Reliable Water Supply & Implications for CCS

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Energy & Geoscience Institute
THE UNIVERSITY OF UTAH

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
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Water Resources Management

- Demand first approach (*currently*)
  - Estimate existing and future demands
  - Develop water supply to meet those demands
- Supply first approach (*moving towards*)
  - Develop a quantity of reliable water supply
  - Adapt water demands to available supply

The same principles from water resources management can be used for CCS

Conjunctive Use

- Strategically managing surface water and groundwater supply to optimize use
  - Surface Water: renewable but not reliable
  - Groundwater: reliable but now renewable
- The aquifer acts as a large storage reservoir
- Have worked on several projects related to collaborative groundwater management (Mt. Nebo & NUCAC)

Can implement the same management programs for CCS that involve stakeholders, account for variable conditions, and look to find the best alternatives

What is a Reliable Water Supply?

Why is a definition important?

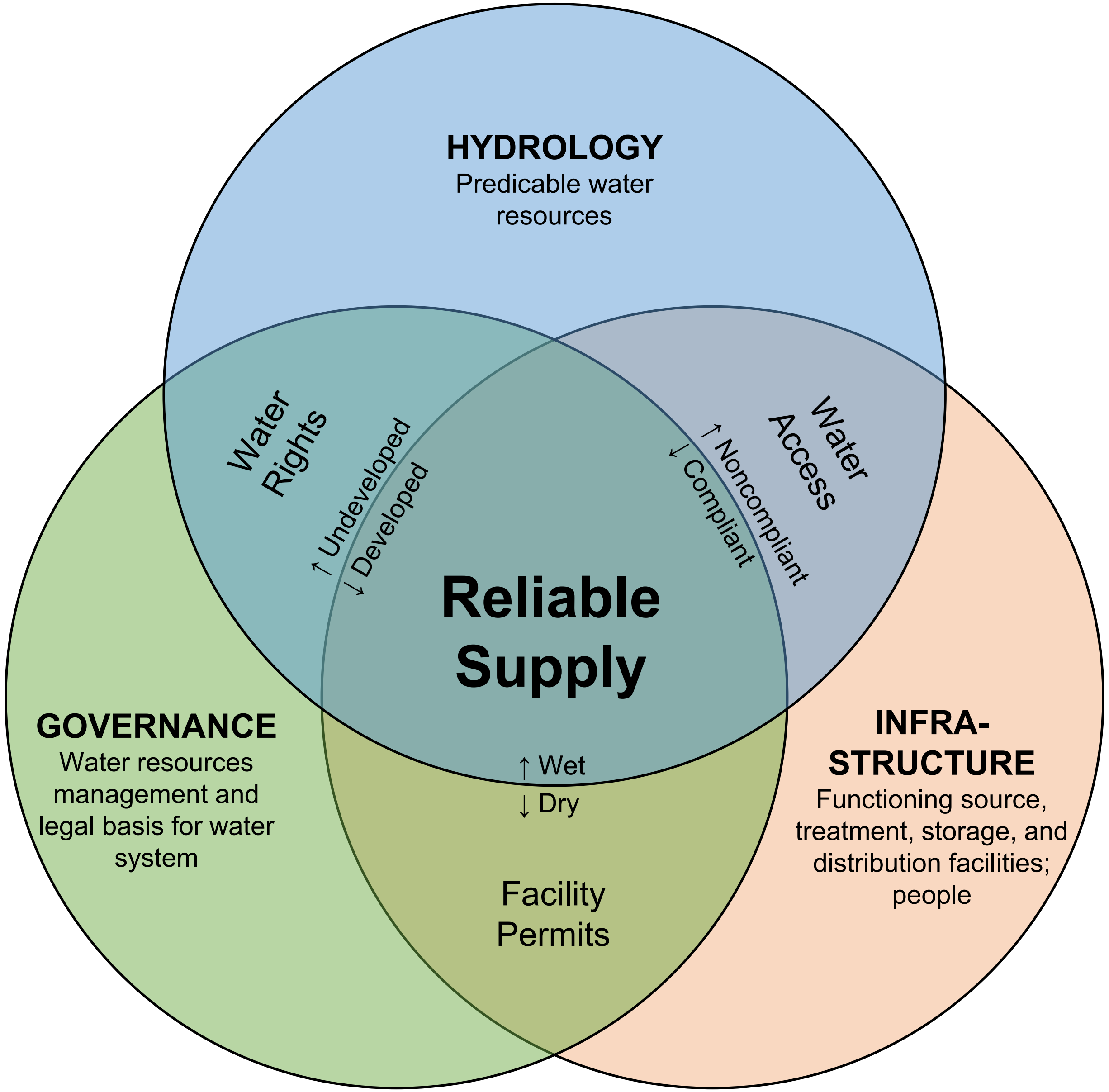
1. Quantitative evaluations
2. Set policy
3. Provide consistency to water resources management

What is reliable storage capacity?

