Building Models from the Data Up:

From CALVIN to HOBBES

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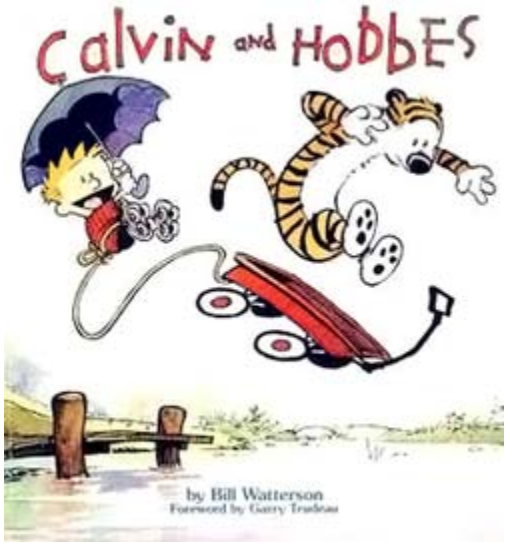
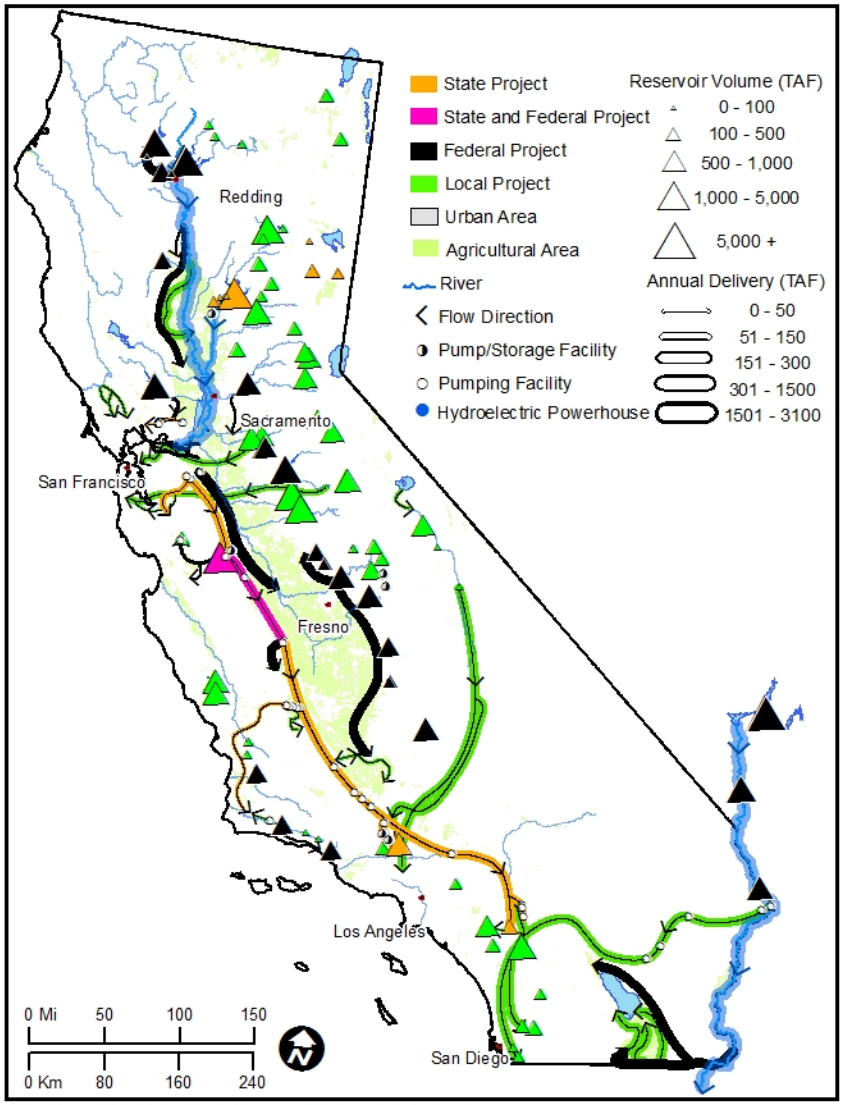


