

WaM-DaM: A Data Model to Synthesize and Organize Water Management Data



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Water Management Data Model (WaM-DaM)

1. Why Do We Need a Data Model?
2. Design Methods
3. WaM-DaM Schema
4. Results
5. Conclusions

WaM-DaM

**Model quicker. Publish
faster.**



Why a Data Model?

Different sources and descriptions

Hoover Dam
e.g., release



Lake Mead
e.g., outflow



HydroDesktop

Reservoir? Water body?

Scientists and managers spend up to 75% of their **time** to build models

Similar Data => Different Models

Reservoir Simulation (HEC-ResSim)

Simulates reservoir operation and management

Requires river network, diversions, reservoir physical & operational data



Water Evaluation and Planning system

Allocates water to meet basin demands

Requires river network, diversions, reservoir physical data, supplies, delivery requirements, allocation priorities, etc.



Prior approaches to organize water data

Feature	Arc Hydro	ODM	Hydro Platform	WEAP	HEC-DSS
Generic, relational, and open source environment		X			
Create dynamic networks	X		X	X	X
Controlled vocabulary	X	X		X	X
Descriptive and explicit metadata		X			
Supports multiple data types (e.g., time series, tabular, text, parameters, binary, and file-based)	X		X	X	X

Objectives

Design a data model to organize and synthesize water management data

Integrate data from different sources

Support consistent metadata descriptions

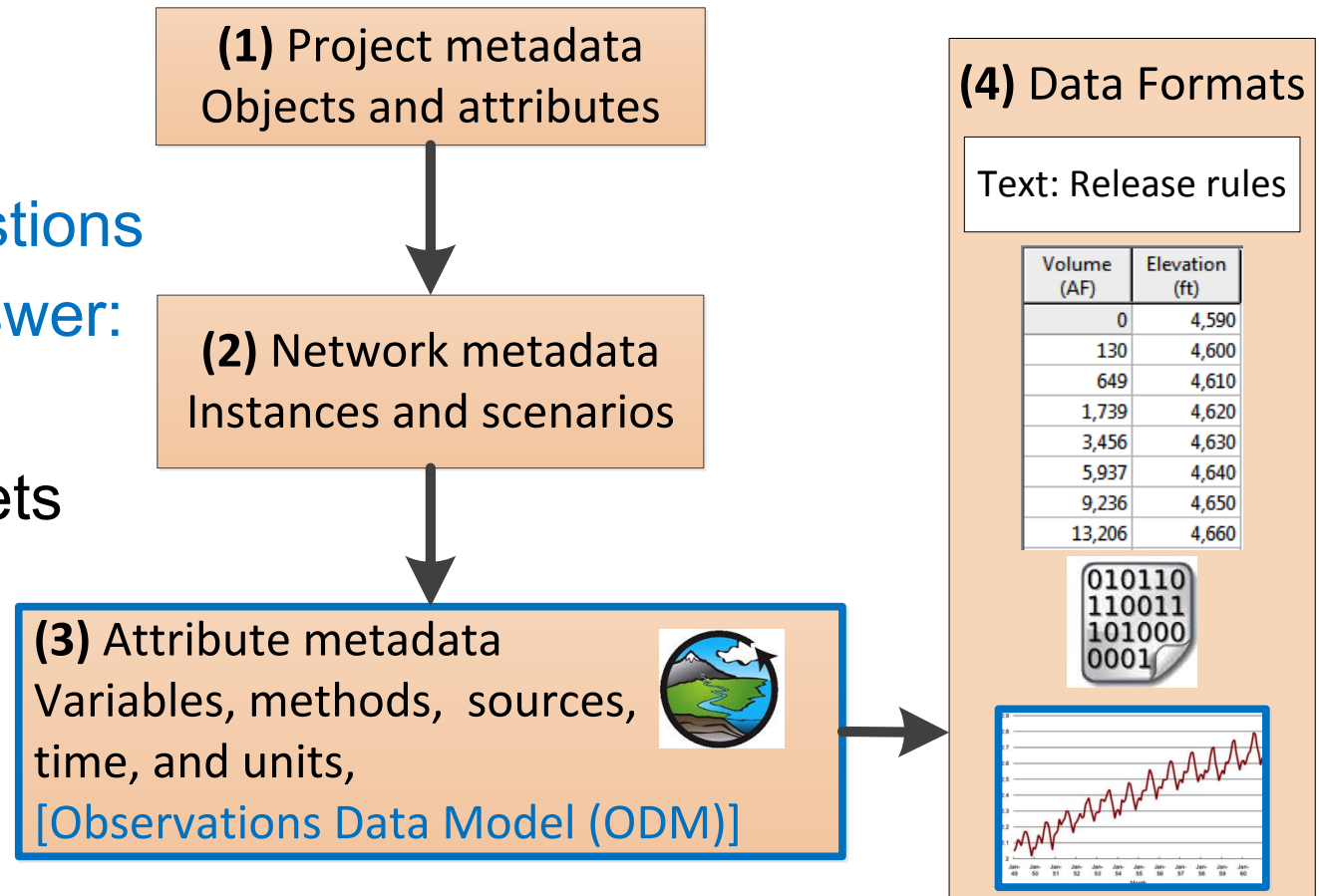
Open-source, generic, programming language and technology independent

