"May you study interesting systems"

Paraphrased proverb

Understanding worldviews may help sort through technical assessment of restoration methods

Focus on the Klamath Basin and Upper Klamath Lake

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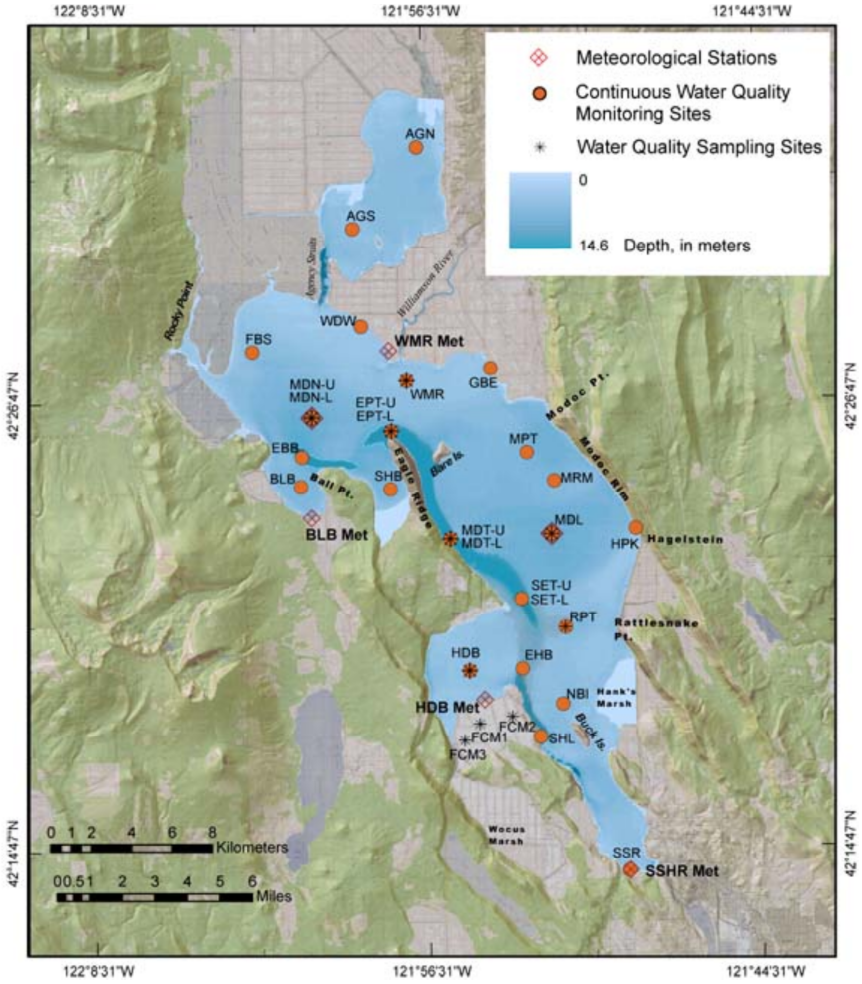
Overview

1. The Klamath Basin and Upper Klamath Lake has problems
2. Technical proposals for cleaning up Upper Klamath Lake
3. It is important to identify worldviews, even in technical sessions
4. We can use information about disparate values to choose approaches
5. Creating scenarios, based on these worldviews, is a start
6. Conclusions

1. Overview of the Klamath Basin and the issues

From KRPRW Environmental Setting



USGS

Issues and problems in the lake

- Not enough water for all users
- High phosphorus
- High chlorophyll
- Extreme algal blooms and crashes
- Endangered fish populations

2. Technical workshop

Klamath River Water Quality Workshop, Sept 10-13, 2012, Sacramento, CA

- Teams were charged with presenting methods for lake restoration
- Common parameters
  - Amount of land area
  - P and N removal
  - Costs
  - Technical feasibility
- Proposed lake restoration methods
  - Dredging
  - Alum treatment
  - Filtration
  - Increase native wetlands
  - Off-channel treatment marshes
  - Distributed, smaller projects

3. Important to identify worldviews

- Based on holder's assumptions about how the world works
- Can use these assumptions to check against the other worldviews
  - Example – Hobbes/ Rousseau
- Can use these to generate scenarios (like in MEA)

Set of Worldviews

- Individualist – free market
- Hierarchist – establish rules and procedures
- Egalitarian – use bottom up governance
- Deep Ecology – respect the rights of other organisms
- Fatalist – skeptical that this will make a difference

