

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

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Utah Water Data Users Group 2nd Meeting
Jan. 27, 2015



Water Management Data Model (WaM-DaM)

1. Why Do We Need WaM-DaM?

2. Design Methods

**A Proposed Method to Organize
Network-Based Water
Management Data**

3. WaM-DaM Schema

4. Results

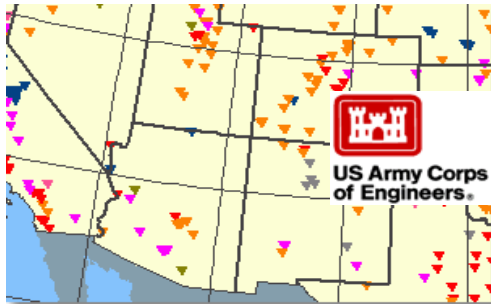
5. Conclusions

WaM-DaM

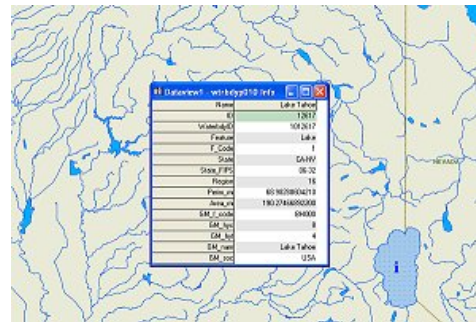
**Model quicker. Publish
faster.**



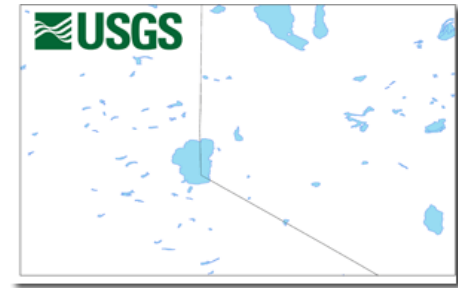
How to organize all these together?



US Dams dataset
23 attributes
8,121 instances



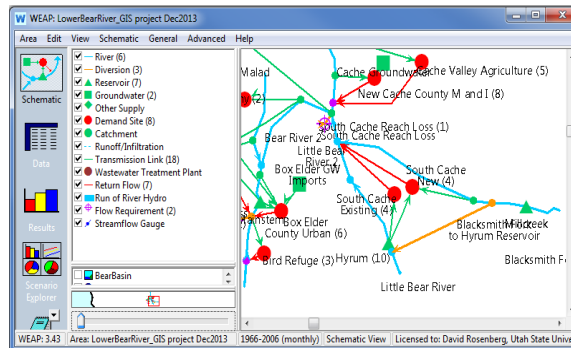
Streams Network
22 attributes
76,976 instances



US Water Bodies and Wetlands Dataset
15 attributes
26,872 instances



Time Series Data
32 attributes



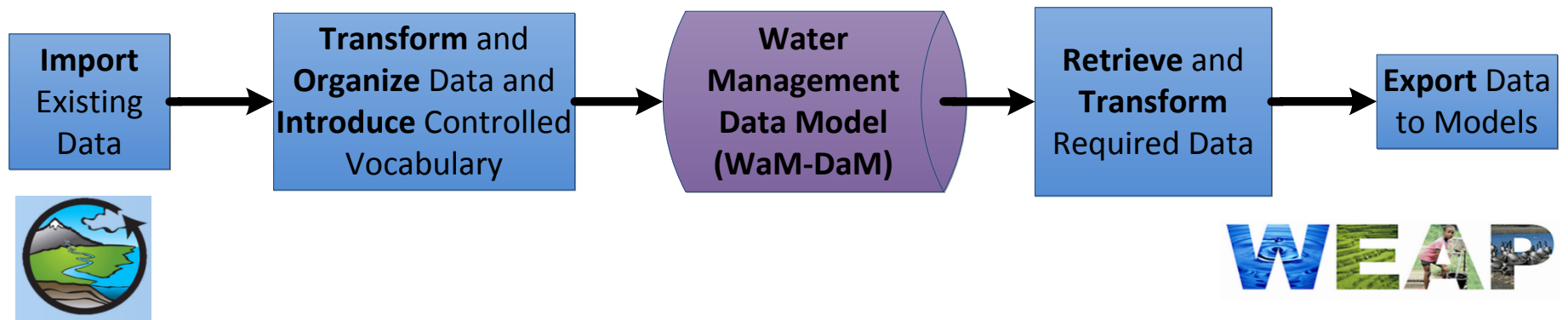
WEAP Model
Lower Bear River, UT
111 instances