Center for Watershed Sciences
UC DAVIS

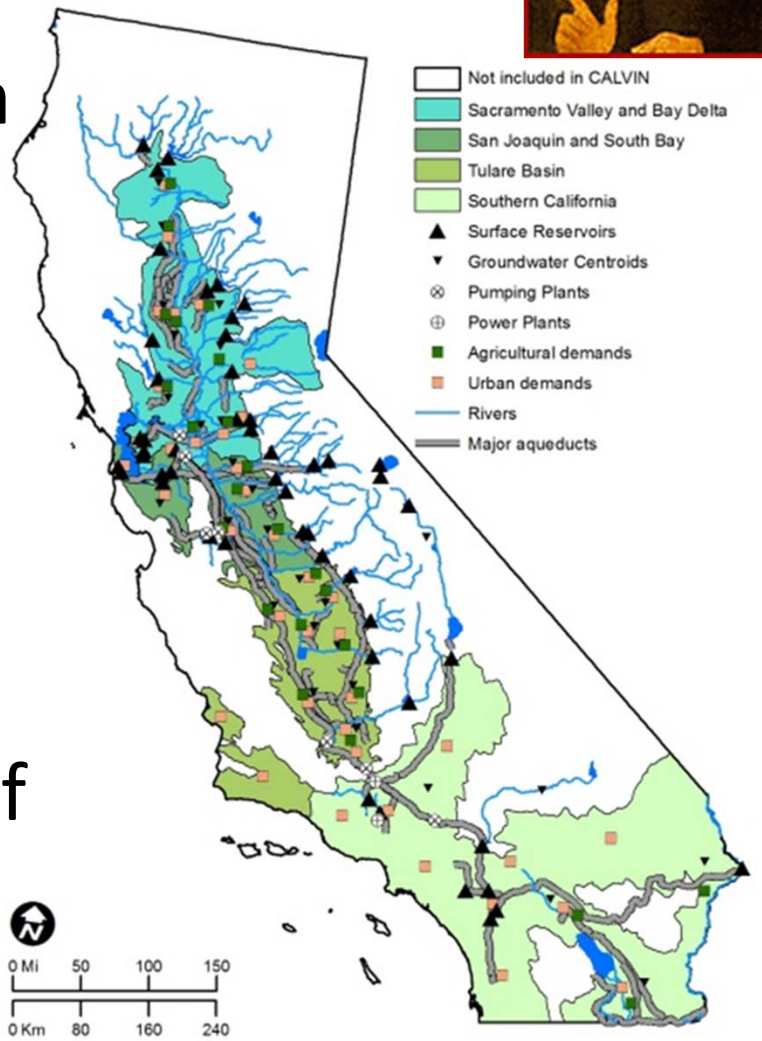
California Water Problems

- Imbalances in supplies and demands
- Droughts & climate change
- Water quality
- Sac.-San Joaquin Delta
- Groundwater
- Flood management
- Ecosystem services
- Quantitative understanding for modeling and discussions

