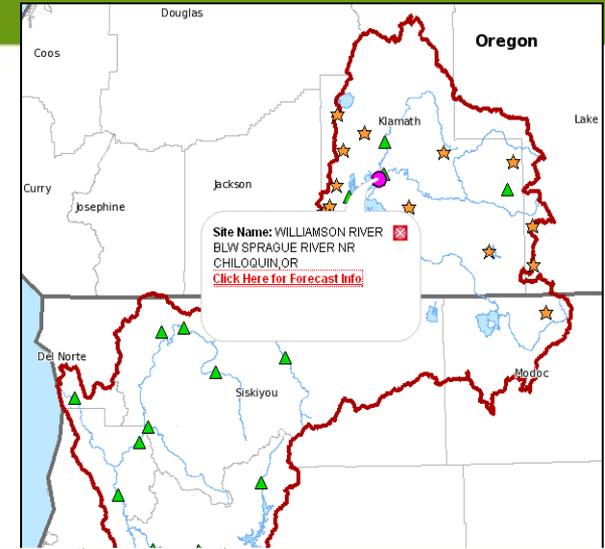
KLAMATH BASIN

Streamflow Forecasts - March 1, 2008

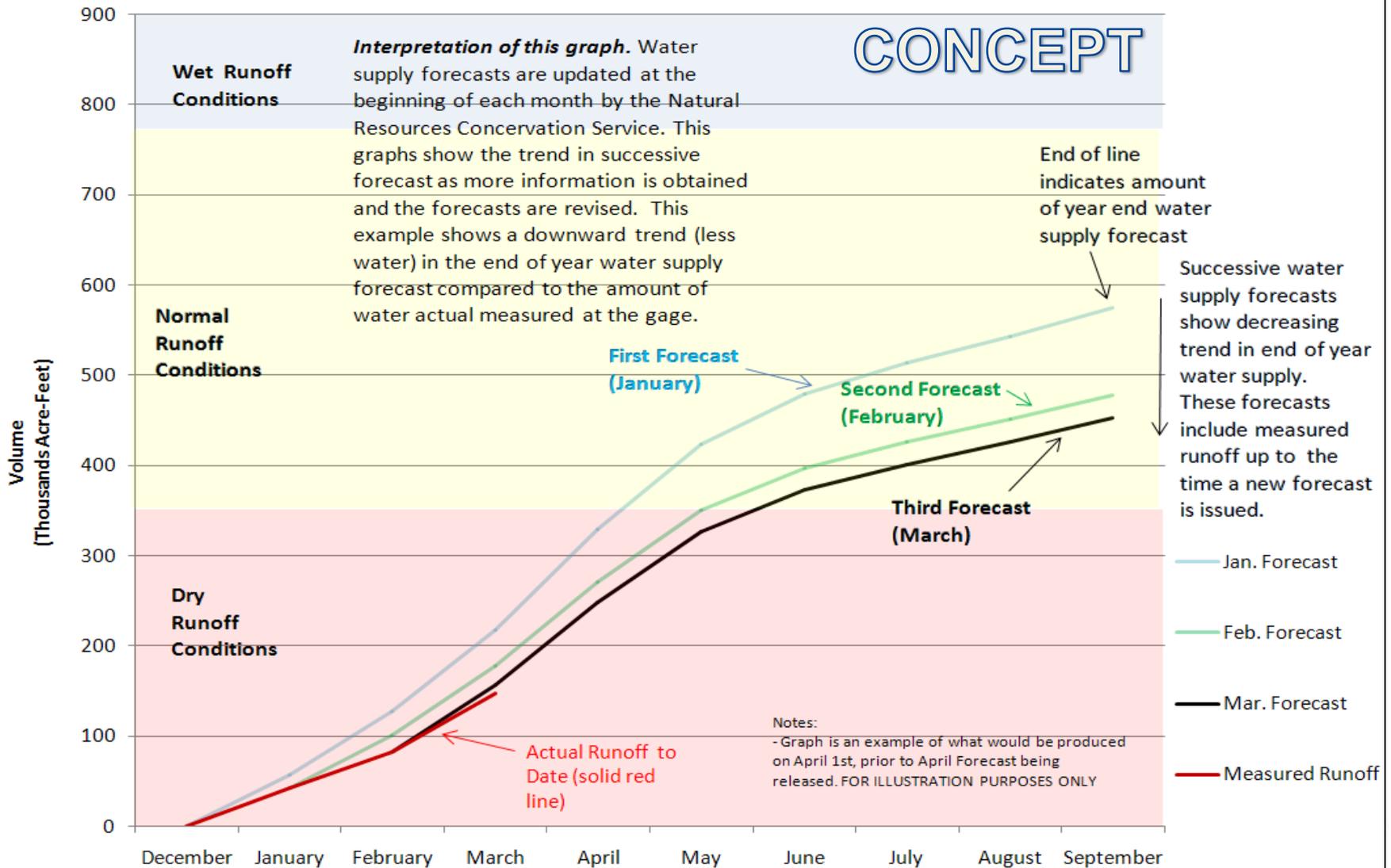
Forecast Pt Forecast Period	Chance of Exceeding *					30 Yr Avg (1000AF)	
	90% (1000AF)	70% (1000AF)	50% (Most Prob) (1000AF) (% AVG.)	30% (1000AF)	10% (1000AF)		
Clear Lake Inflow (2)							
MAR-JUL	39	72	94	118	116	149	80
APR-SEP	23	40	52	108	64	81	48
Gerber Reservoir Inflow (2)							
MAR-JUL	16.0	29	38	103	47	60	37
APR-SEP	4.5	12.6	18.0	101	23	31	17.8
Sprague R nr Chiloquin							
MAR-JUL	188	240	275	100	310	360	275
MAR-SEP	215	270	305	100	340	395	305
APR-SEP	161	200	230	100	260	300	230
Upper Klamath Lake Inflow (1,2)							
MAR-JUL	410	545	605	97	665	800	625
MAR-SEP	490	635	700	97	765	910	720
APR-SEP	355	455	500	97	545	645	515
Williamson R bl Sprague R nr Chiloquin							
MAR-JUL	320	385	430	98	475	540	440
MAR-SEP	375	445	490	97	535	605	505
APR-SEP	285	340	375	97	410	465	385