We need a data model to support all these common features

Model	Flexible and extensible	Networks	Scenarios	Conditional query	Dynamic controlled vocabulary	Descriptive and explicit metadata	Multiple data formats	Open source envir.
WaDE								
ODM-CUAHSI								
WEAP								
GoldSim								
WISKI Kisters								
RiverWare								
GSSHA								
SWMM								
HEC-DSS								
ArcSWAT								
Arc Hydro								
CALVIN								
TOPNET								
AdHydro								
HydroPlatform								

Water Management Data Model (WaM-DaM)

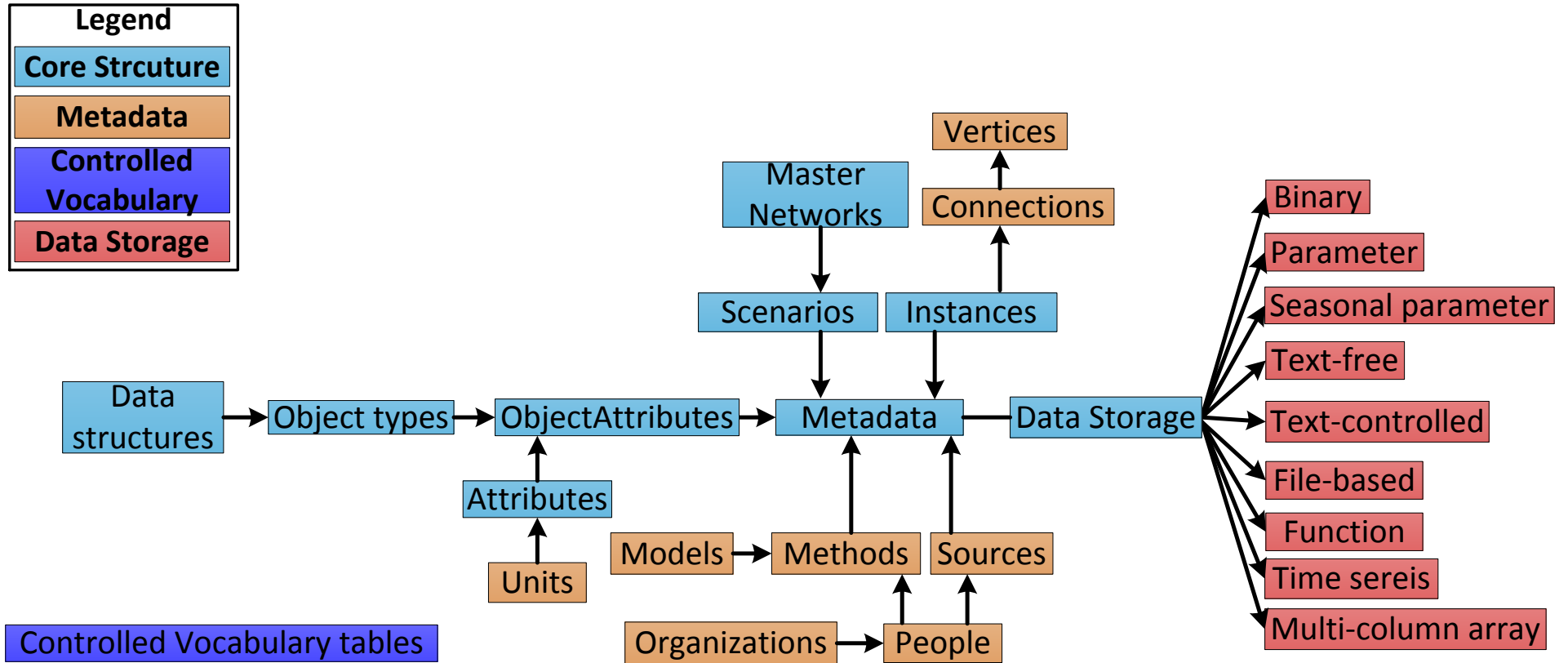
1. Organize water management data
2. Synthesize data across domains and sources
3. Compare data from different scenarios
4. Serve data to run models