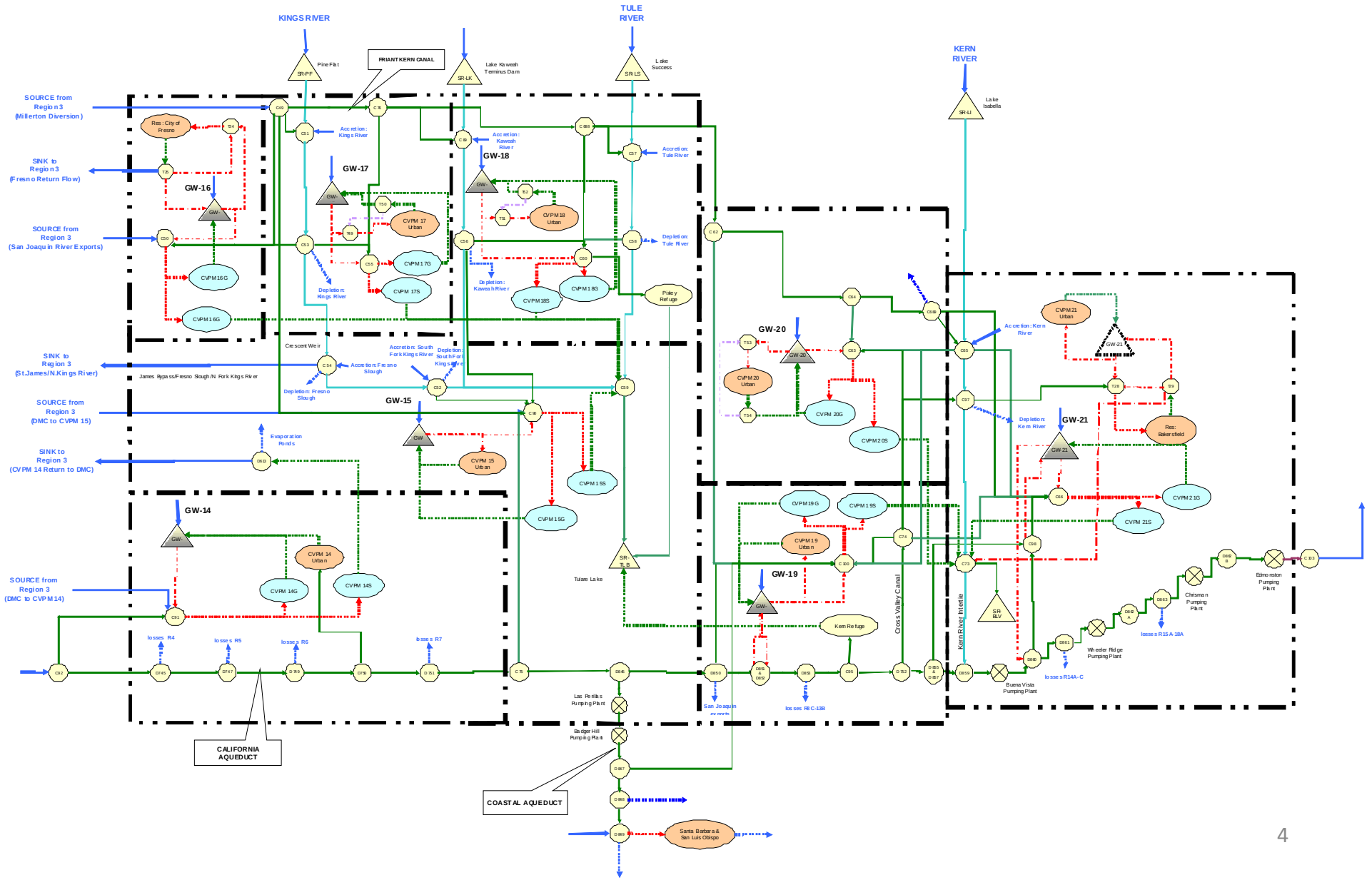


The (12 Year Old) CALVIN Model

- Entire inter-tied water system
- Hydro-economic model
- Prescribes 72 year of operations
- Surface and Groundwater infrastructure
- Quantitative understanding of the system



Tulare Basin, California



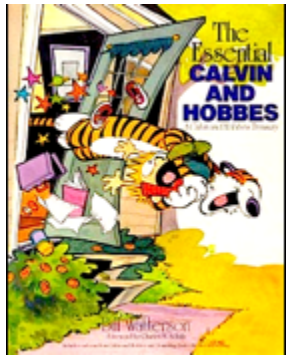
CALVIN Applications and Insights

Topics	Citation
Integrated water management, water markets, capacity expansion, at regional and statewide scales	Draper et al. (2003); Jenkins et al. (2001; 2004); Newlin et al. (2002)
Conjunctive use and southern California	Pulido et al.(2004)
Hetch Hetchy restoration	Null (2004); Null and Lund (2006)
Perfect and limited foresight	Draper (2001)
Climate warming, wet and dry	Lund et al. (2003); Tanaka et al.(2006; 2008)
Climate warming, dry	Medellín-Azuara et al.(2008a; 2009)
Climate warming, dry and warm-only	Medellín-Azuara et al.(2008a; 2009); Connell (2009)
Severe sustained drought adaptation (paleodrought)	Harou et al. (2010)
Increasing Sacramento River outflows	Tanaka and Lund (2003)
Reducing Delta exports and increasing Delta outflows	Tanaka et al.(2006; 2008; 2011); Lund et al.(2007; 2008)
Colorado River delta and Baja California water management	Medellín-Azuara et al.(2006; 2007; 2008b)
Cosumnes River and Sacramento area water management	Hersh-Burdick (2008)
Bay Area adaptation to severe climate changes	Sicke (2011)
Responses to Water Scarcity in Southern California	Bartolomeo (2011)
Ending overdraft in the Tulare Basin	Harou and Lund (2008); Chou (2012), Zikalala (2013)
Urban water conservation with climate change and reduced Delta pumping	Ragatz (2013)

