Collaborative Modeling for Decision Support & IWRM

Integrating collaborative modeling with participatory processes to inform natural resource management decisions.

Collaborative Modeling Steering Committee:

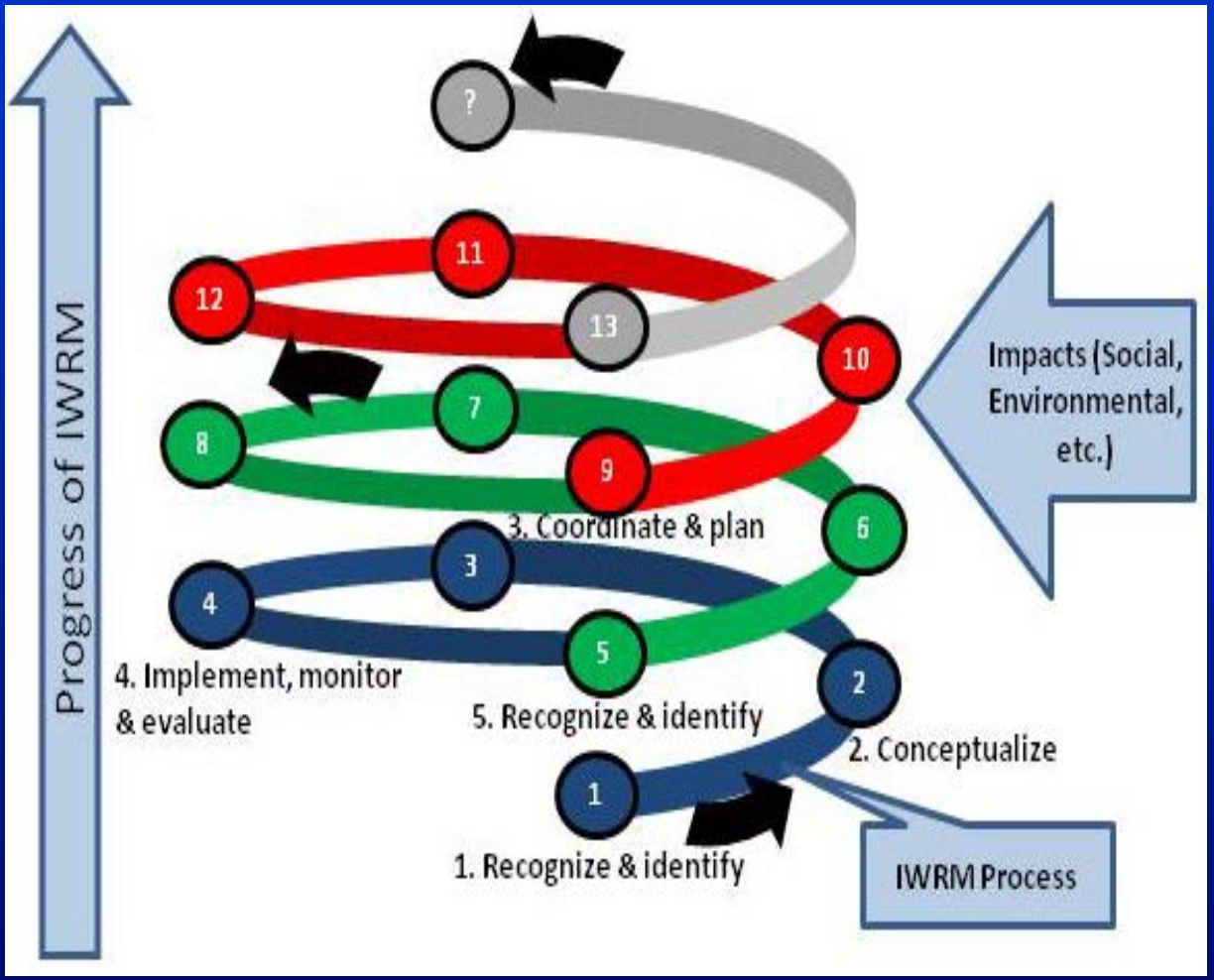
Hal Cardwell, USACE; Vince Tidwell, Sandia National Labs; Brian Manwaring , USIECR; Stacy Langsdale, USACE; Megan Wiley-Rivera, Hydrologics; Linda Manning, Council Oaks; Mark Lorie, Resolution Planning; Bill Werick, Werick Creative Solutions; Bill Michaud, SRA Intl.

IWRM – Emperor's New Clothes or Indispensible Process?

- GWP Definition – *IWRM is a process which promotes the coordinated development and management of water land and related resources in order to maximize the resultant economic and social welfare in an equitable madder without compromising the sustainability of vital ecosystems*
- GWP doesn't say how, doesn't give guidelines
- Our *obligation* to go beyond definitions to operationalize IWRM

UNESCO-IHP IWRM Guidelines

http://www.unesco.org/water/news/pdf/Part_1_Principles.pdf



IWRM evolves over time, adapts to new demands and needs

Each phase has an IWRM process:

- Recognize & Identify
- Conceptualize
- Coordinate and Plan
- Implement, monitor & evaluate

Implementing IWRM Ain't easy

- Persistent conflict; Conflicting interests / values
- Complexity & uncertainty in overlapping systems
  - Natural systems: hydrology, ecology etc.
  - Human systems: infrastructure, policy, funding, etc.

Requires "sound science" (physical and social)

Stakeholder Involvement is imperative

Q: How to integrate technical analysis into a public, multi-stakeholder decision process

Collaborative Modeling for Decision Support

the use of collaboratively built computer models to support negotiation and decision-making for water resources problems

- Various similar approaches & proponents addressing water issues around the world
  - Droughts, Reservoir Operation, TMDLs, Urban Water Mgmt, Water Supply Permitting, Water Allocation

"the process of building a model is a way of working out a shared view of what is being managed and how the managing should be done." K. Lee

- builds understanding of the system –
- builds confidence in the analysis
- builds trust between stakeholders

Infusing Collaboration into Traditional Planning

SETTING THE STAGE FOR COLLABORATION

Deciding who else is a "partner"

Identifying the levels of involvement in decision making

Developing organizational arrangements

Developing process agreements with partners

Establishing a process for consultation with other stakeholders and interests

Additional Collaborative Elements

TRADITIONAL PLANNING PROCESS

Identifying Problems and Opportunities (Step 1)

Inventorying and Forecasting (Step 2)

Formulating Alternative Plans (Step 3)

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Selecting Recommended Plan (Step 6)

COLLABORATION DURING TRADITIONAL PLANNING PROCESS

Team (multi-party) decision making

Opportunities for stakeholder involvement throughout the process

Exploration of non-traditional objectives

Iterative development and modification of objectives

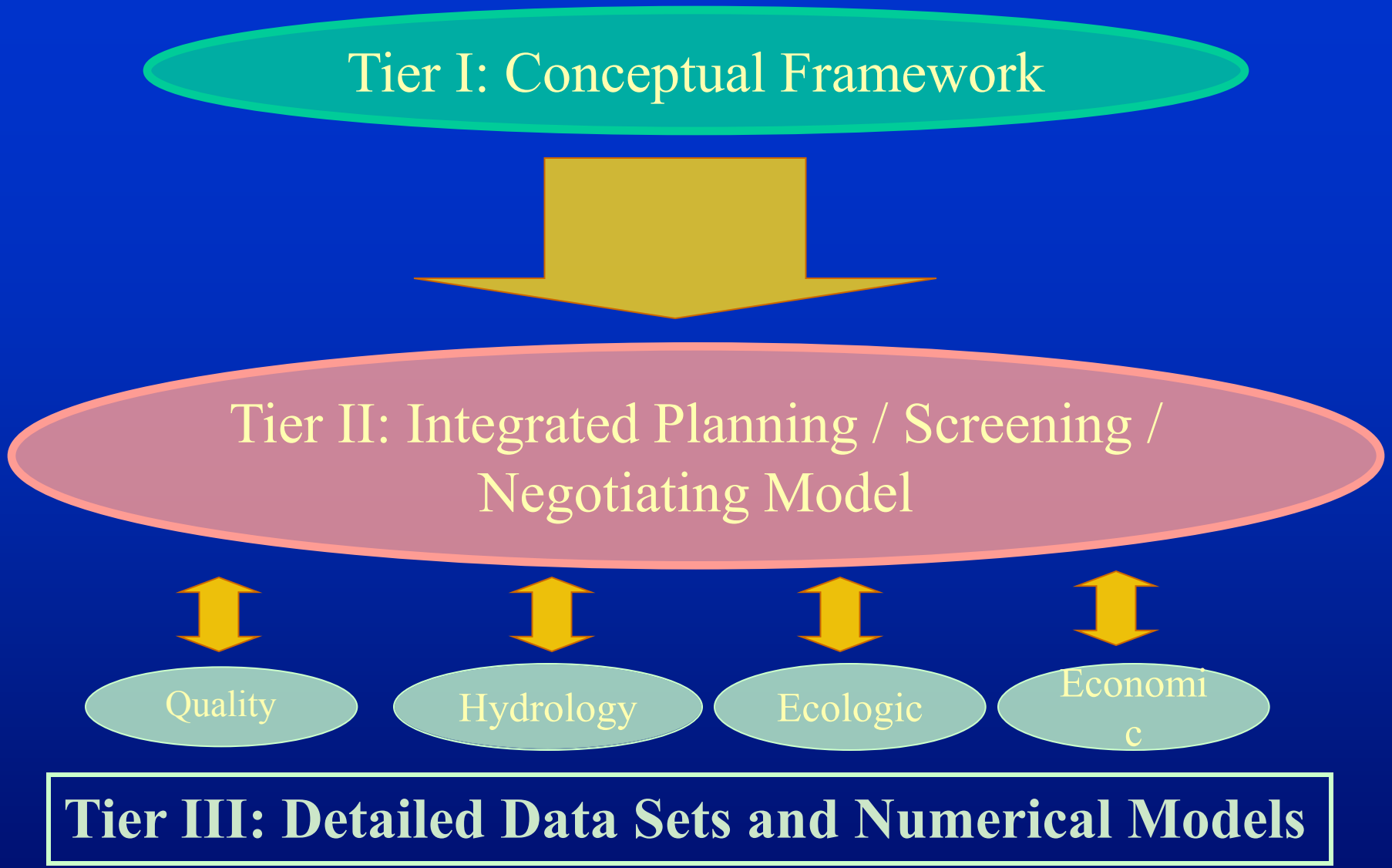
Joint analysis of technical data

Collaborative evaluation of alternatives

Adaptive Management

Characteristics of Collaborative Models

- **Integrated**
  - all issues are in one place
- **User Friendly**
  - can be used by non-technical parties
- **Understandable/Transparent**
  - assumptions, input, relationships, & output
- **Relevant**
  - to the issues important to stakeholders and decision makers
- **Adaptable/Flexible**
  - to changing conditions or evolving process


Tier I: Conceptual Framework
Tier II: Integrated Planning / Screening / Negotiating Model
Quality
Hydrology
Ecologic
Economic
Tier III: Detailed Data Sets and Numerical Models

What is different...