Design Methods

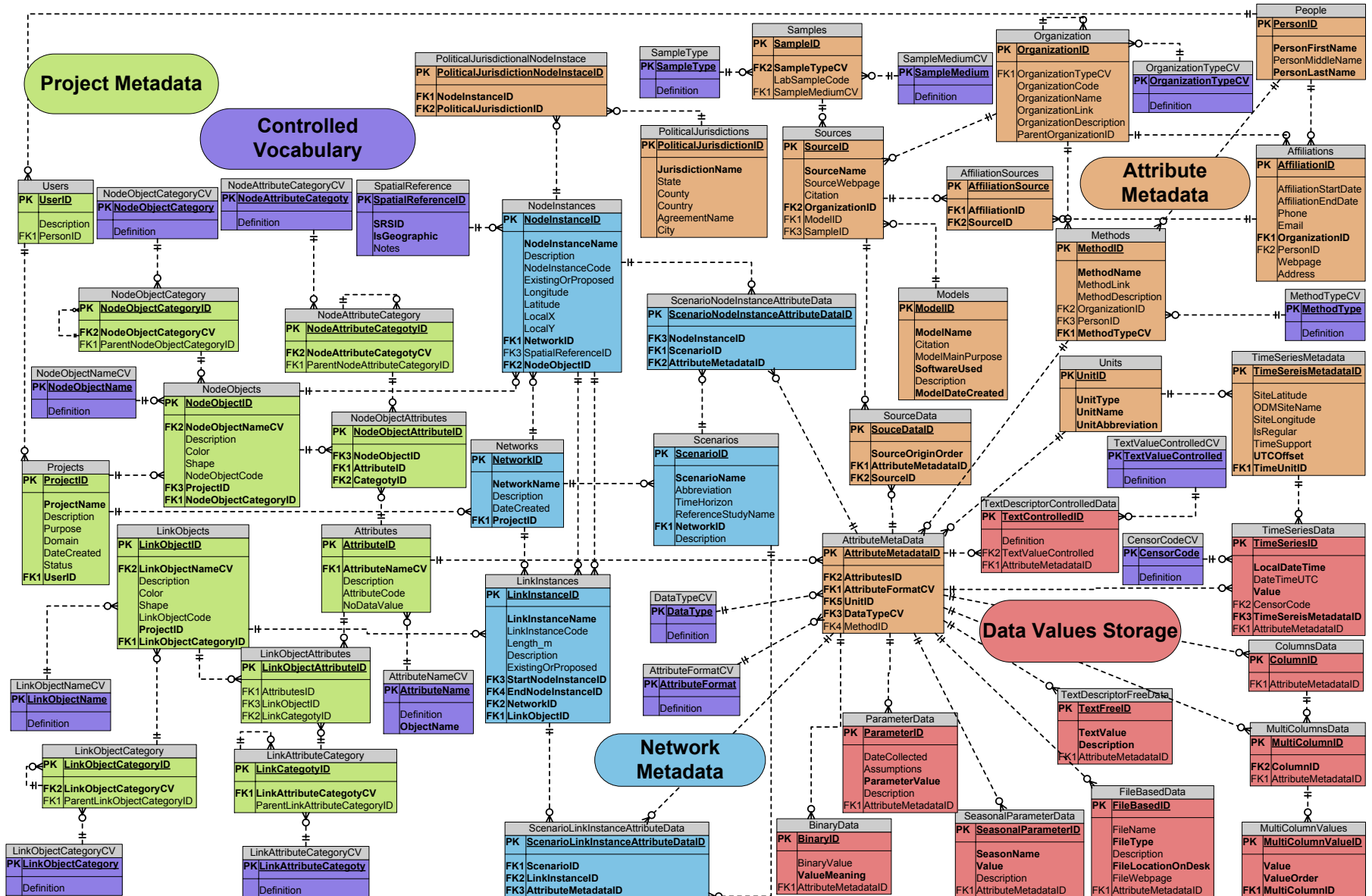
1. **Identify** the essential data for water management - 184 fields
2. **Represent** fields in tables according to Relational Model Theory and Jim Gray's rule - 58 tables