What we have learned

- Organize model data into databases
- Document data in databases
- Modeling capabilities for water issues
- Use an integrated and workable technical plan
- Don’t wait for perfect data
- Virtuous cycle of : Quantify, document, improve

HOBBES: Building Models from Data Up



Need a new approach:

- Models are too big and detailed to build data around solution algorithms
- Build models on foundation of documented data to allow flexibility with algorithms
- Let problem determine algorithm and scenarios
- Let reality determine the data
- Begin with data

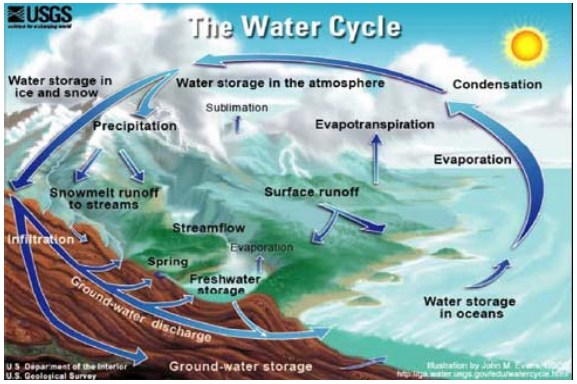
New Directions:
Data Management and Documentation

- Standards for storing, documenting, and sharing datasets for modeling
- Standardized networks and elements
- Object-oriented geospatial database platform
- Graphical user and web Interfaces
- Log of changes in data
- Documentation of multiple estimates
- Local involvement in data and documentation

What goes in the HOBBES system?