...from other collaborative planning processes?

– the focus on the technical analysis

...from traditional technical analysis?

– the participation of stakeholders in developing and validating the analysis

Collaborative Modeling for Decision Support

- Focus on Water, but applicable to all Natural Resources
- More than a DSS – a way to build and use simulation models
- Lots of variations on the theme – why?
- End game – making the decision – is our weak link

This Week's Module

- Videos
  - SVP and Regulatory (history & regulatory)
  - Collaborative Modeling in the Roanoke
  - SVP and Lake Ontario
- Readings
  - SVP definitional paper (AWRA special issue)
  - Shabman & Stevenson papers from Converging Waters
  - Lake Ontario paper
- Exercise
  - Web based Lake Ontario Model
  - Excel Lake Ontario Model
  - Discussion

Collaborative Modeling for Decision Support

the use of collaboratively built computer models to support negotiation and decision-making for water resources problems

- Sept 07 workshop was 1st attempt to gather a large group of practitioners, advocates and researchers
- Focused on commonalities across approaches and practitioners, and building a community

Collaborative Modeling for Decision Support

the use of collaboratively built computer models to support negotiation and decision-making for water resources problems

- Oct 09 Workshop created - 6 workgroups
  - Identity, Naming, and Branding
  - Apprenticeship and Internship Program
  - Evaluation criteria
  - Build a community of practice
  - International, Integrated Water Resources Management
  - Agency and Political Buy-In

Collaborative Modeling for Decision Support

the use of collaboratively built computer models to support negotiation and decision-making for water resources problems

- Jun 11 symposium
  - focuses on linkage between IWRM and Collaborative Modeling and
  - extends the discussion internationally
- Will result in UNESCO-IHP Guidelines on Collaborative Modeling for IWRM

putting clothes on the emperor

Collaborative Modeling & IWRM - Symposium Agenda

- Sunday – Workshop on Integrated Modeling
- Yesterday – Plenary - Clothing the Emperor
- 8:30-10 - Opening session
- 10:30-5:00 - Case Studies & Discussion
- 5:00-6:00 – Facilitated Discussion
- 6:00-7:30 – Reception (CDM) – **Book Launch**
- Tomorrow – Working session

Stakeholder Involvement in Technical Analysis is not just theory

- Applied across different water issues:
  - Droughts, TMDLs, Urban Water Mgmt, 404 Water Supply Permitting, Reservoir Operation, Water Allocation
- Applied across various advocates/sponsors:
  - Feds, states, NGOs, private sector
- Interagency federal initiative
- Corps is mounting a major effort to support collaborative planning

April Water Resources Impact Article

UNESCO-IHP Phases of IWRM	The Steps of Shared Vision Planning
1. Recognize and Identify a. Recognize b. Identify problems and needs c. Create public awareness & accountability d. Develop capacity	1. Build team & Identify problems and opportunities
1. Conceptualize a. Assess b. Conceptualize c. Draft plan	1. Develop objectives and metrics for evaluation
	1. Develop a collaborative model and evaluate the '*status quo*'
	1. Formulate Alternatives
1. Coordinate and plan details a. Build coordinating mechanism b. Coordinate c. Reach preliminary agreements d. Finalize the plan **e. Reach an agreement**	5. Evaluate alternatives and make recommendations
	5. Institutionalize the plan or project
1. Implement, monitor and evaluate a. Implement b. Monitor & evaluate	5. Exercise and update (adapt) the plan or project

Identified How Collaborative Modeling accomplished IWRM goals

- Problem Definition:
- Collaboration:
- Technical Analysis:
- Reach Agreement/Make Recommendation:
- Monitor and Evaluate:

Today

- Critically analyze each case study
  - Convening stakeholder-based processes in IWRM
  - Using Decision Support Tools in IWRM
  - Navigating Institutional Frameworks and Implementing Decisions
  - Outcome
  - Reflection
- Identify Keys for Success across case studies

Post –Symposium

- August 2011 - 1st draft – Guidelines for Use of Collaborative Modeling for IWRM
- Fall 2011 - GWP workshop
- Spring 2012 – Final UNESCO-IHP Guidelines
- March 2012 – World Water Forum – Implementing IWRM track
- Other activities domestically, methodologically
- 2013 ????
- Keep in touch - LinkedIn

Here we are assembling the best thinkers on water management, decision-support, and dispute resolution
The aim is to develop the best possible methods for addressing tomorrow's toughest water management problems

Entreaties

- Listen / Engage / Debate
- Focus on the Key's for Success / Obstacles
- Reach for the (Emperor's) Gold Ring

IWRM GUIDELINES at RIVER BASIN LEVEL:
USING COLLABORATIVE MODELLING FOR
DECISION SUPPORT TO IMPLEMENT IWRM

Objective for Today

I. Introduction - *problem, purpose and location of the study? What was the catalyst or reason for using collaborative modeling / shared vision planning?*

II. Convening stakeholder-based processes in IWRM - *Describe the participatory framework who was involved? What role did they play*

III. Using decision support tools in iwrm *how did collaborative modeling support conceptualization of the project decision or plan)?*
How did collaborative modeling support implementation, monitoring and evaluation of the decision or plan?

IV. Navigating Institutional Frameworks and Implementing Decisions - *describe any policies or legislation that influenced the study. Challenges*

V. Outcome - *what changed as a result of your effort?*

VI. Reflection - *describe the most critical aspects of your project for support of IWRM*

Collaborative Modeling & IWRM – The Long View

- Assembled today we have some of the best thinkers on water management, decision-support, and dispute resolution
- Our aim should be to develop the best possible methods for addressing tomorrow's toughest water management problems
- Let's clothe that Emperor – PICTURE?

II. CONVENING STAKEHOLDER-BASED PROCESSES IN IWRM

Please describe the participatory framework and how that was used to identify a distinct set of problems or opportunities. Who was involved? What role did they play (e.g. data provider, reviewer, problem definer, etc.)? What aspects of the participation framework enhanced or restricted IWRM planning?

How did collaborative modeling support coordination of all the participants? Did the collaborative model support stakeholder participation throughout the process, from problem definition through implementation? How did participation influence public awareness of the problem and/or increase accountability?

What were the capacity development needs and limitations of stakeholders?

III. USING DECISION SUPPORT TOOLS IN IWRM 85

How did collaborative modeling support conceptualization of the project decision or plan (from developing objectives through formulating alternatives)?

How was collaborative modeling used to coordinate and plan details (evaluate and finalize the decision or plan)?

How did collaborative modeling support implementation, monitoring and evaluation of the decision or plan?

IV. NAVIGATING INSTITUTIONAL FRAMEWORKS AND IMPLEMENTING DECISIONS

Describe any policies or legislation that influenced the study. See above.

Principles & Best Practices for Collaborative Modeling

1. Models must address the questions that are important to decision makers and stakeholders.
2. Collaborative modeling should support interest-based processes.
3. Leading collaborative modeling requires both modeling and facilitation skills.
4. All stakeholders' interests should be represented in the model and the process.
5. Collaborative modeling should build trust and respect among all parties.
6. Collaborative modeling should be accessible to all participants.
7. Model design should encourage exploration of the problem space.