* 90%, 70%, 30%, and 10% chances of exceeding are the probabilities that the actual flow will exceed the volumes in the table.

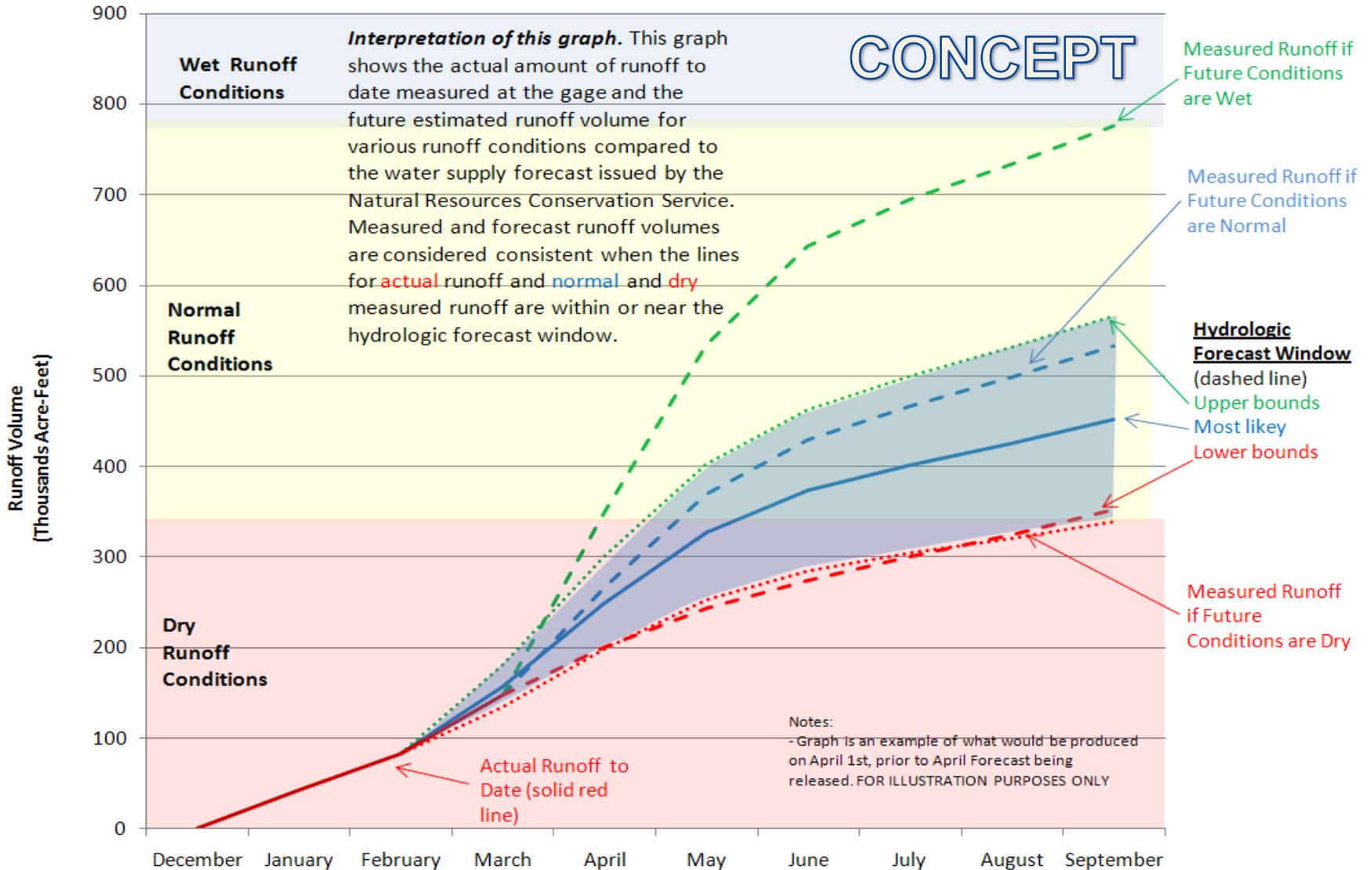
- (1) - The values listed under the 10% and 90% Change of Exceeding are actually 5% and 95% exceedance levels.
- (2) - The value is natural flow - actual flow may be affected by upstream water management.