Water infrastructure

Environmental services



Hydrology

Water economics

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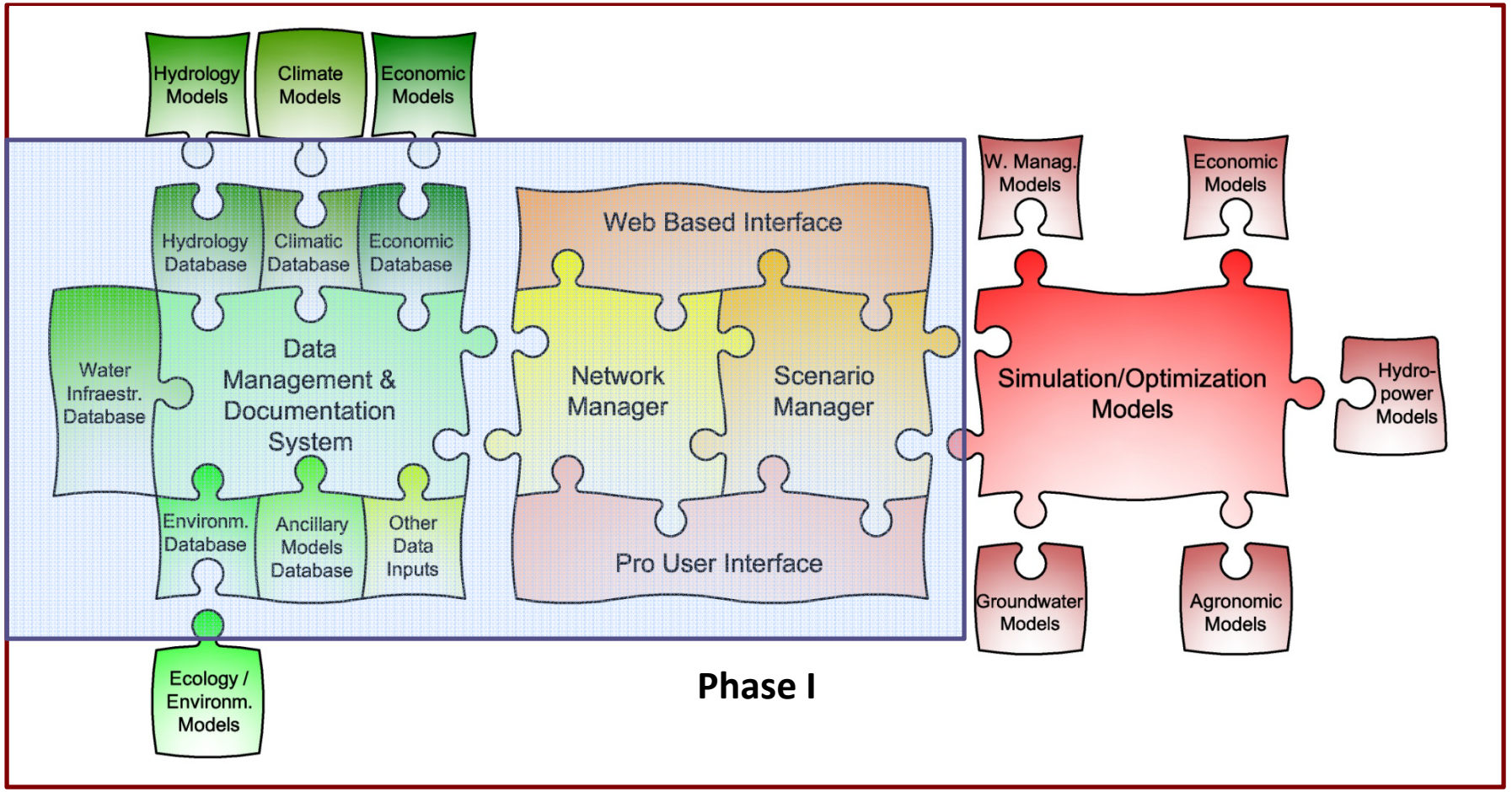
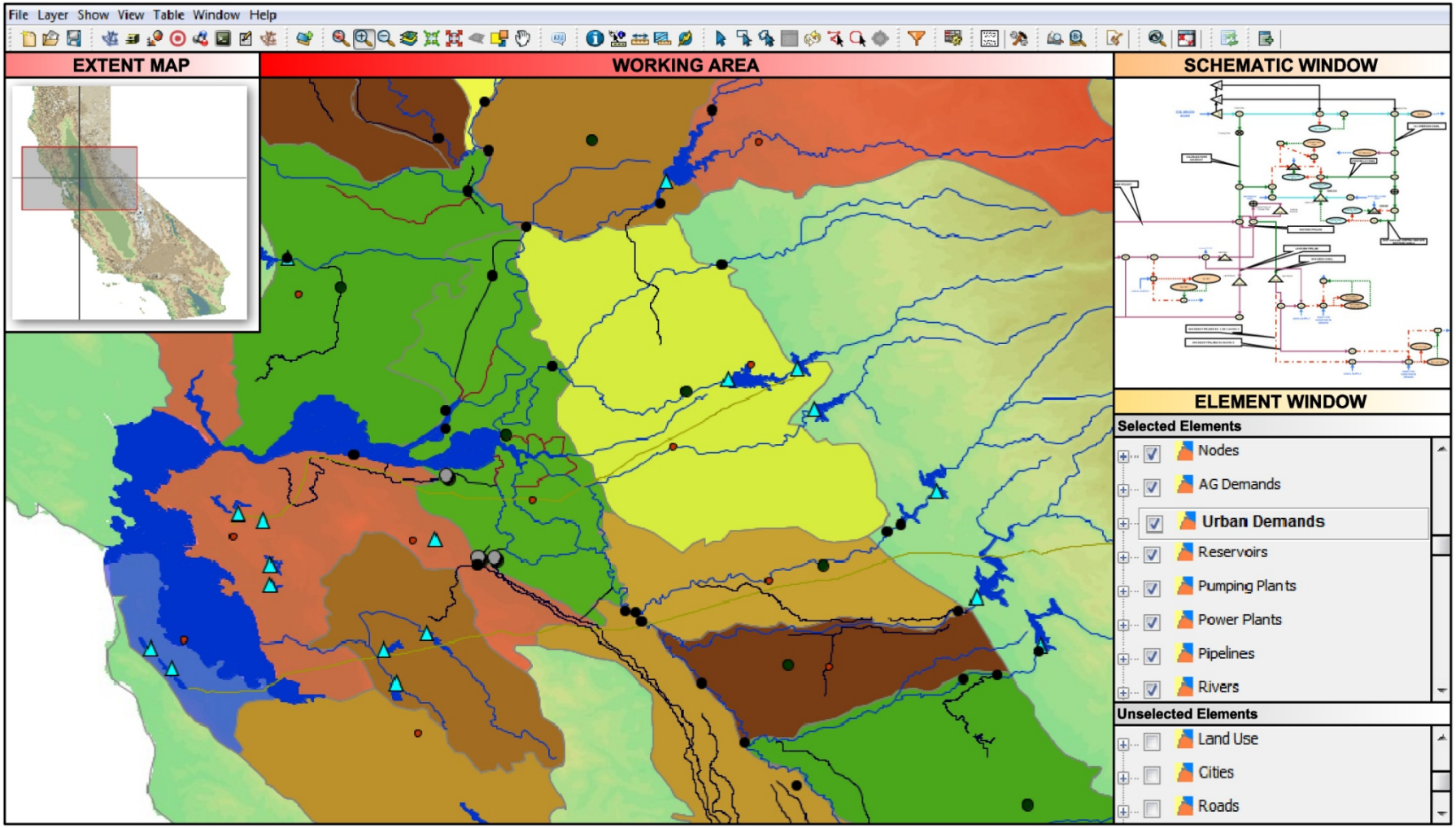
Documentation of the data