The Principles

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For more information:

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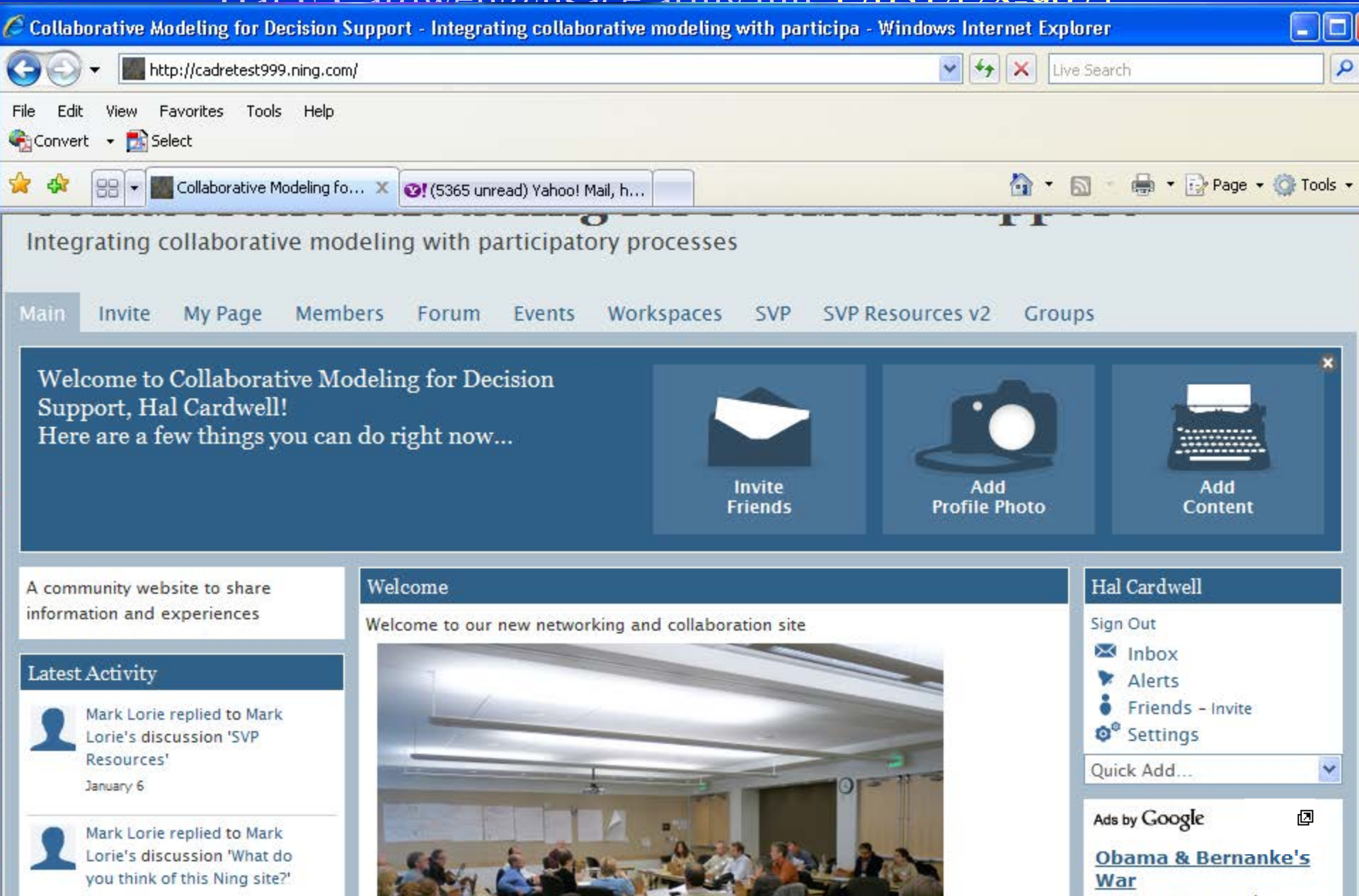

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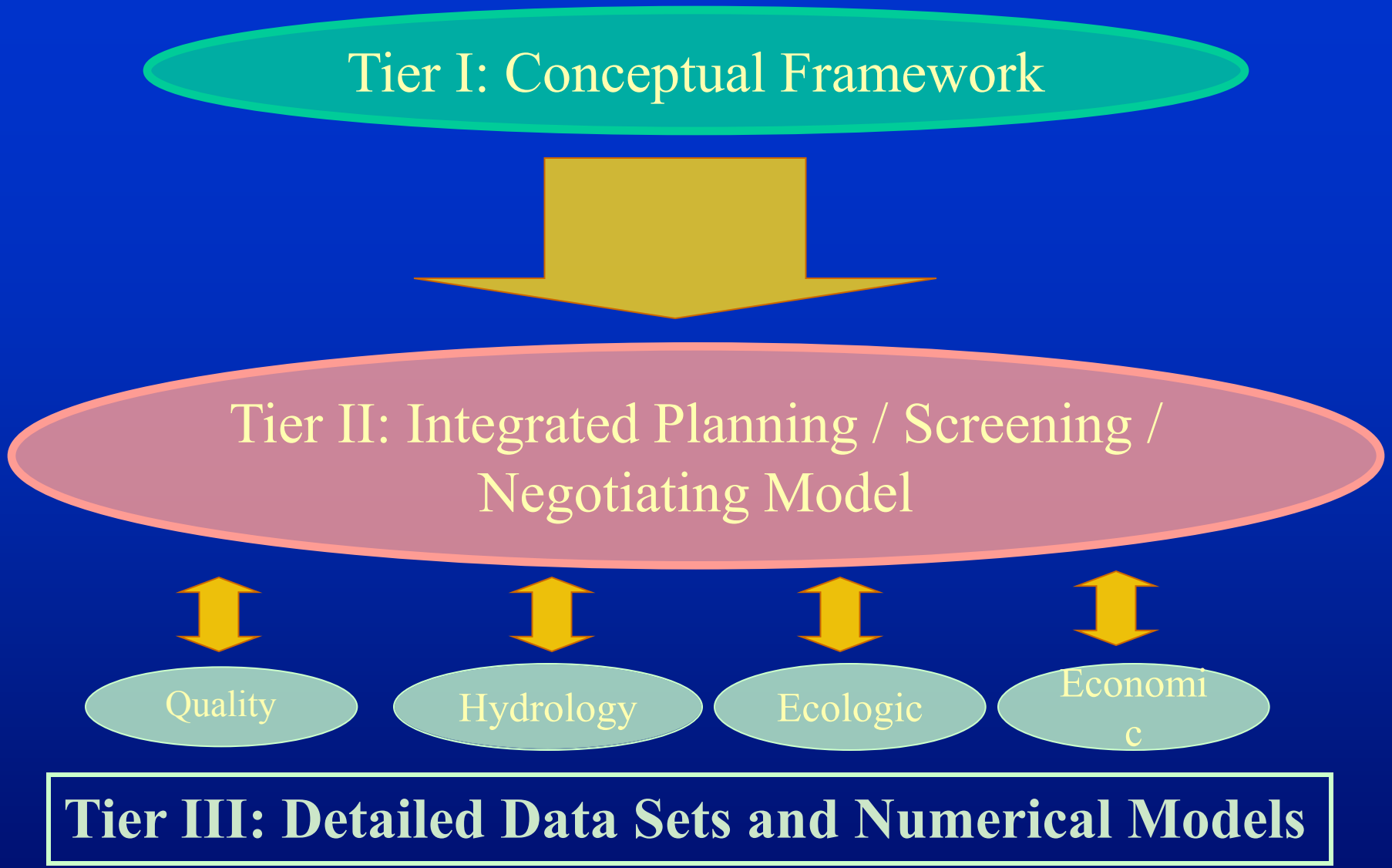
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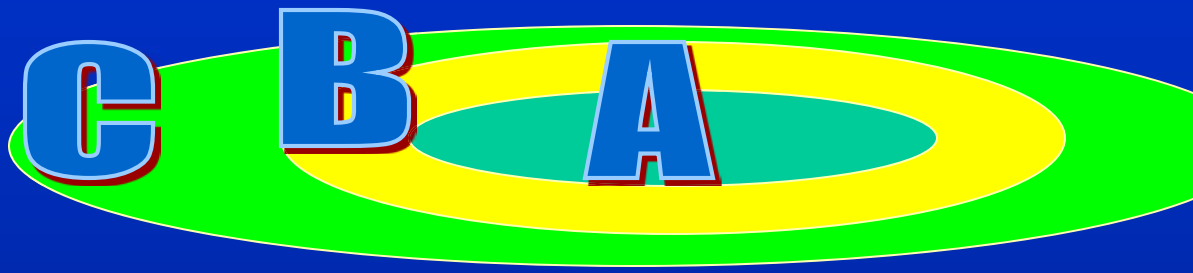
A Quick Example - Lake Ontario Regulation Study

- Five year, $25 Million study on re-regulation of Lake Ontario-St. Lawrence River
- Co-sponsored by the US and Canada through the International Joint Commission
- Collaboratively-built models help interest groups identify and begin to quantify the relationships between hydrology and their interests.

Structured Stakeholder-involvement in Model building



Circle A

- Modelers from Corps + Envt Canada + contractors
- email, weekly teleconferences

Circle B

- Working groups on Navigation, Hydropower, M&I water supply, Environment, recreational boating, coastal (lake) erosion
- Working groups developed technical information and passed it to the Circle A team