Workshop & Worldviews

Worldview	Proponent	Salient words
Individualist/ cornucopian	USDA NRCS who works closely with farmers	Ranchers have always been able to solve them using innovation Individuals will do the right thing with their property
Hierachist/ Industrical ecology	Representative from USGS	We can identify the causes and scale our efforts to efficiently address these
Egalitarian/ Committed environmentalist	University professor	Precautionary principle invoked, don't rely on large scale energy use
Deep Ecology	Representative from Resighini Rancheria	Return to pre-European conditions Self-regulating ecosystem
Fatalist/techno-skeptic	Not represented	Need to solve your current problems

Considering values mismatches in looking for approaches

- Range of worldviews means that there will be values mismatches
  - Example: Individualists will favor population growth whereas Deep Ecologists will favor zero population growth
  - Not our job to solve these debates
- Can include disparate values as a factor in choosing how to address environmental problems

4. Problem types and strategies

Problem typology

	Value alignment	Value conflict
Information available	Simple (Regulations)	CPR (Institutions)
Information lacking	Information (Research)	Wicked (Entrepre-neurial)

Management strategies

	High control	Low control
Sufficient knowledge	Optimal project management	Hedging/ diversification
Uncertainty	Scientific Adaptive Managment	Scenarios

Knowledge:Control:Value

K	C	V	Effective modes of engagement
L	L	L	Scenarios and expanded narratives
L	L	H	
L	H	L	Environmental Entrepreneurism
L	H	H	Scientific Adaptive Manage
H	L	L	Multi-criteria
H	L	H	Hedging/Diversification
H	H	L	CPR - institutions
H	H	H	Optimal Project Management

Engaging with problems

Building scenarios: Assumptions

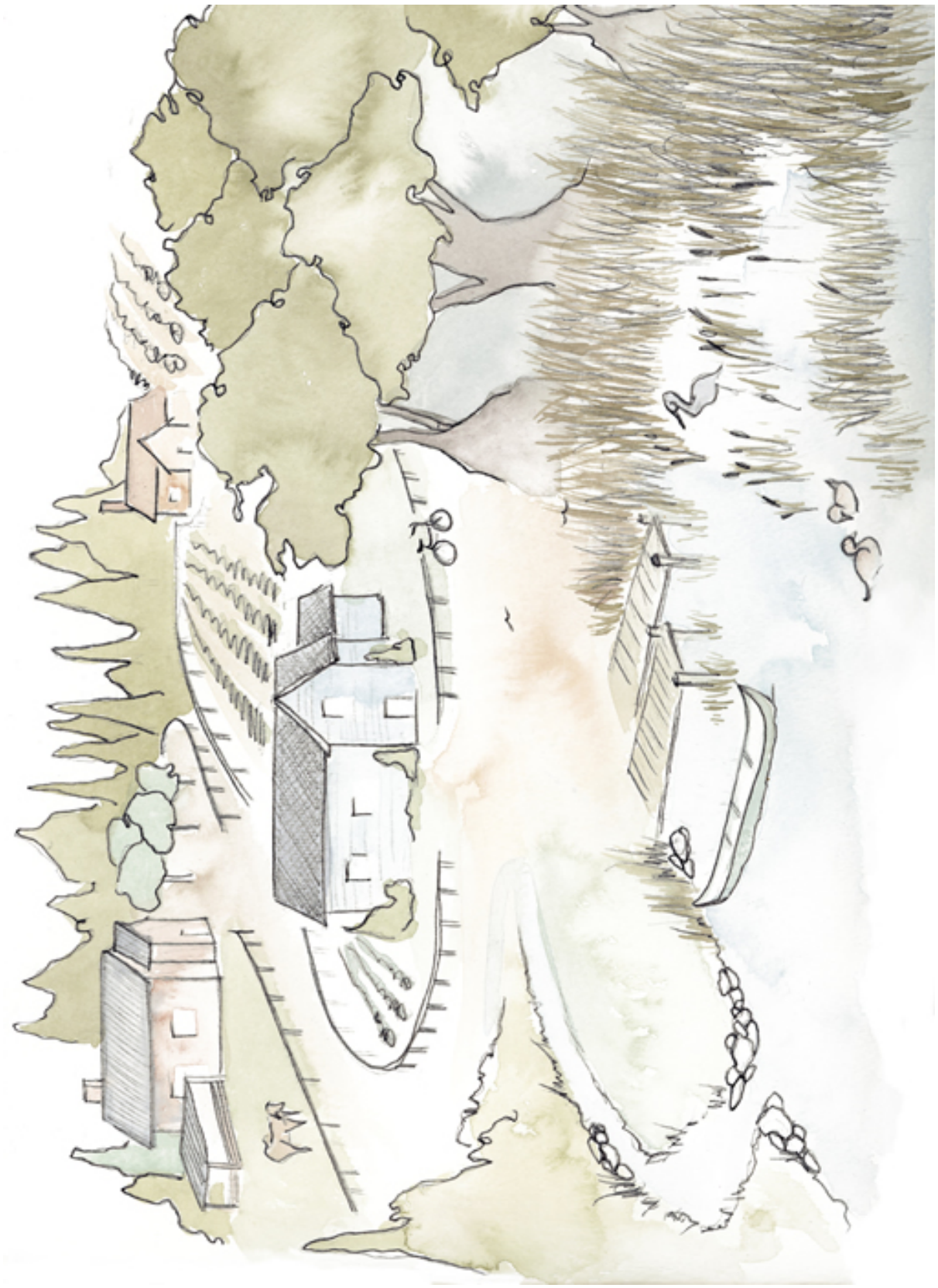
- Lake restoration will involve the entire community
- Building trust will take deliberate effort
- What will the lake and the region look like?
  - Modernity
  - Post-modernity
  - Second modernity (Gross)
  - Retro-modernity
- Went through an analysis of what conditions and values each of these worldviews think will be in their future