Categories of questions
WaM-DaM will answer:

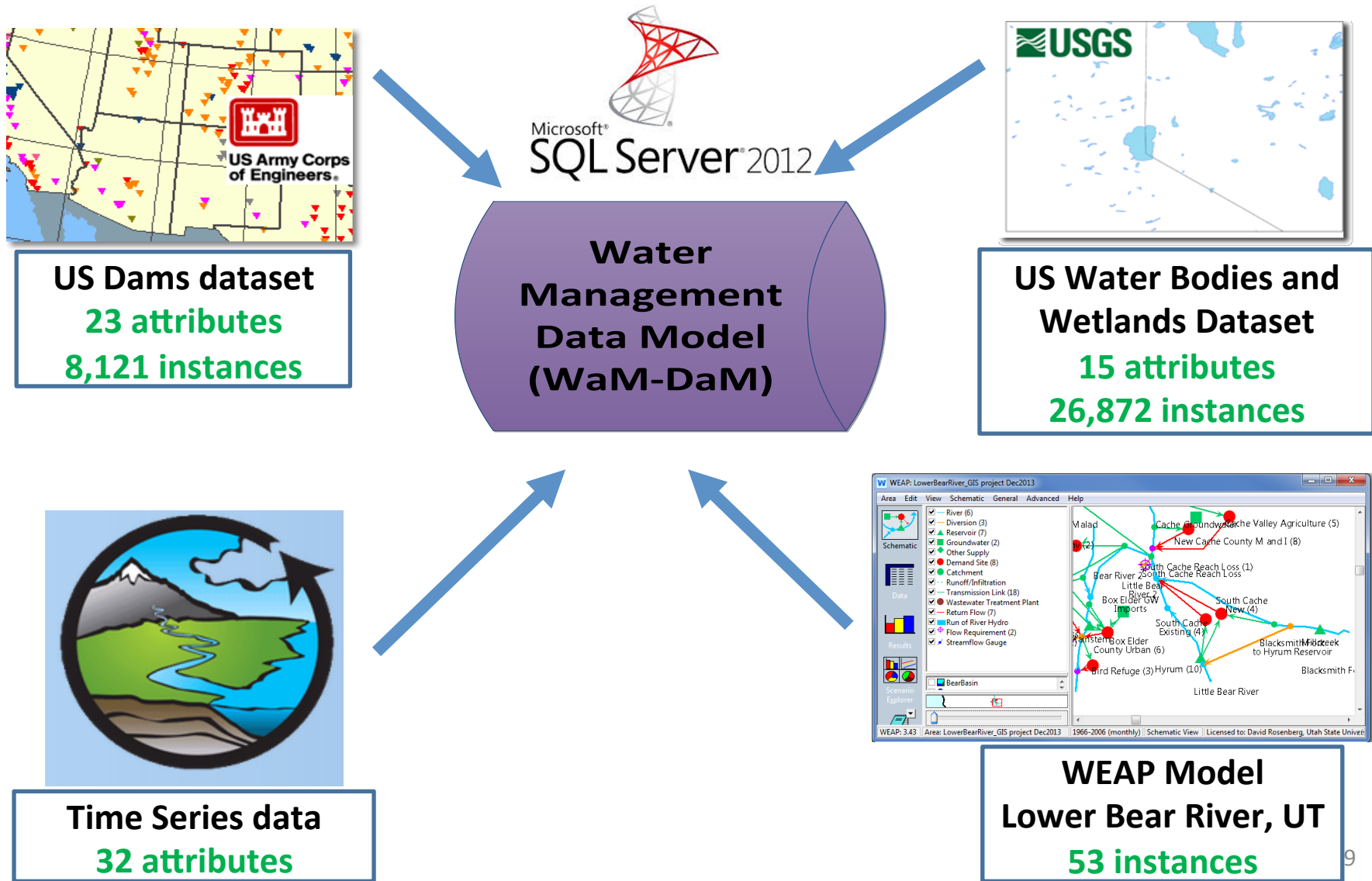
- i) Build a network
- ii) Compare datasets
- iii) Query data