Circle C

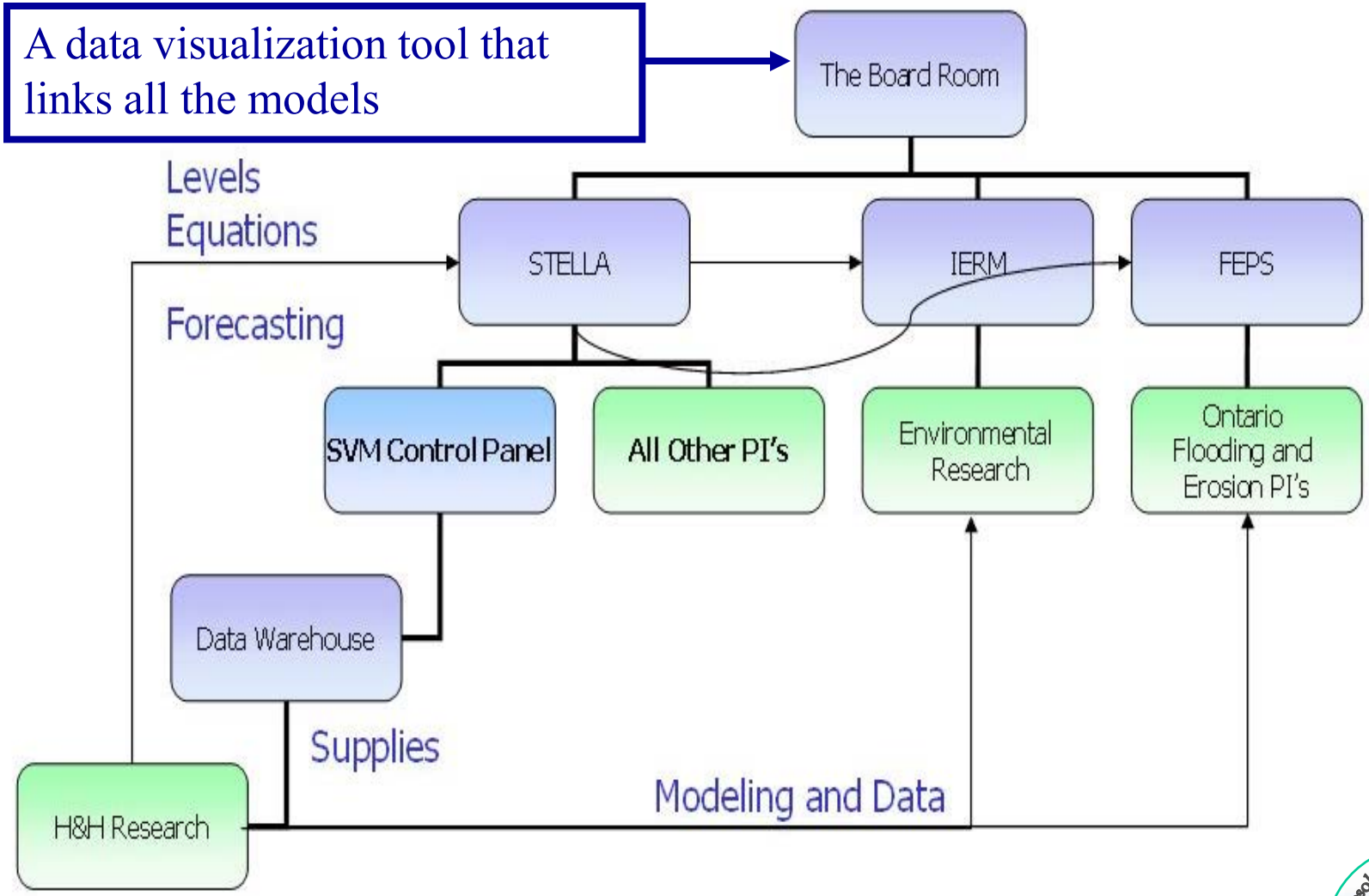
- The most interested members of the public
- Technical experts in subsidiary studies
- Road Show presentations at stakeholder gatherings

Circle D

- Practice Decision-Making workshop with US-Canada Study Board

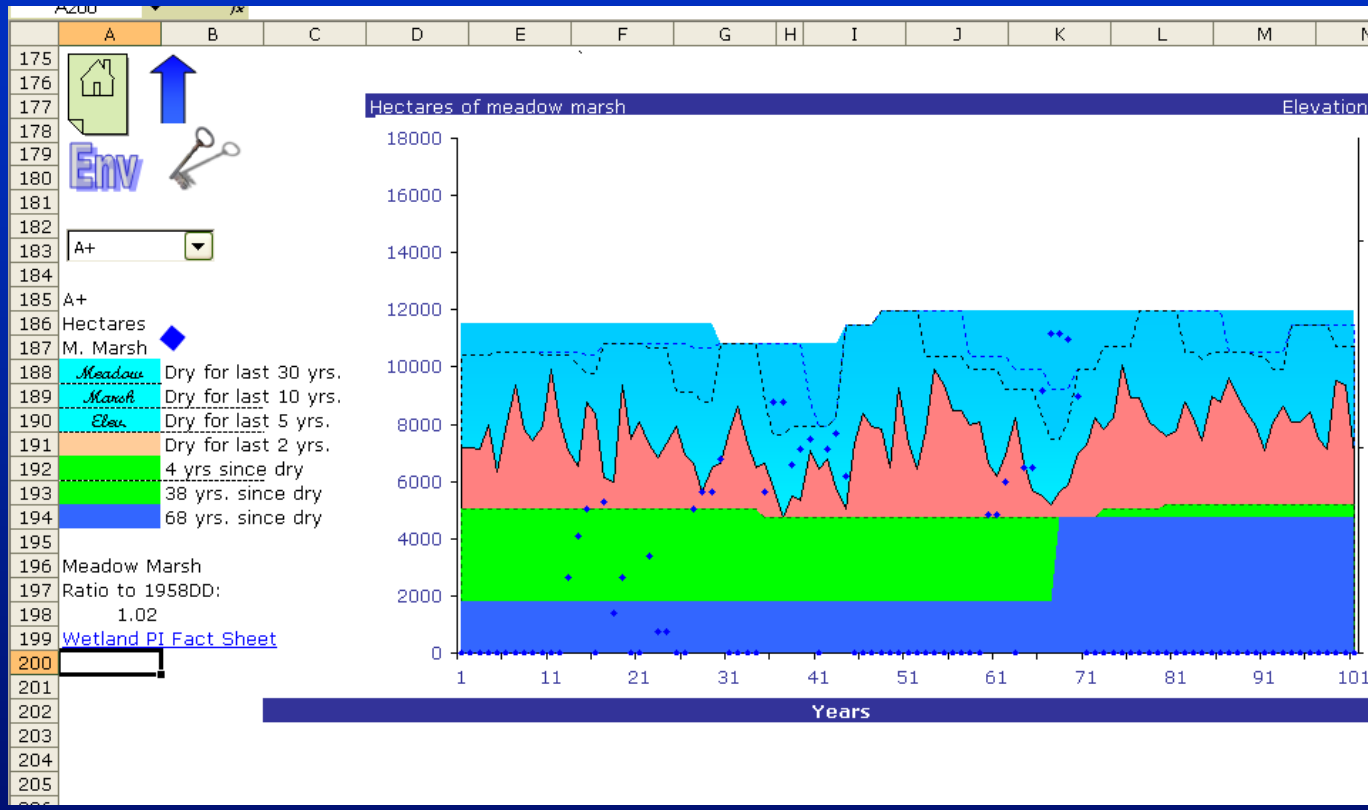
Stella linked w/process models

A data visualization tool that links all the models



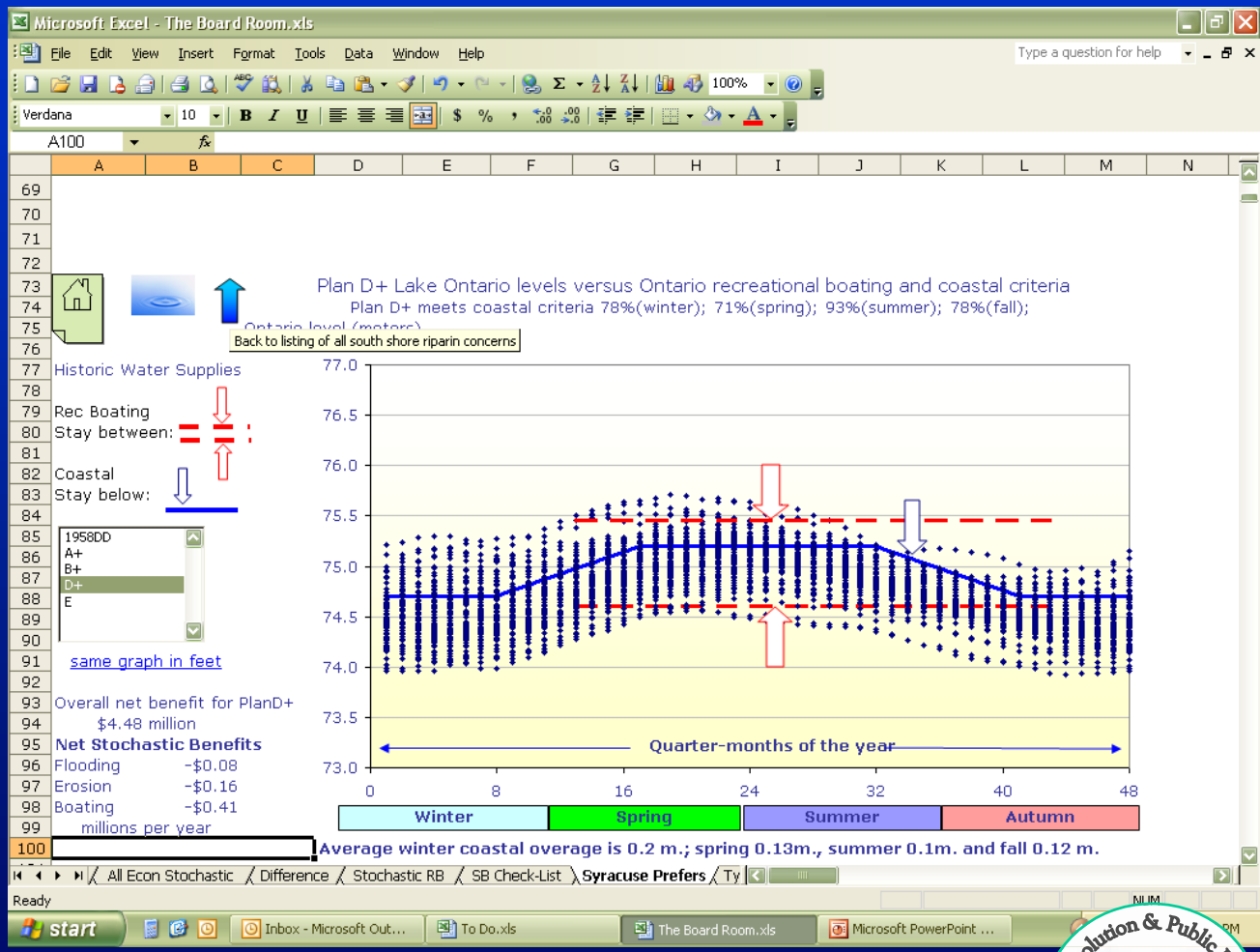
Evaluation using dynamic Excel spreadsheet in workshop settings

Graphic displays like this one on meadow marsh can relate alternatives to "thing people care about"; able to switch alternatives to play "what if" games



Evaluation using dynamic Excel spreadsheet in workshop settings

Different graphics can display more of the available data in ways that people relate to – and again allow what-if games.