Individualist: Economic Renaissance

Hierarchist:
Expert Lake Management

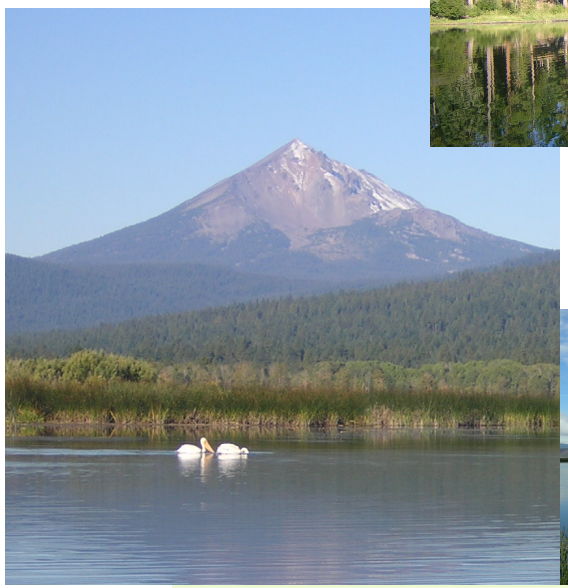
Egalitarian: Mosaic

Deep Ecology: Return to Nature

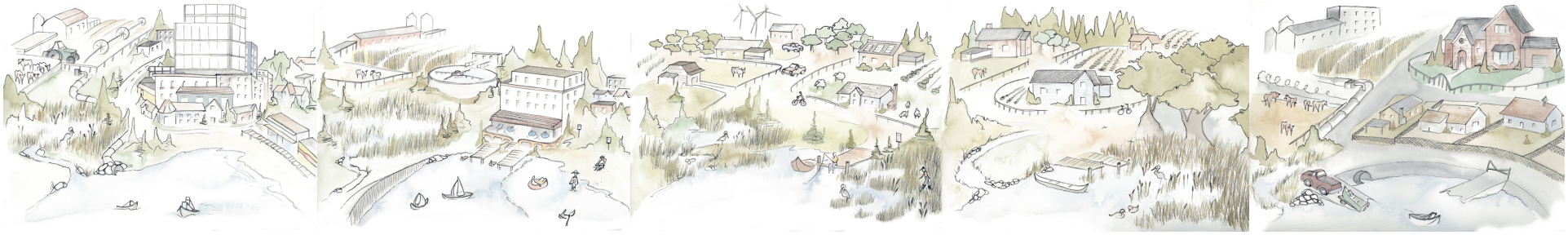


Fatalist:
You're all crazy!

6. Conclusions



- It's not hopeless for us.
- We can make objective statements about values.
- Sorting out KCV can help us choose approaches
- Under high uncertainty, scenarios that contain familiar elements can help us build trust and cooperation.