2009 Water Supply Forecast for Williamson R. blw Sprague R., Forecast Date March 1, 2009



2009 Water Supply Forecast for Williamson R. blw Sprague R., Forecast Date March 1, 2009



Water Supply Forecasts

Klamath River Basin Enhanced Water Supply Forecasting – A Concept



November 9, 2009

Purpose: The purpose of this project is to develop and deploy improved water supply forecast tools and models as well as web products and applications in an operational environment, for the Klamath Basin (southern Oregon and northern California), which can be used as template for other locations. The products from this project are envisioned as a Decision Support Tool which can be used to make local management decisions by the Klamath Water and Power Authority and other organizations working on resource management issues, responsible for efforts to conserve the supply of water, and achieve management decisions related to the U.S. Fish and Wildlife Service and National Marine Fisheries Service Biological Opinions.

General Approach: The general approach for the completion of this project is a collaborative process which includes local, state, federal and tribal agencies, with an interest in and responsibility for, water supply forecasting within the Klamath Basin. The approach recognizes and maintains the institutional responsibility of Natural Resources Conservation Service and the National Weather Service for water supply forecasting and the reliance of the U.S. Bureau of Reclamation upon the forecasts for making operational decision related to the Klamath Project.

Participation: The success of this effort is dependent upon the full and active participation of the various agencies responsible for water supply forecasting and water management within the Klamath Basin. The intent is not to usurp the institutional responsibility of these agencies, but to use local initiative to facilitate the development of new tools of mutual benefit to those responsible for resource management in the Klamath Basin.

Probable Tasks: The project will be completed in four phases. **Phase I** will consist of developing a project team, developing forecast modeling goals, technical objectives, and recommending an approach to developing new forecast approaches using recent and emerging technologies, including a spatially varied hydrologic forecasting model. Phase I will also include the development of grant proposals, applications, cost-sharing agreements and other means to attain funding.

Phase II will focus on developing and testing the proposed modeling approach (including spatially distributed modeling techniques) and data sources to evaluate their suitability for incorporation into hydrologic simulation based operational forecasts, preferably on a daily basis. Phase II is expected to culminate in the development of a Technical Memorandum describing the capabilities of the recommended modeling platform, the ability to calibrate and verify the model, technical issues associated with model use, the ability to resolve these issues, and the time-frame and probable cost for deployment in an operational setting. The approach recommended during Phase I will actually be developed and applied to a pilot portion of the Klamath Basin (e.g., drainage area upstream of Upper Klamath Lake). This development and application will be used as the basis for developing the Technical Memorandum. Phase II will also include the development of grant proposals, applications, cost-sharing agreements and other means to attain continued funding.

1

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What is an Improved Forecast?

- Better accuracy (now $\pm 50\%$ b/w 10% and 90% chance seasonal runoff values)?
- Methods (e.g., process vs statistical)?
- Daily volume rather than seasonal?
- Information about time of availability?
- Refined inputs (e.g., snowtel)?
- Context of use (relative to demand)?
- Relationship b/w risk and defined actions

URLs

- Klamath Map
<http://klamathcounty.houstoneng.com/klamathmap/klamathmap.html>
- Klamath Basin DSS web page
 - Watershed Viewer
 - Restoration Viewer
 - Water Supply Forecast Tracking Tool Concept<http://www.klamathdss.org/>

Special Thanks & Acknowledgement

- County Board (the vision)
- Lani Hickey (energizer bunny)
- Randy Paul and Bruce Fichtman (Klamath Map)
- Amy Gowan (Restoration database / viewer)