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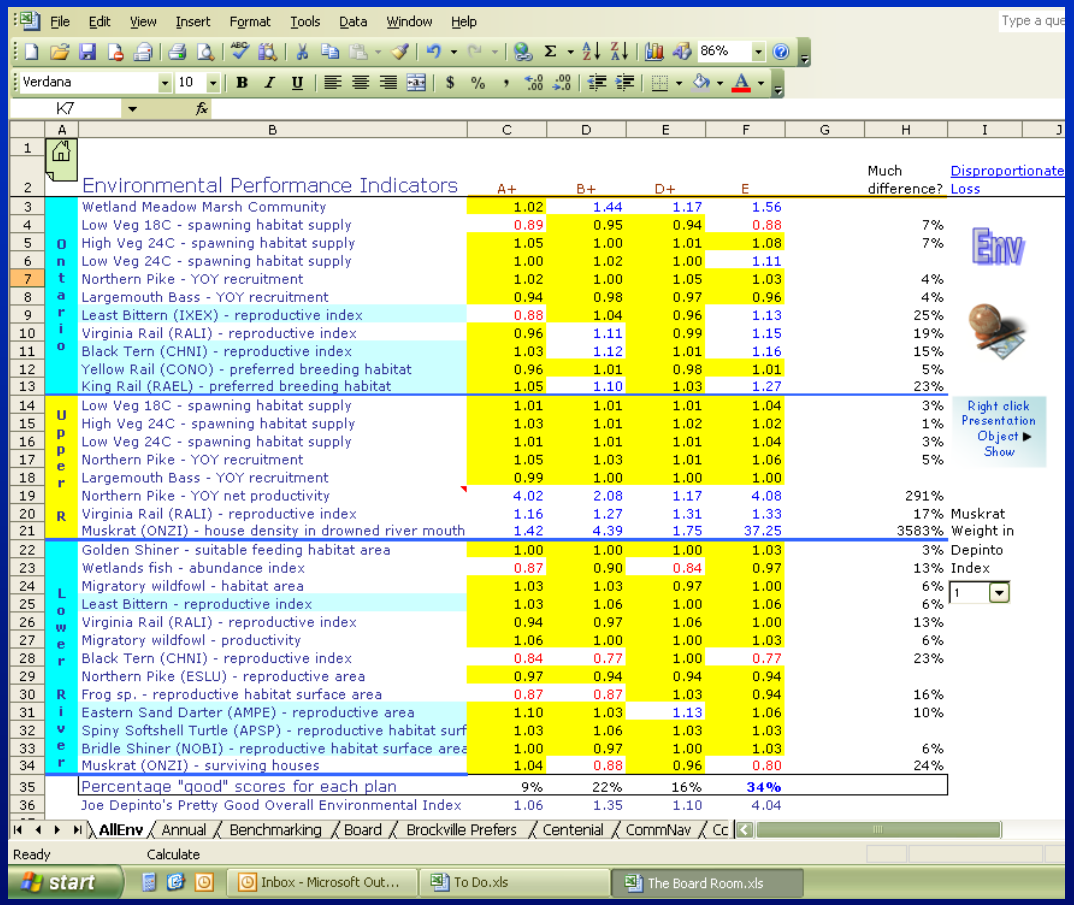
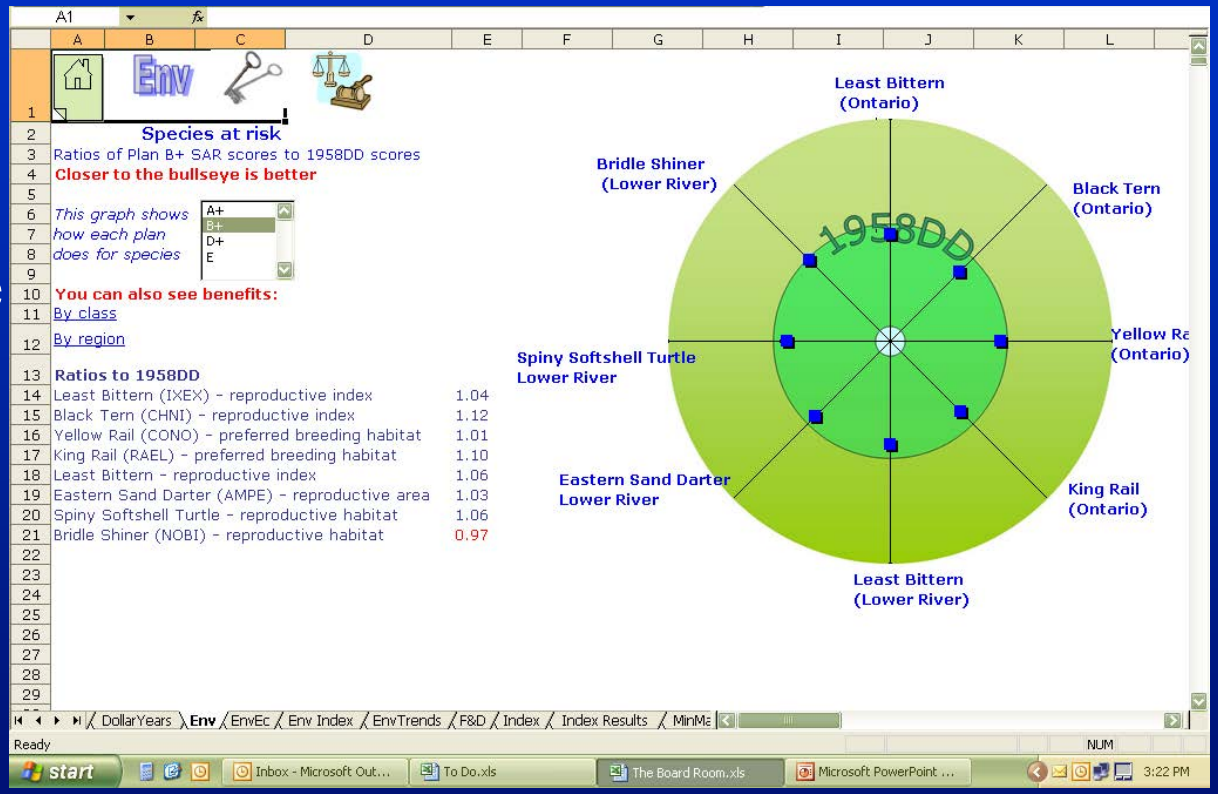


		Environmental Performance Indicators	A+	B+	D+	E	Much difference?	Disproportionate Loss
3		Wetland Meadow Marsh Community	1.02	1.44	1.17	1.56		
4		Low Veg 18C - spawning habitat supply	0.89	0.95	0.94	0.88	7%	
5	O	High Veg 24C - spawning habitat supply	1.05	1.00	1.01	1.08	7%	
6	n	Low Veg 24C - spawning habitat supply	1.00	1.02	1.00	1.11		
7	t	Northern Pike - YOY recruitment	1.02	1.00	1.05	1.03	4%	
8	a	Largemouth Bass - YOY recruitment	0.94	0.98	0.97	0.96	4%	
9	r	Least Bittern (IXEX) - reproductive index	0.88	1.04	0.96	1.13	25%	
10	i	Virginia Rail (RALI) - reproductive index	0.96	1.11	0.99	1.15	19%	
11	o	Black Tern (CHNI) - reproductive index	1.03	1.12	1.01	1.16	15%	
12		Yellow Rail (CONO) - preferred breeding habitat	0.96	1.01	0.98	1.01	5%	
13		King Rail (RAEL) - preferred breeding habitat	1.05	1.10	1.03	1.27	23%	
14		Low Veg 18C - spawning habitat supply	1.01	1.01	1.01	1.04	3%	
15	U	High Veg 24C - spawning habitat supply	1.03	1.01	1.02	1.02	1%	
16	p	Low Veg 24C - spawning habitat supply	1.01	1.01	1.01	1.04	3%	
17	p	Northern Pike - YOY recruitment	1.05	1.03	1.01	1.06	5%	
18	e	Largemouth Bass - YOY recruitment	0.99	1.00	1.00	1.00		
19	r	Northern Pike - YOY net productivity	4.02	2.08	1.17	4.08	291%	
20		Virginia Rail (RALI) - reproductive index	1.16	1.27	1.31	1.33	17%	Muskrat
21	R	Muskrat (ONZI) - house density in drowned river mouth	1.42	4.39	1.75	37.25	3583%	Weight in
22		Golden Shiner - suitable feeding habitat area	1.00	1.00	1.00	1.03	3%	Depinto
23		Wetlands fish - abundance index	0.87	0.90	0.84	0.97	13%	Index
24		Migratory wildfowl - habitat area	1.03	1.03	0.97	1.00	6%	1
25	L	Least Bittern - reproductive index	1.03	1.06	1.00	1.06	6%	
26	o	Virginia Rail (RALI) - reproductive index	0.94	0.97	1.06	1.00	13%	
27	w	Migratory wildfowl - productivity	1.06	1.00	1.00	1.03	6%	
28	e	Black Tern (CHNI) - reproductive index	0.84	0.77	1.00	0.77	23%	
29	r	Northern Pike (ESLU) - reproductive area	0.97	0.94	0.94	0.94		
30	R	Frog sp. - reproductive habitat surface area	0.87	0.87	1.03	0.94	16%	
31	i	Eastern Sand Darter (AMPE) - reproductive area	1.10	1.03	1.13	1.06	10%	
32	v	Spiny Softshell Turtle (APSP) - reproductive habitat surf	1.03	1.06	1.03	1.03		
33	e	Bridle Shiner (NOBI) - reproductive habitat surface area	1.00	0.97	1.00	1.03	6%	
34	r	Muskrat (ONZI) - surviving houses	1.04	0.88	0.96	0.80	24%	
35		Percentage "good" scores for each plan	9%	22%	16%	**34%**		
36		Joe Depinto's Pretty Good Overall Environmental Index	1.06	1.35	1.10	4.04		

Table displays resonate with some & color coding can help focus information.