Thank You

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  - http://lindsayjordankretchun.com/

- My contact info:
  - John Rueter
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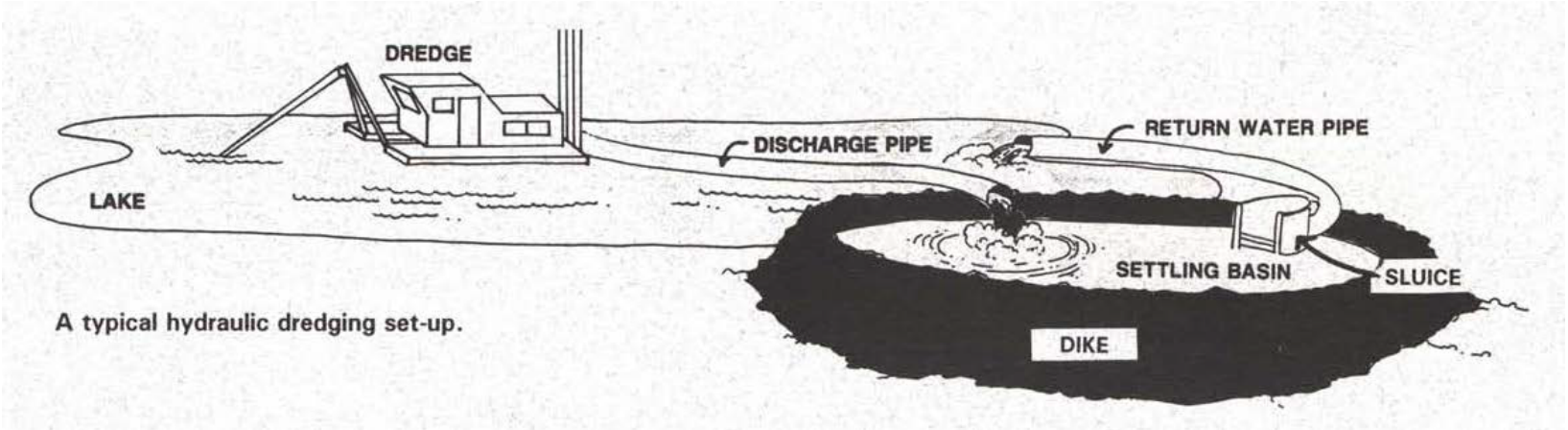
Problem typology

Complexity of information	Alignment of values with costs: good	Alignment of values with costs: poor
Low	Simple	CPR
High	Inform-ation	Wicked

The problems we will address in this seminar contain different mixtures values, information demands, and our ability to control the situation enough to manage change

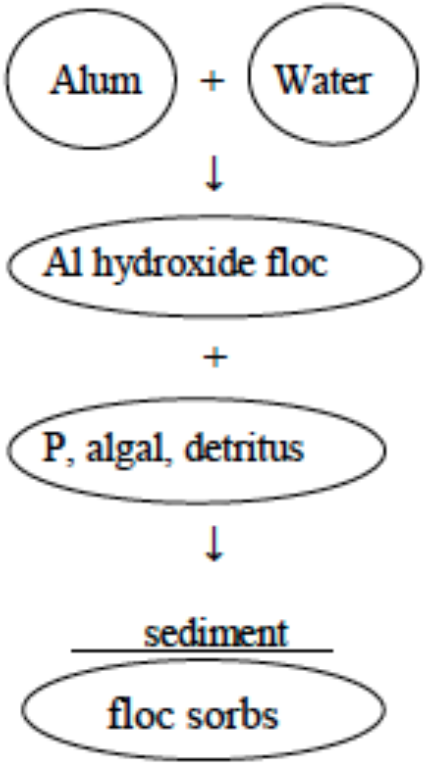


A typical hydraulic dredging set-up.

Dredging

- Captial and O&M = $5-15/yd^3
- Total project costs $150-460 mil
- $110-330 per Kg P
- Estimates don't include disposal costs