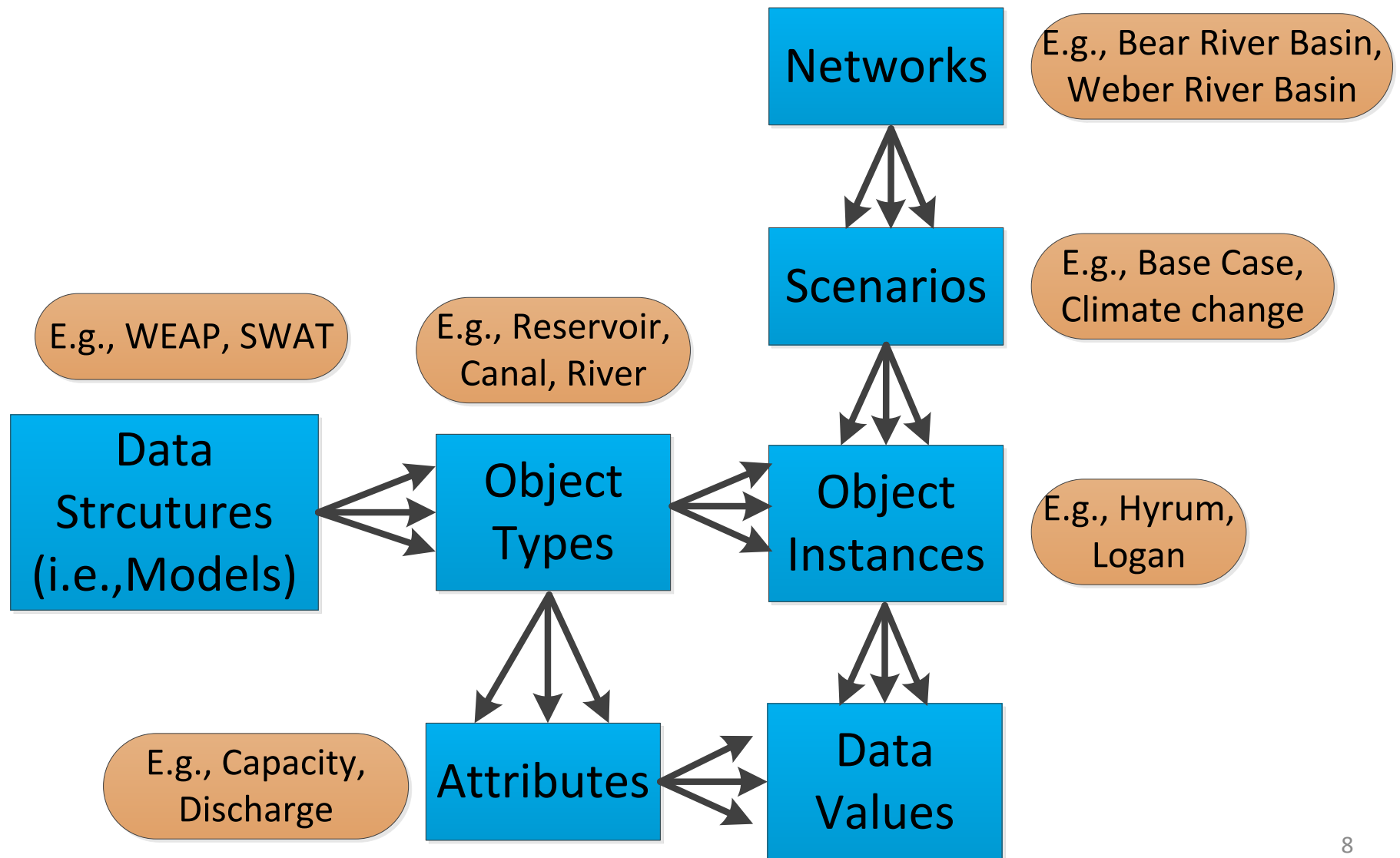
Methods

1. **Review** data management systems for 22 existing water management models
2. **Identify** most important user questions
3. **Design** a generic relational data model to answer user questions
4. **Verify** functionality with use cases