Evaluation using dynamic Excel spreadsheet in workshop settings

A radar or "bulls-eye" format can help display relative impacts of different alternatives. Again, color-coding and what-if games may help people learn about options.



Outcomes of Ontario Case

- Increased general understanding of how the system works and others' concerns
- Models reflective of public concerns, with results understandable and accessible to those interested
- Three new alternative plans identified
- Status:
  - Two alternatives refined
  - Proposed approach issued for public comment
  - One-year process proposed to address remaining concerns and to lead to inter-governmental concurrence

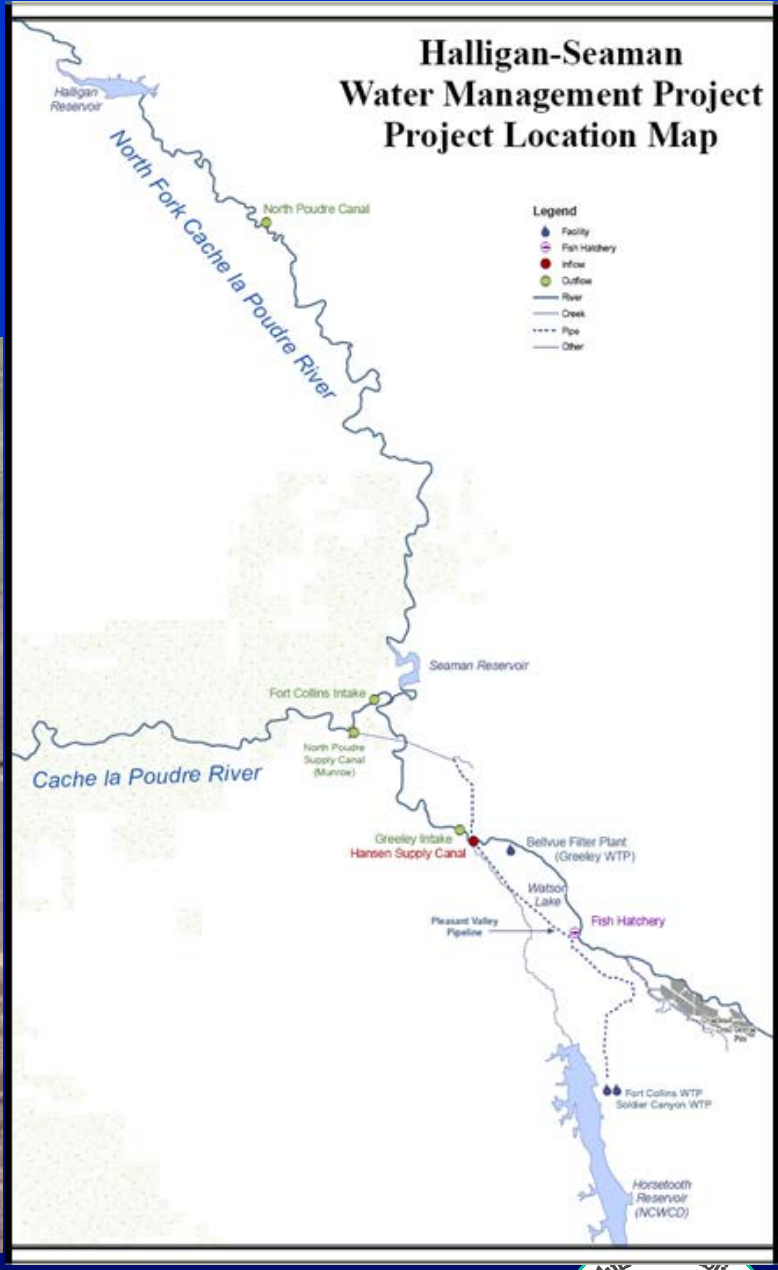
Example 2:
SVP application in Regulatory with Western States Water Council

Cache La Poudre River, CO

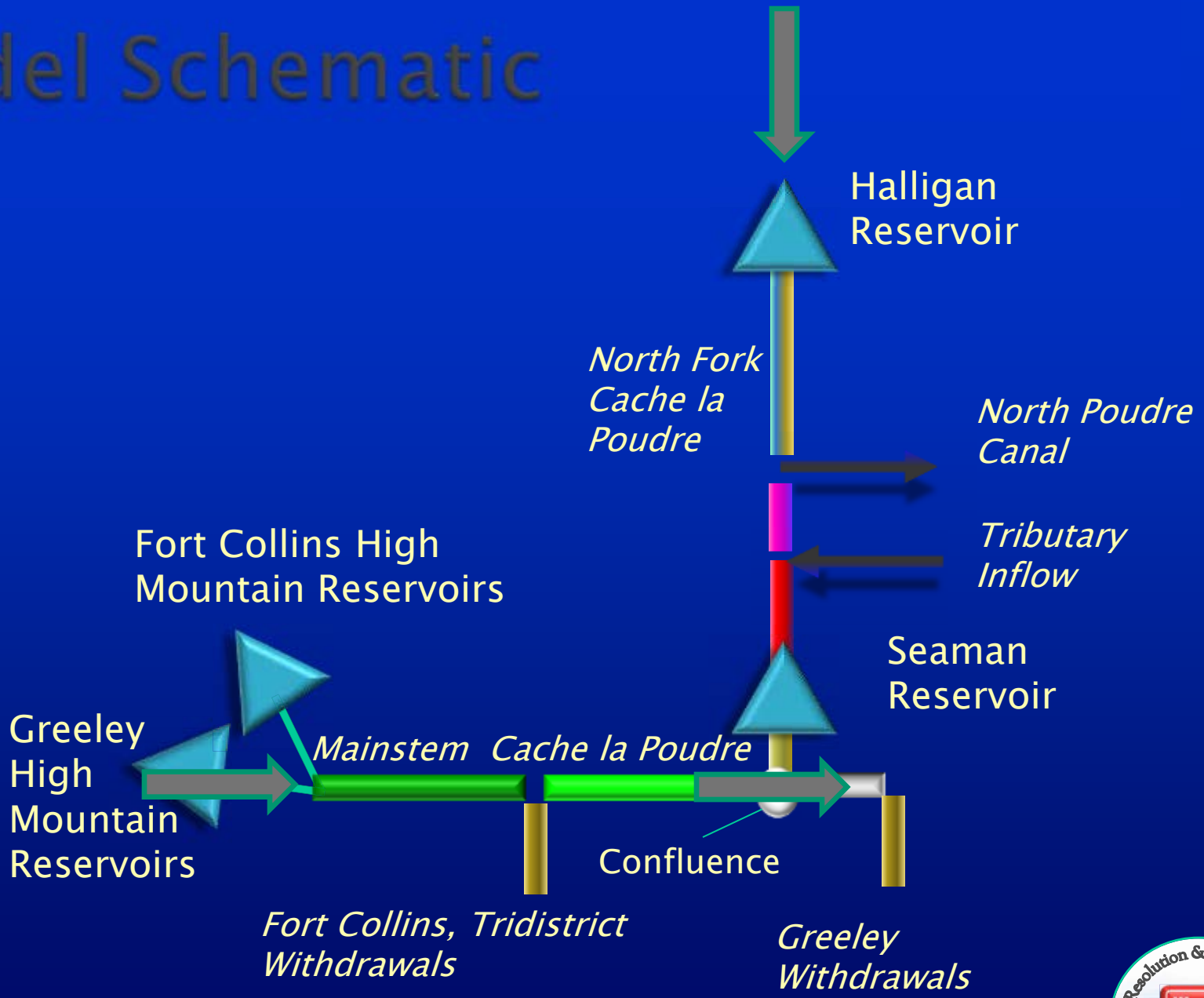
Public Participation

- Anyone who can "veto" should be involved
- Includes decision makers or NGOs who can access through public review but without shared vision
- Practical limits – not every possible individual, but involve the true leaders of different sectors
- Local TNC reps actively involved in validating and contributing information.

Cache La Poudre River, CO



Model Schematic



What Could Happen?

Better, Faster, Cheaper

- What could go right?
  - Open up the permit process so there is more immediate feedback about what would be permittable
  - Clarify the objectives and constraints of all who will have a voice in the permitting process.
  - One medium length analysis that leads to a decision versus countless short to medium length revisions brought on by challenges
  - Better solution
- What could go wrong?
  - Participants hoping for a specific alternative may not be able to stay with the process
  - Participants could fake collaboration ("Oh, I thought you said "discovery")

Example 3: Collaborative Modeling application for Reservoir Operations and TMDLs

Willamette River, OR

Planning Setting - Willamette Basin

- 28,750 km^2, 300 km long, 5 million people
- 2007 – Oregon DEQ adopts a TMDL for Temperature
- 2008 – USFWS & NMFS draft Bio. Opinions for O&M of Corps Willamette Projects
- Concerns re: reservoir op. effects on Recreation & other project purposes
- Pending water supply reallocation & contracting issues
- Desire to establish a marketplace for ecological goods & services
- Sustainable Rivers Project site