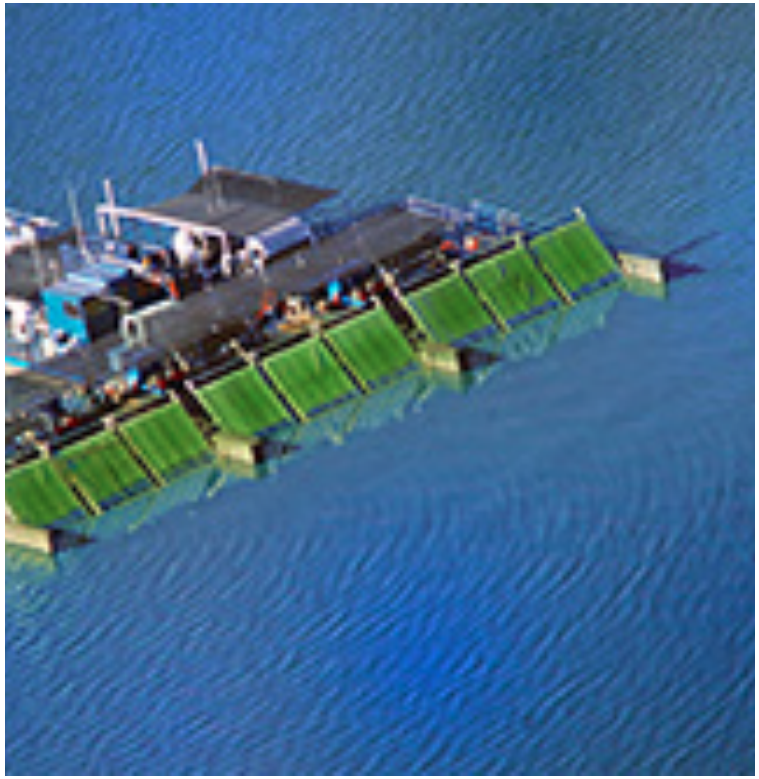
Phosphorus removal – alum or aeration



- Compared to other lakes with similar characteristics
- $90 to $180 mil for a treatment that would last from 8 to 15 years
- Over 50 years
- $260 per Kg P

Also considered aeration

Removing algae with filtration



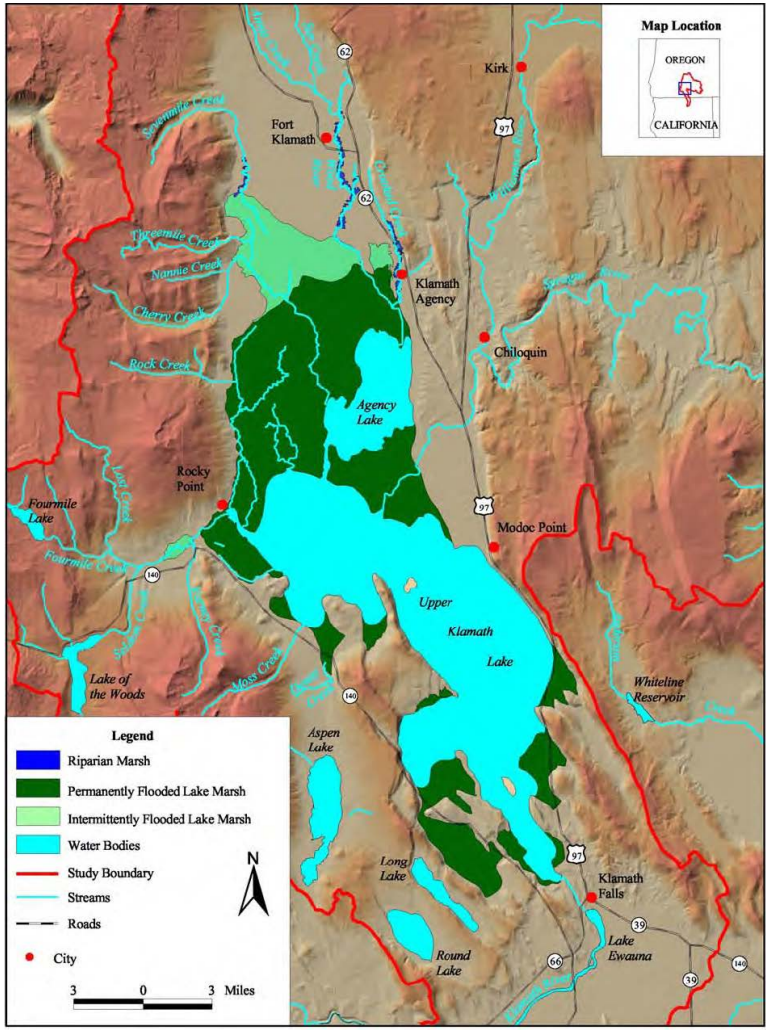
- Roaming filtering barges or stationary
- Barge costs
- Capital = $300k
- O&M = $3.4 mill
- $110 per Kg P filtered and removed to landfill