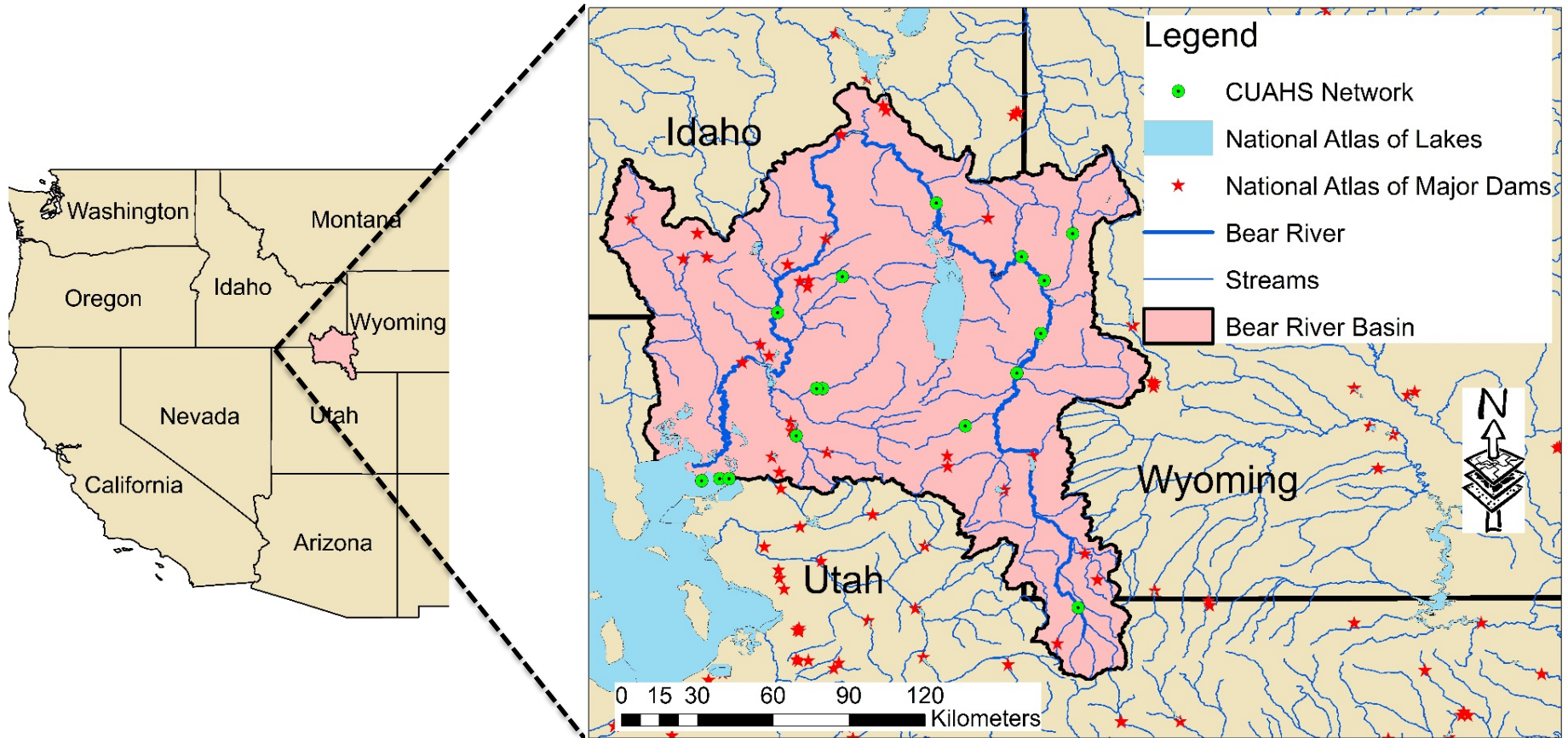
WaM-DaM Conceptual Design



How Does WaM-DaM Work?



Integrate disparate water management data for the Bear River Basin, Utah



What are the water management **instances** in the Bear River Watershed, Utah?

Native Object Types	Instances	Source Name
Dam	PORCUPINE	Dams Dataset
Dam	Cutler	Dams Dataset
Dam	Hyrum	Dams Dataset
Water Body	Bear Lake	Water Bodies
Water Body	Mantua Reservoir	Water Bodies
Reservoir	Mainstem	WEAP Model
Demand Site	Bird Refuge	WEAP Model
Groundwater	Box Elder GW Imports	WEAP Model
Site	Little Bear River at Paradise, UT	CUAHSI
Atmosphere	Logan Cache AP, UT	CUAHSI