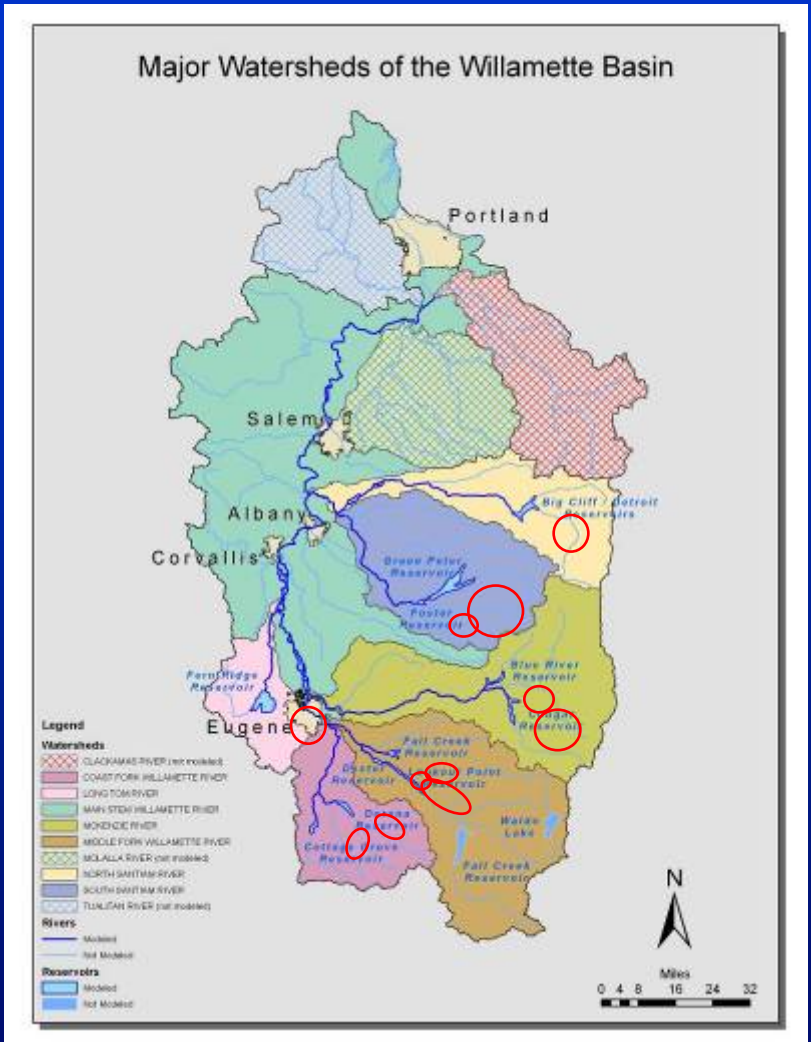
Willamette: Key Players

- *USACE - Portland District:* Operates 13 reservoirs for flood control, power generation, recreation, and water quality

- *Willamette Partnership*: Consortium of interested parties including ODEQ, industry, local, regional, and state governments, NGO's, and academia
  - Evaluate policy alternatives for temperature trades in the basin
  - $ value to point source reductions, added shading, etc.

- *Local stakeholders*: Build confidence and support for any decisions that are made

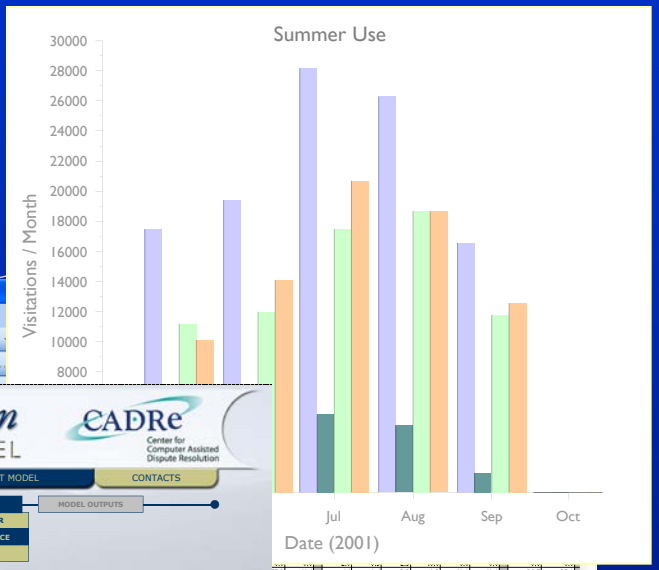
Model Objectives

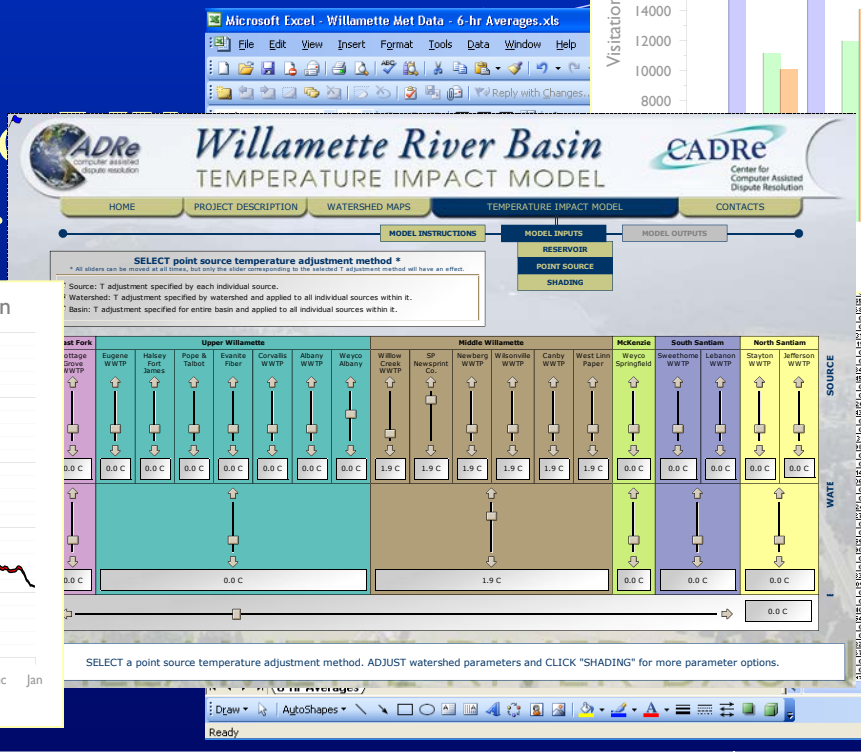


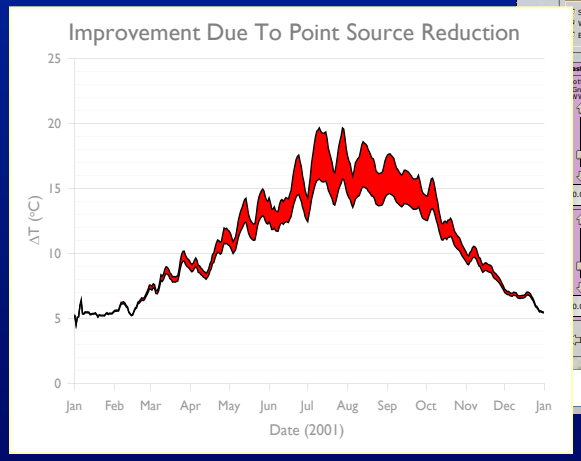
- Policy Options Considered
  - Reservoir operations
  - Shading
  - Point Source
- Modeled Effects
  - Hydrology (Flow rates, water levels, water temp),
  - Economics (Costs, Power generation, Recreation,
  - Environmental (Fish habitat, Nutrient loading, Carbon sequestration)

Modeling Approach

- System Dynamics - Powersim
  - Stocks and Flows
  - Link w/ Outside Data
  - Visualization
  - Quick execution
  - Optimization
- Basin Dived int
- Simulation year