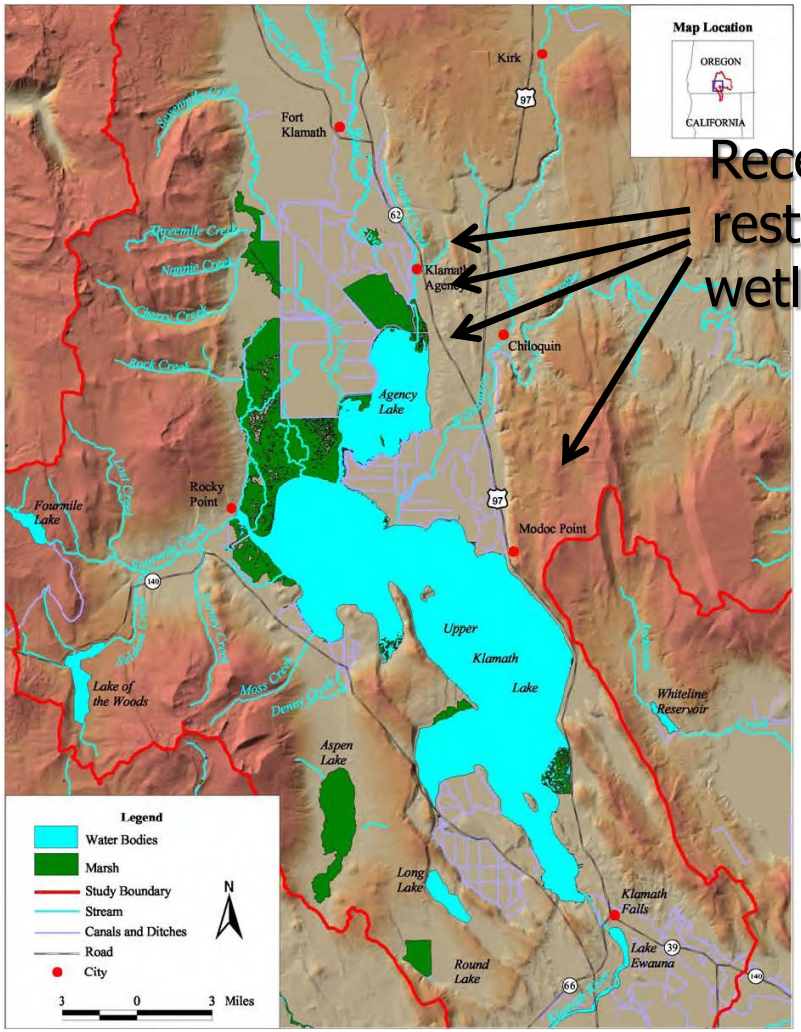
Filtration at Canal A

Restore existing marshes

- Based on general size of the current projects for restoration
- Capital = $15M to $28M
- O&M = $16M - $128M
- $30 - $480 per Kg P