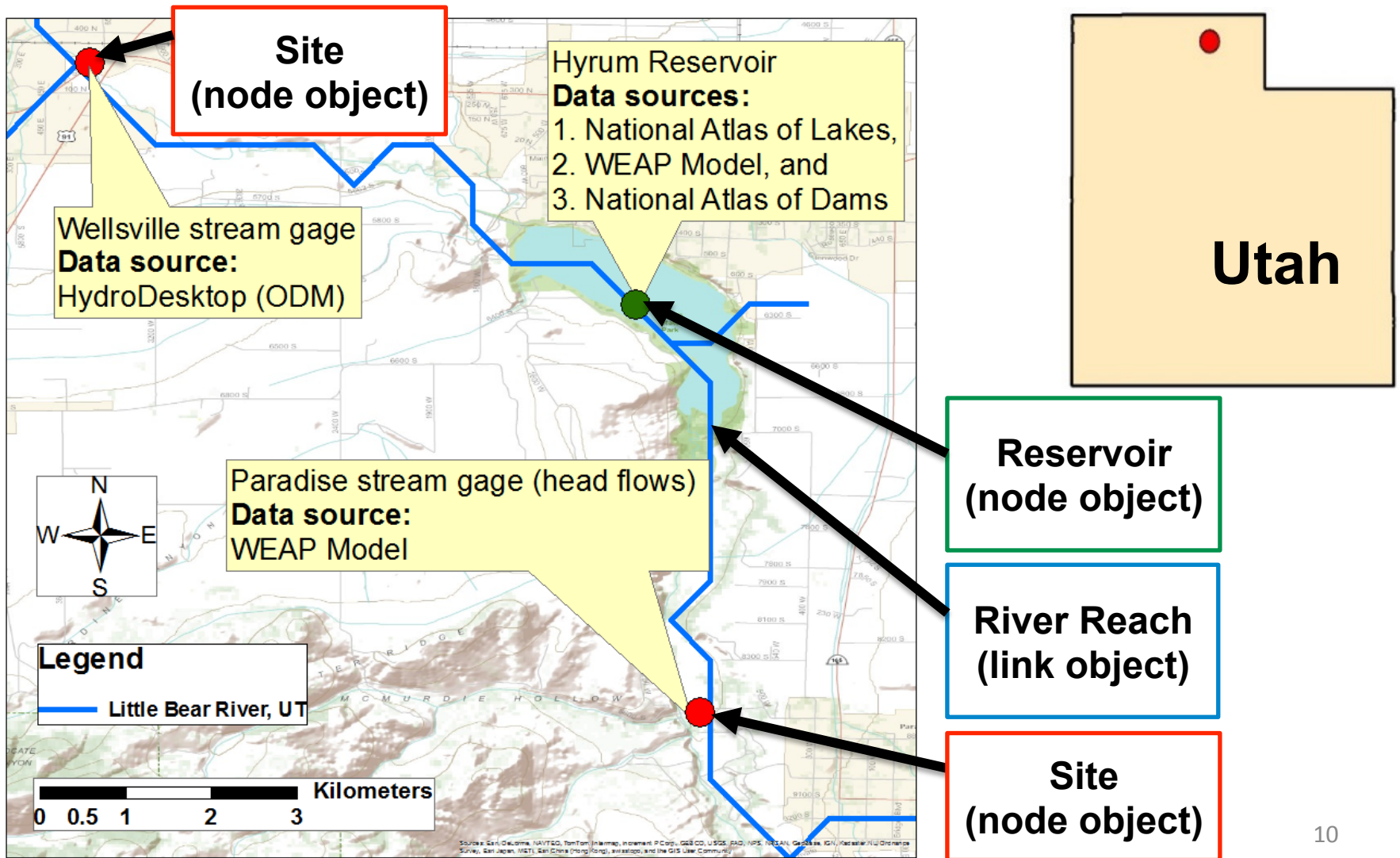
WaM-DaM 0.2 Schema



Load Different Data to WaM-DaM



Represent the Little Bear River Network, Utah in WaM-DaM



What are the attributes for Hyrum Reservoir and their units?