HOBBES: Assembling the puzzle



Graphical User Interface



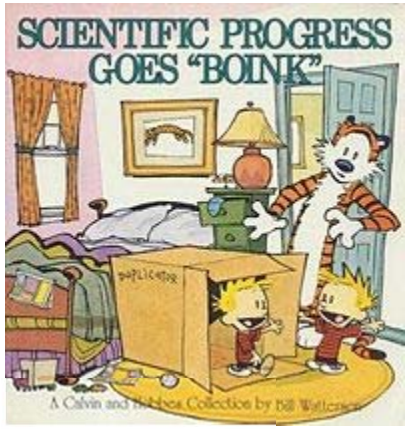
Synchronized network generator

HOBBES Objectives

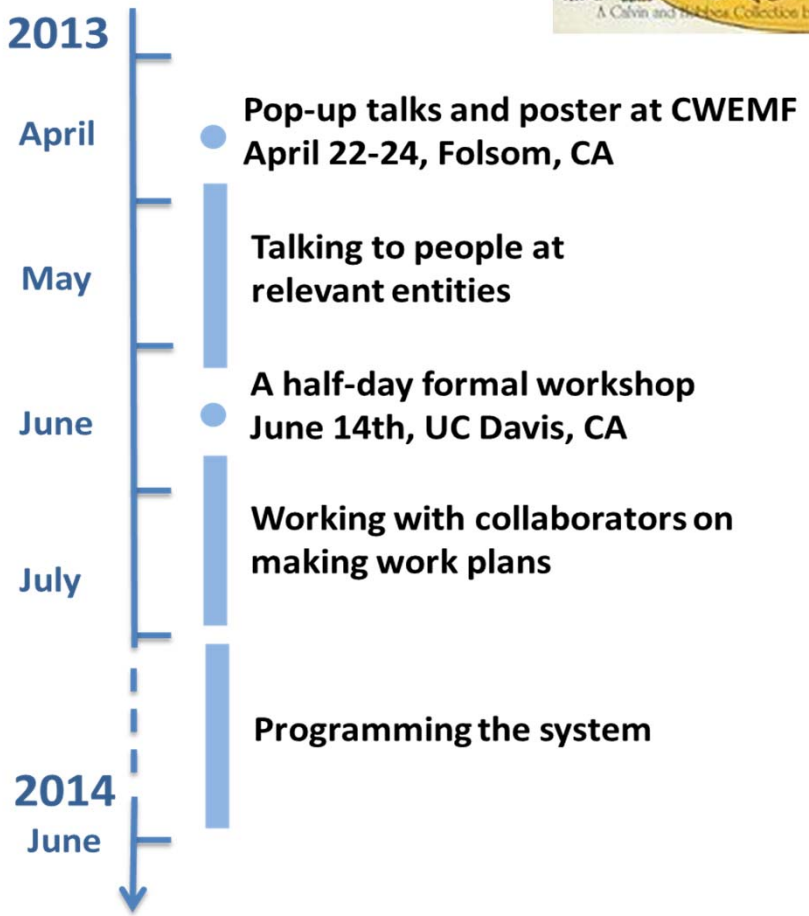
- Standardize and document data for modeling
- Transform database elements into model inputs
- Focus on data and database structure, and documentation, instead of specific models
- Develop agreed upon data and document data differences as step forward

- Decentralize involvement in data development
- Geocoded data element representation
- Open platform with web access