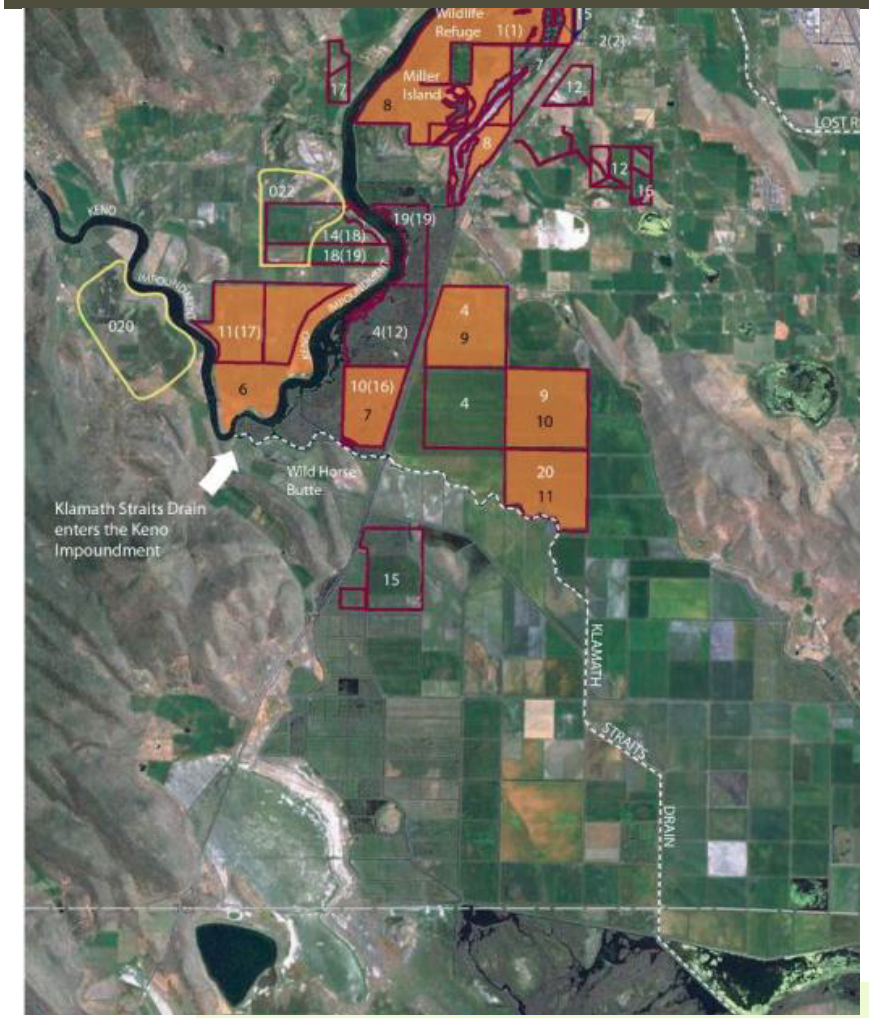
Wetlands Drained for Agriculture





Images: USBR (2005) Natural Flow of the Upper Klamath River

Build treatment marshes

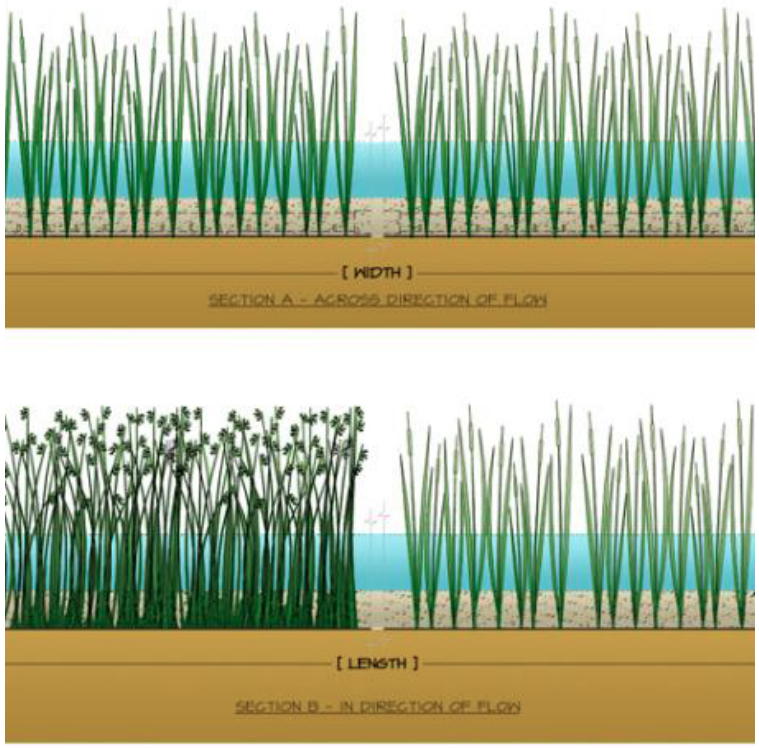


- For 1,000 to 2,000 acres for 50 years
- Capital = $17M
- O&M = $21M -$64M
- $47 - $162 per Kg P

Floating Treatment Wetlands

Considered as a type of treatment wetlands

Distributed BMP on Ranches



- 100 acre parcel with 0.9 acre in-pasture wetland
- 50 years
- Capital = $18k
- O&M = $12k
- $160-$320 per Kg P removed

Values and Conditions

- Values of the Public
- Ecosystem Function
- Demographics
- Energy and Global Climate Change
- Institutions
- Knowledge base

Values and Conditions

- Values of the Public
  - Trust individuals vs. control with rules
  - Rights: property-animal-"nature" continuum
  - Economics: financial methods can capture all important values
  - Job preference: people will seek environmental jobs
  - People support the government's projects
- Ecosystem Function
- Demographics
- Energy and Global Climate Change
- Institutions
- Knowledge base

Values and Conditions

- Values of the Public
- Ecosystem Function
  - The system is currently resilient and will take great effort to change
  - There are thresholds vs. the system will respond incrementally
  - Rehabilitated or restored ecosystems (marshes) will provide benefits to the public beyond just the marsh
- Demographics
- Energy and Global Climate Change
- Institutions
- Knowledge base

Values and Conditions

- Values of the Public
- Ecosystem Function
- Demographics
  - The population will grow significantly
  - Employment opportunities will increase overall
- Energy and Global Climate Change
- Institutions
- Knowledge base

Values and Conditions

- Values of the Public
- Ecosystem Function
- Demographics
- Energy and Global Climate Change
  - Strong global warming impact
  - Restricted/expensive energy costs
- Institutions
- Knowledge base