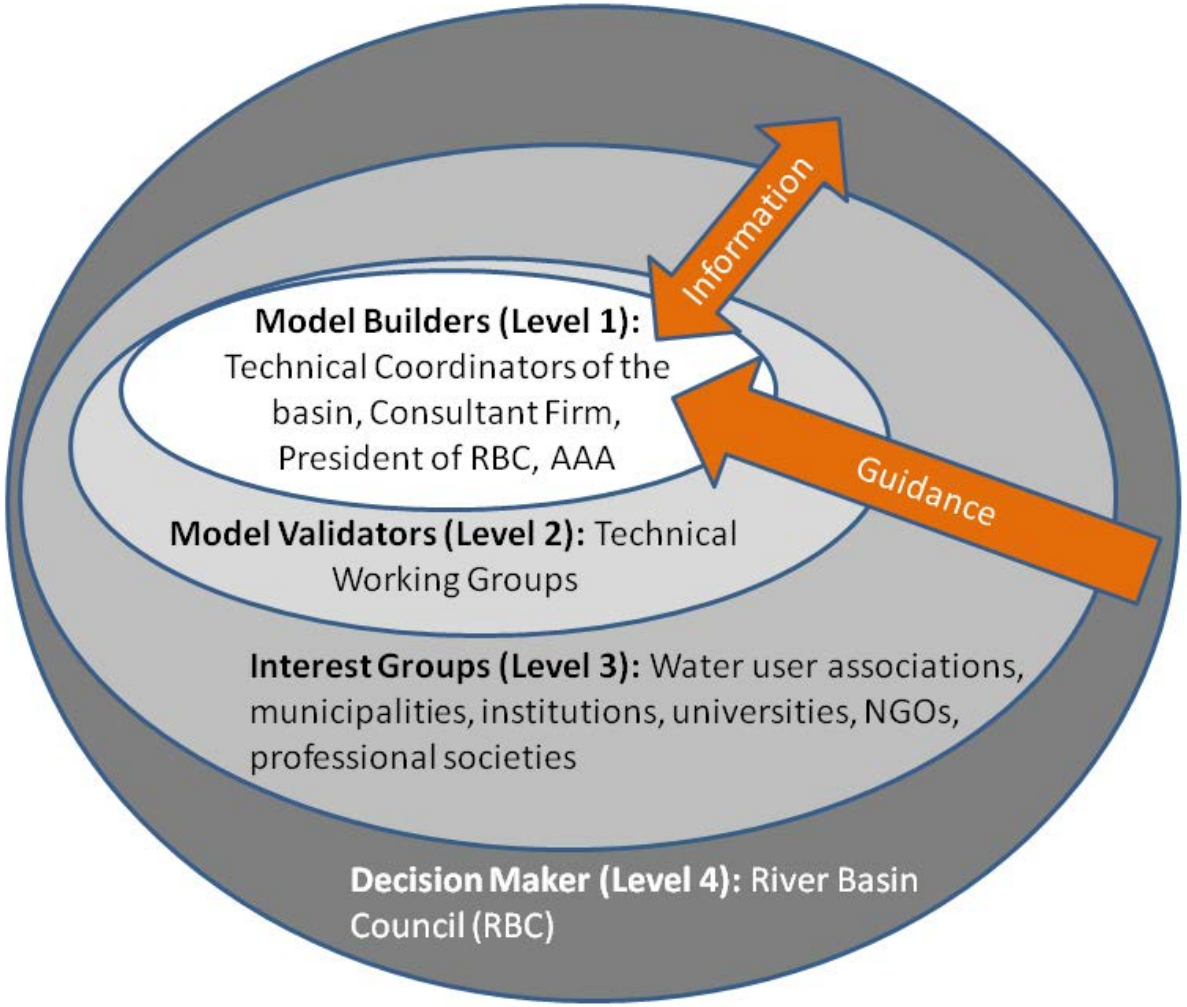




Example 4: Peru Water Resources Modernization

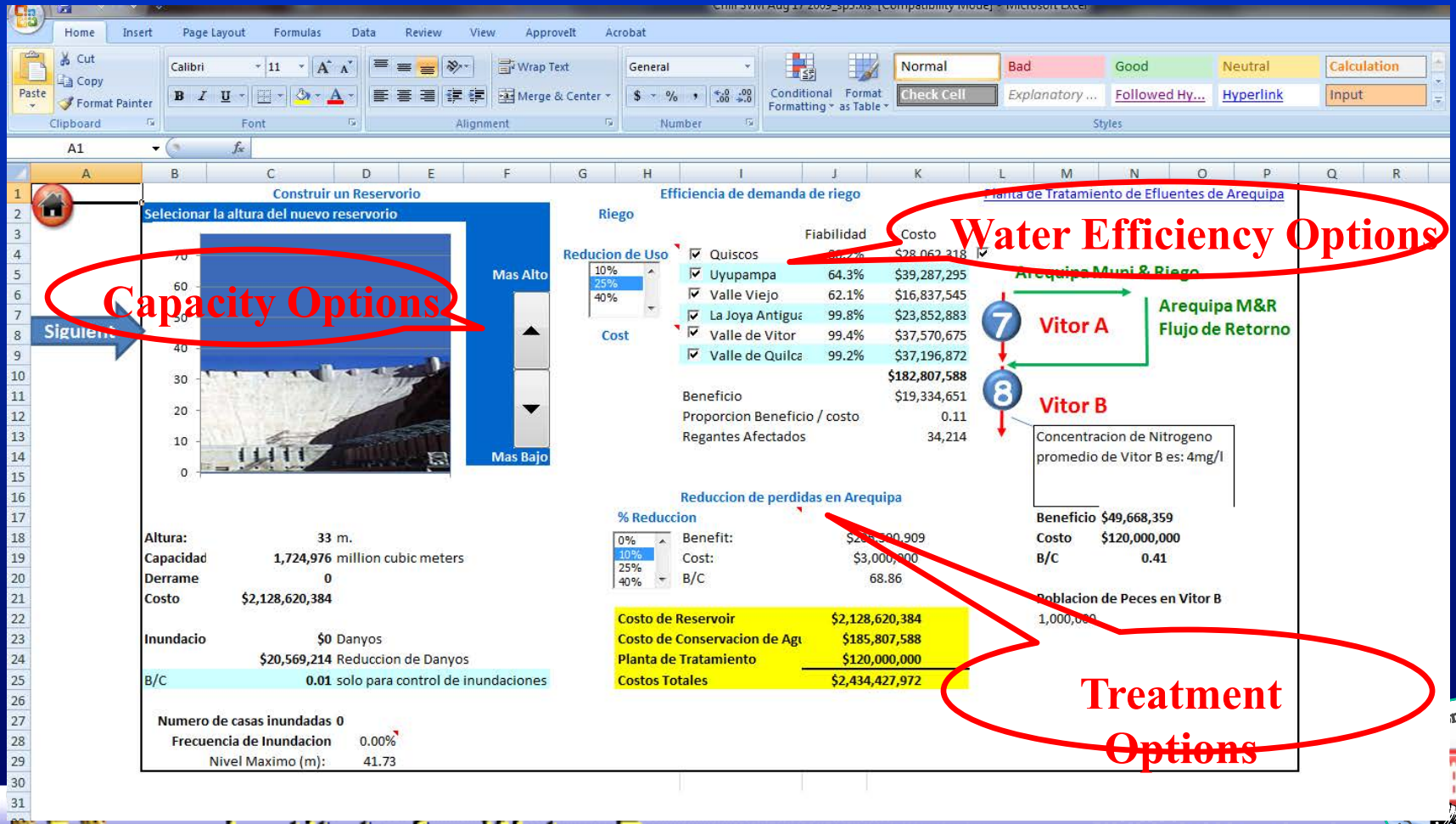
- New Water Law (2009)
  - Decentralizes water planning
  - Authorizes River Basin Councils
  - Focuses on Participation
- IWRM Plans for 6 Pilot Basins on the Arid Pacific Coast.
- Using Shared Vision Planning
- $40 million Loan from World Bank and IDB

Circles of Influence Guides Participation & Informs Analysis

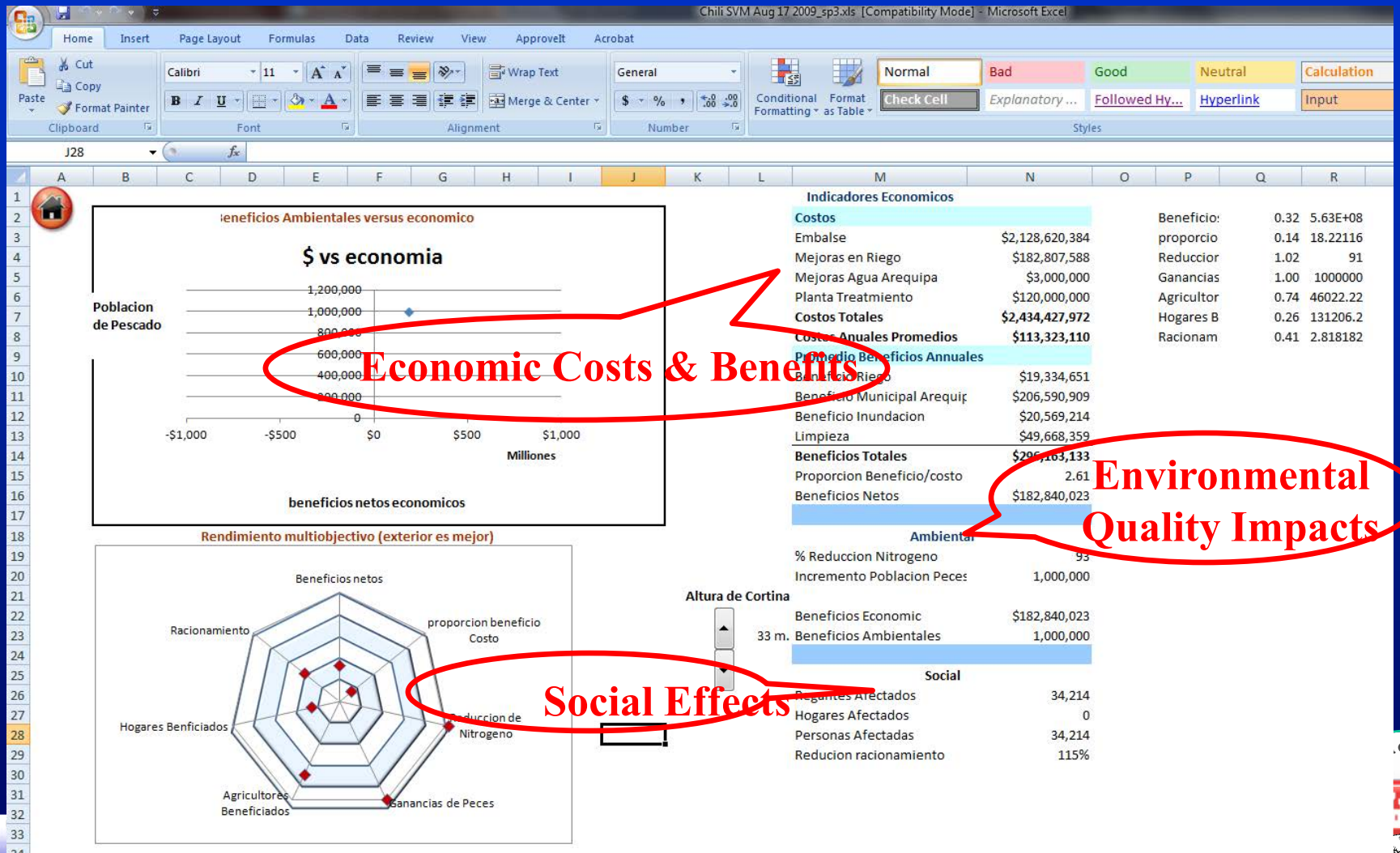


- Model Builders
- Model Validators
- Interest Groups
- Decision Makers

Integrated Model Allows Stakeholders to Test Alternatives



Integrated Model Allows Stakeholders to Test Alternatives



Stakeholder Involvement in Technical Analysis is not just theory

- Applied across different water issues:
  - Droughts, TMDLs, Urban Water Mgmt, 404 Water Supply Permitting, Reservoir Operation, Water Allocation
- Applied across various advocates/sponsors:
  - Feds, states, NGOs, private sector
- Interagency federal initiative
- Corps is mounting a major effort to support collaborative planning