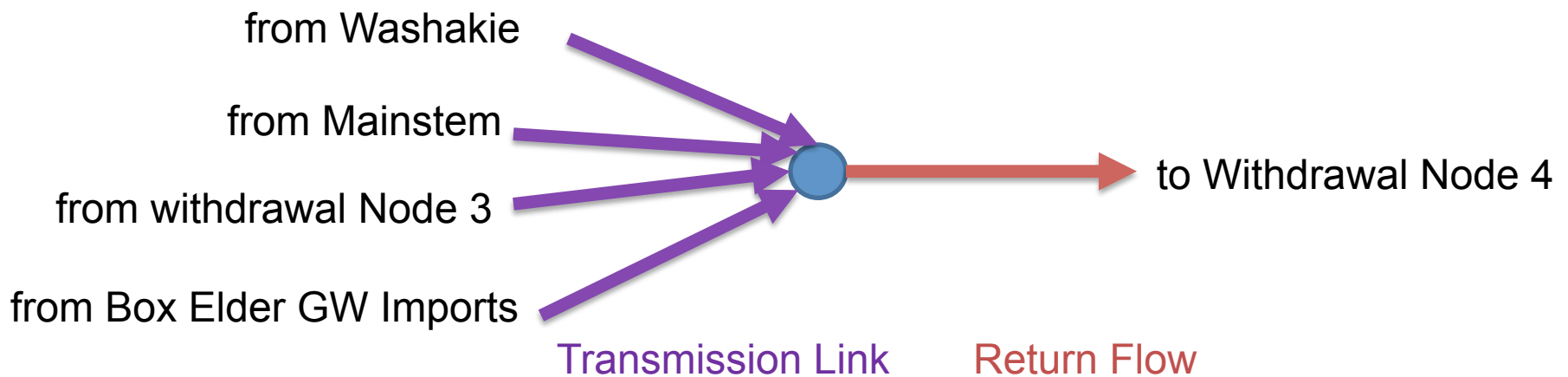
What is the "surface area" of an object type "Reservoir" within a boundary of lat. and long. ?

Instance Name	Source Name	Common Object Name	Native Object Name	Common Attribute Name	Native Attribute Name	Unit Name	Parameter Value
Hyrum Reservoir	Water Bodies Dataset	Reservoir	Water Body	surface area	Area_mi	square mile	0.705559 ~452 acre
Hyrum (10)	WEAP/Lower Bear River Network	Reservoir	Reservoir	surface area	Area	Acre	
HYRUM	Dams Dataset	Reservoir	Dam	surface area	SURF_AREA	Acre	480

What other **attribute** data are available for Hyrum Reservoir?

Native Attribute Name	Unit	Data Type	Source Name
DAM_TYPE	-	Controlled Text	Dams Dataset
PURPOSES	-	Controlled Text	Dams Dataset
HAZARD	-	Controlled Text	Dams Dataset
Elevation	international foot	Parameter	Dams Dataset
Storage Capacity	acre feet	Parameter	Dams Dataset
DRAIN_AREA	acre	Parameter	Water Bodies
Region	-	Controlled Text	Water Bodies
Max. Turbine Flow	cubic meters per second	Parameter	WEAP Model
Volume Elevation Curve	-	Multi-Column	WEAP Model
Inflow	cubic foot per second	Time series	WEAP Model
Net Evaporation	inch	Time series	WEAP Model
Reservoir storage, acre feet	acre feet	Time series	CUAHSI

What are the supply and discharge links for “Box Elder County Urban” Demand Site Object?



Data Structure Name	Native Object Name	Supply Link Instances
WEAP	Transmission Link	from Washakie
WEAP	Transmission Link	from Mainstem
WEAP	Transmission Link	from withdrawal Node 3
WEAP	Transmission Link	from Box Elder GW Imports
		Discharge Link Instances
WEAP	Return Flow	to Withdrawal Node 4

Future Work

- **Compare** data and metadata across scenarios
- **Serve** data from WaM-DaM to WEAP and GoldSim models
- **Manage** simulation and optimization models data and metadata

Benefits of WaM-DaM

- Provide a **synthetic view** of the data available within a watershed
- **Overcome** semantic heterogeneity of water management data
- **Compare datasets**, identify discrepancies and uncertainties, and include uncertainties in preparing model input data
- **Answer questions** that previously required significant effort and manipulations among multiple data sets

Acknowledgement



Thank you!
Questions?

WaM-DaM

**Model quicker. Publish
faster.**



WaM-DaM Logical Data Model