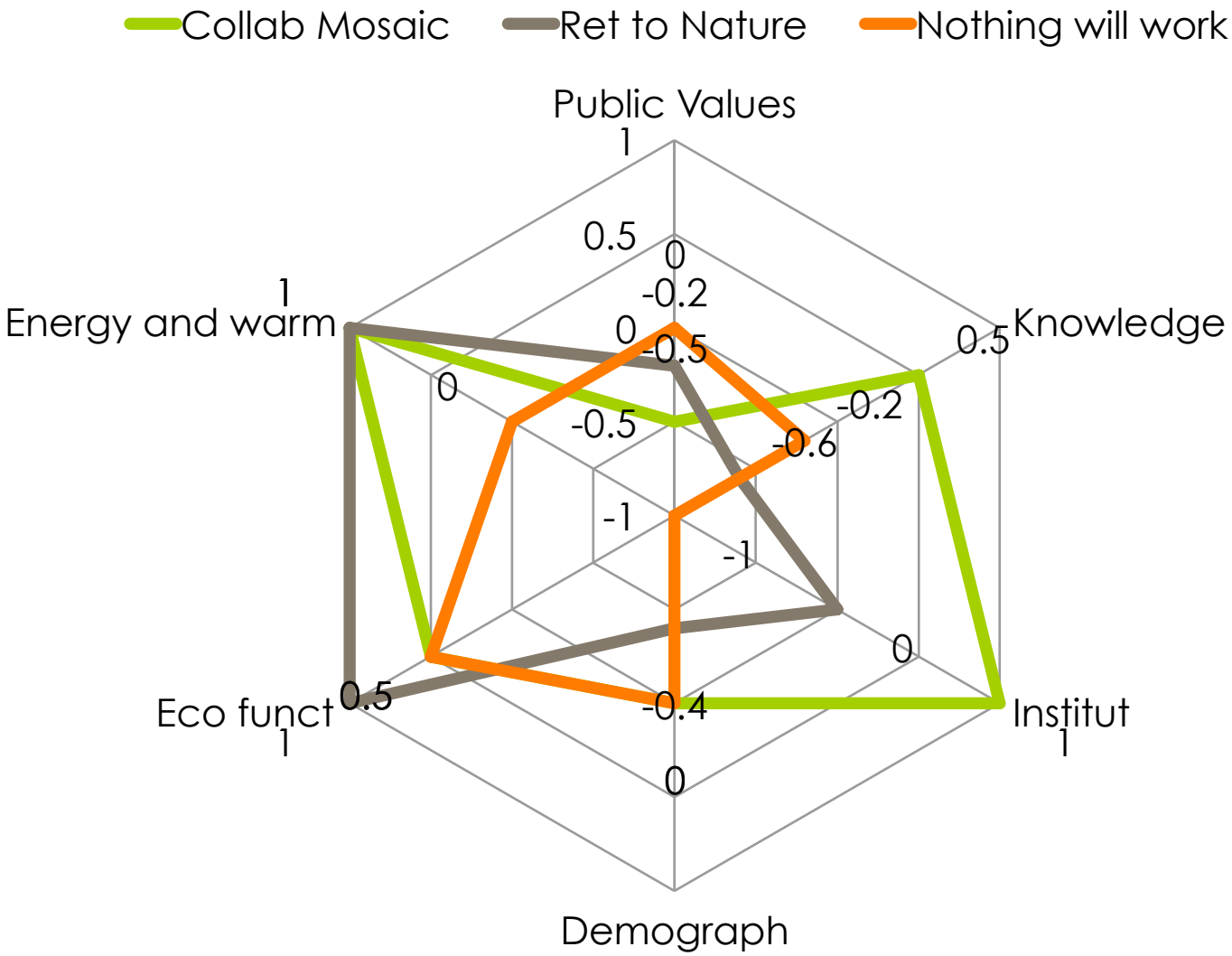
Values and Conditions

- Values of the Public
- Ecosystem Function
- Demographics
- Energy and Global Climate Change
- Institutions
  - Government is effective enough to lead change
  - Government has sufficient money
  - Government mission is stable over a long enough period to finish projects
  - NGOs and Trust are effective
  - Private enterprise, such as socially responsible corporations, can contribute to accomplishing goals
  - There is continued innovation in institutions to meet new needs
- Knowledge base

Values and Conditions

- Values of the Public
- Ecosystem Function
- Demographics
- Energy and Global Climate Change
- Institutions
- Knowledge base
  - technical projects are feasible at these scales
  - wetlands will provide desired water quality outcomes
  - direct innovation will help meet mission goals
  - Scientific adaptive management can be employed

Redo --- Cross comparison of assumptions



Fatalist/Techno-Skeptic

- Maybe interpreted as the need to take care of your current infrastructure
- Water spraying out of the penstock that connects the Link River Dam to the powerhouse
- Shooting 10 to 30 feet into the air

Knowledge, Control & Values

- Knowledge
  - From well understood to substantial uncertainty
- Control
  - From ability to manage projects to un-manageable
- Values
  - From everybody agrees to mismatches between individuals and society or disparity in the benefits