A Work Plan



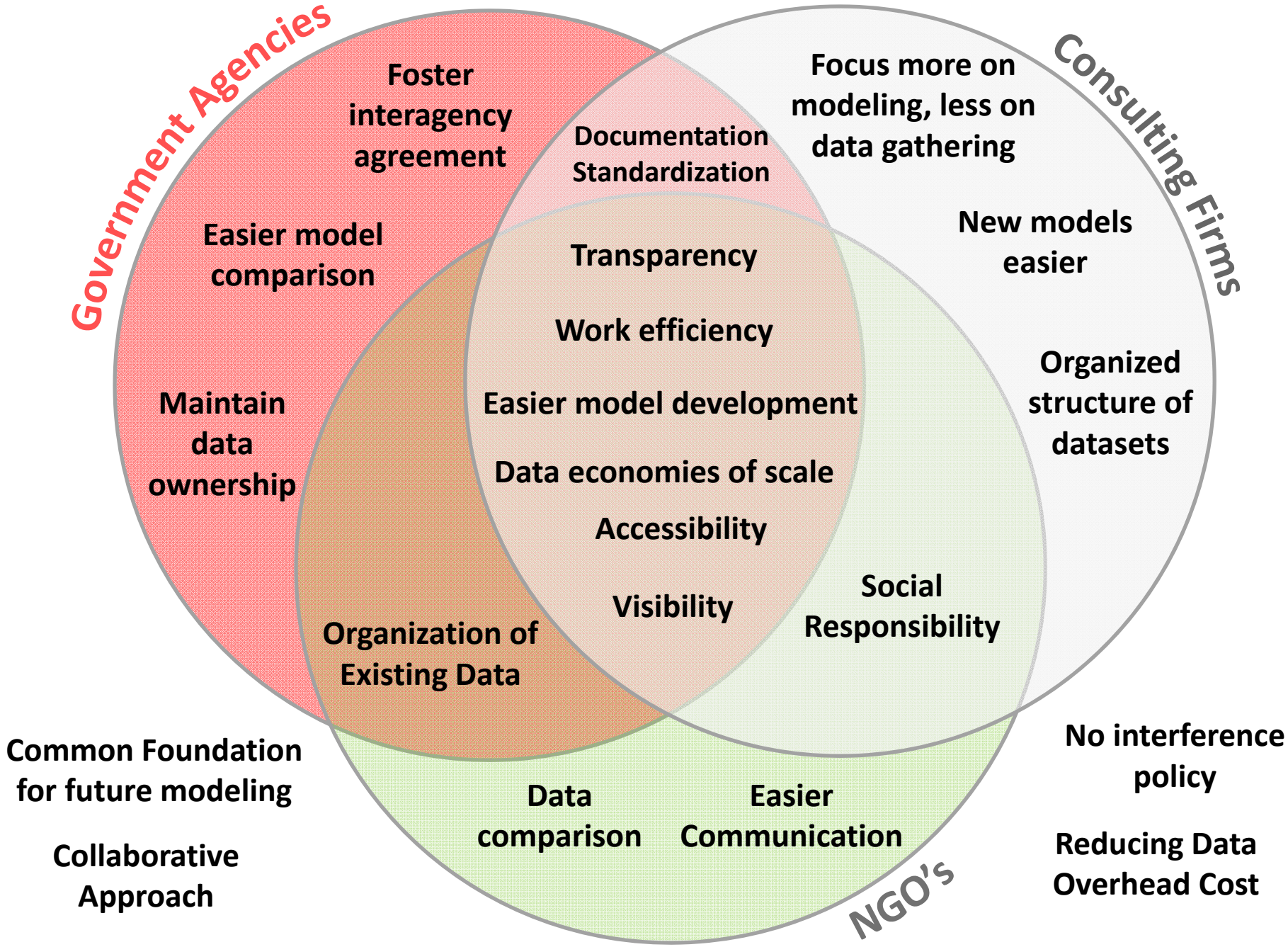
- Conceptual design
- Feedback
- Partnerships
- Technical specifications
- Coding
- Calibration/debugging
- First application?
- Expansion, governance, maintenance



Other Network and Modeling Features

- Water system network constructed from HOBBES system connectivity
- Networks rendered at different levels of detail
- Objects in the database can be aggregated or disaggregated
- Several pre-configured networks and tiers of users
- An Scenario Manager to prepare, store and document model network runs
- Exporting features

Motivations



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