Object name	Node instance name	Attribute format	Attribute name	Unit name
Reservoir	Hyrum	Columns	Area	acre
Reservoir	Hyrum	MultiColumns	ElevationAreaStorage	dimensionless
Reservoir	Hyrum	Parameter	MaxStorage	acre foot
Reservoir	Hyrum	Text	DamOwner	dimensionless

⇒ **Organize** multiple data formats and maintain consistent metadata

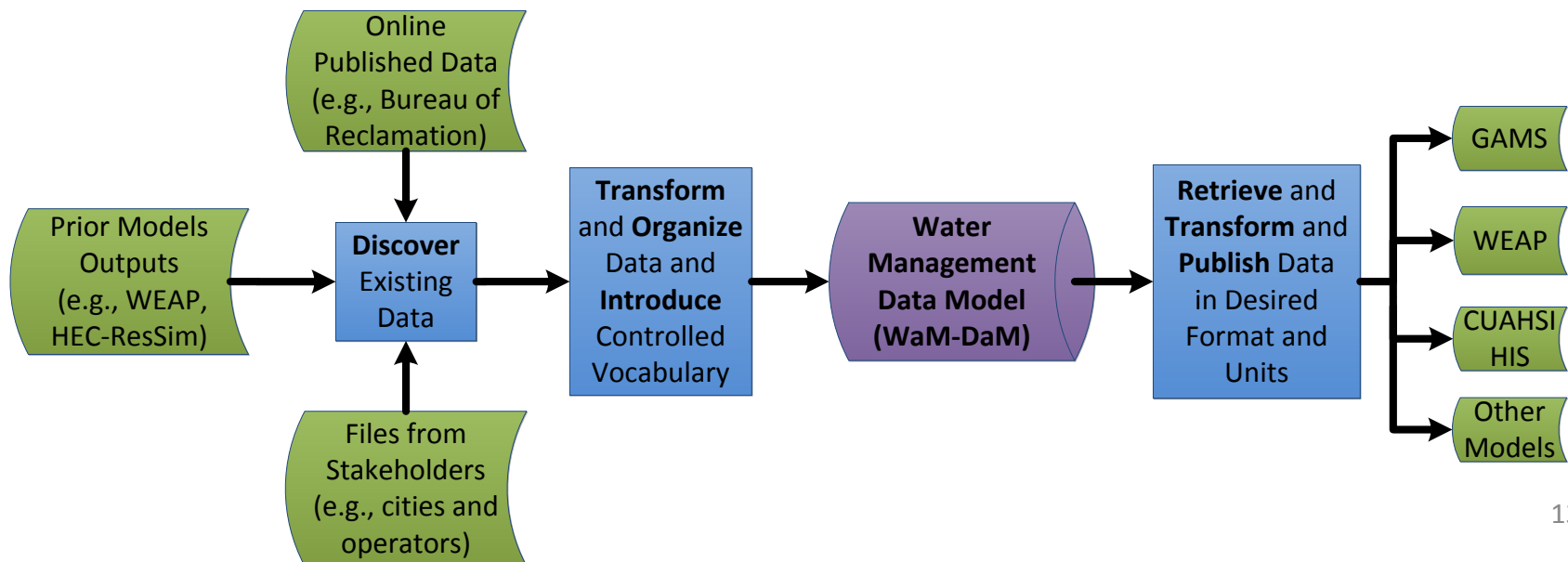
What are the reservoir attributes and their values, units, and sources?

Node instance name	Attribute name	Value	Unit name	Source
Hyrum	Area	451.558	acre	National Atlas Waterbodies
Hyrum	Area	480	acre	National Atlas Major Dams ..
Hyrum	MaxStorage	14440	acre foot	National Atlas Major Dams ..
Hyrum	MaxStorage	18684	acre foot	DavidRosenberg/WEAP
Hyrum	MaxStorage	18684	acre foot	Utah Division of Water Res..

- ⇒ **Controlled vocabulary** => MAX_STOR, Total Capacity
- ⇒ **Integrate** data sources and support explicit descriptive metadata
- ⇒ **Incorporate** uncertainty in models
- ⇒ **Foster** integrated understanding of systems data

Ongoing Work

- **Finalize** the data model design and **test** it with larger networks and national datasets
- **Automate** data loading, retrieval, and **use** WaM-DaM to populate and run models
- **Integrate** WaM-DaM with **Hydra** software to visualize and edit networks



Conclusions

- **Proposing** WaM-DaM to organize network-based water management data
- **Organize** multiple data formats like time series, text, multi-column, and parameters from different sources
- **Foster** integrated analysis and understandings of water systems
- Future work will **automate** the ability to discover, transform, and publish of data plus **populate** models

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<http://ci-water.org/>

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Thank you!

Questions?

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How WaM-DaM organizes tabular data