1. **Policy is evolving and want to provide consistency**
2. **Class II policy for oil and gas fields is very mature**
   - **In some ways, not as strict as Class VI , the two permits are very different**

Definition Development

1. **Review of existing definitions in the literature**
2. **Semi-structured interviews with municipalities and water districts**



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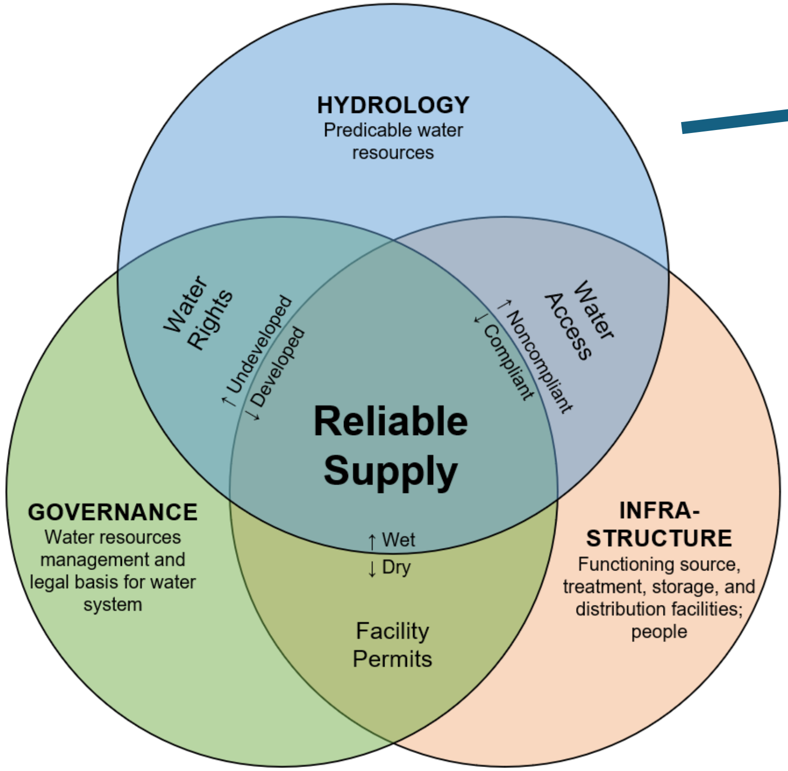
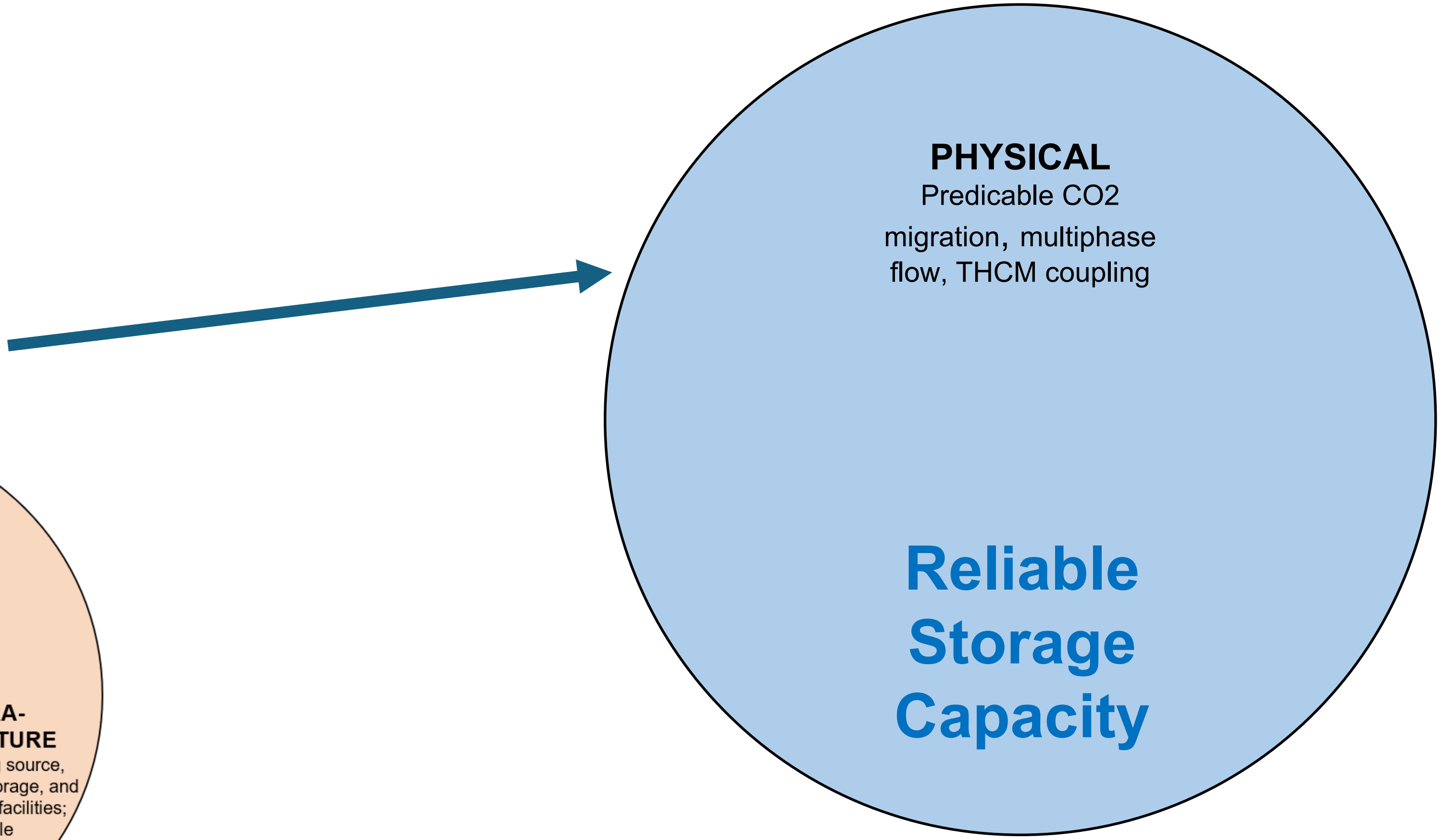
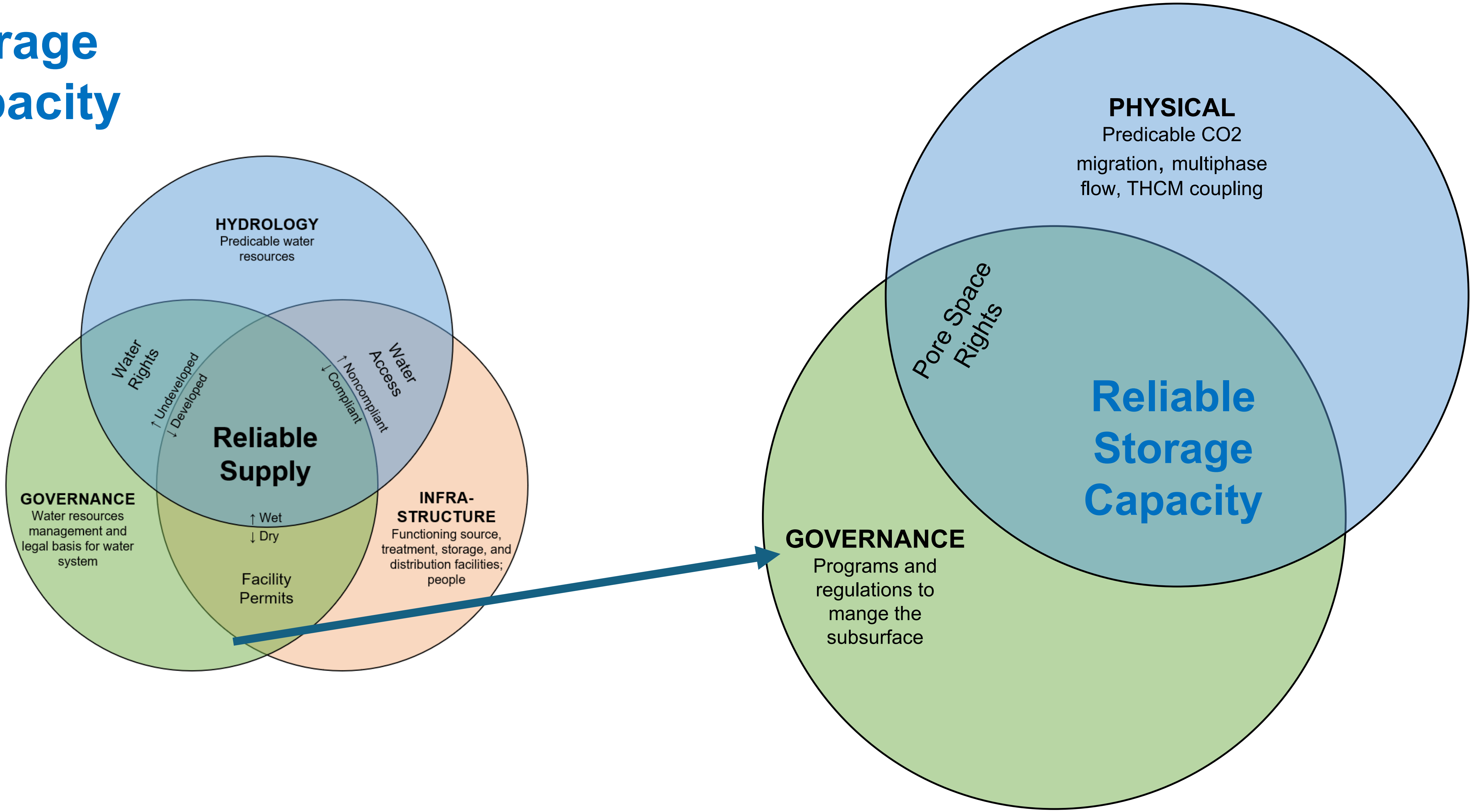
Reliable Storage Capacity





Reliable Storage Capacity



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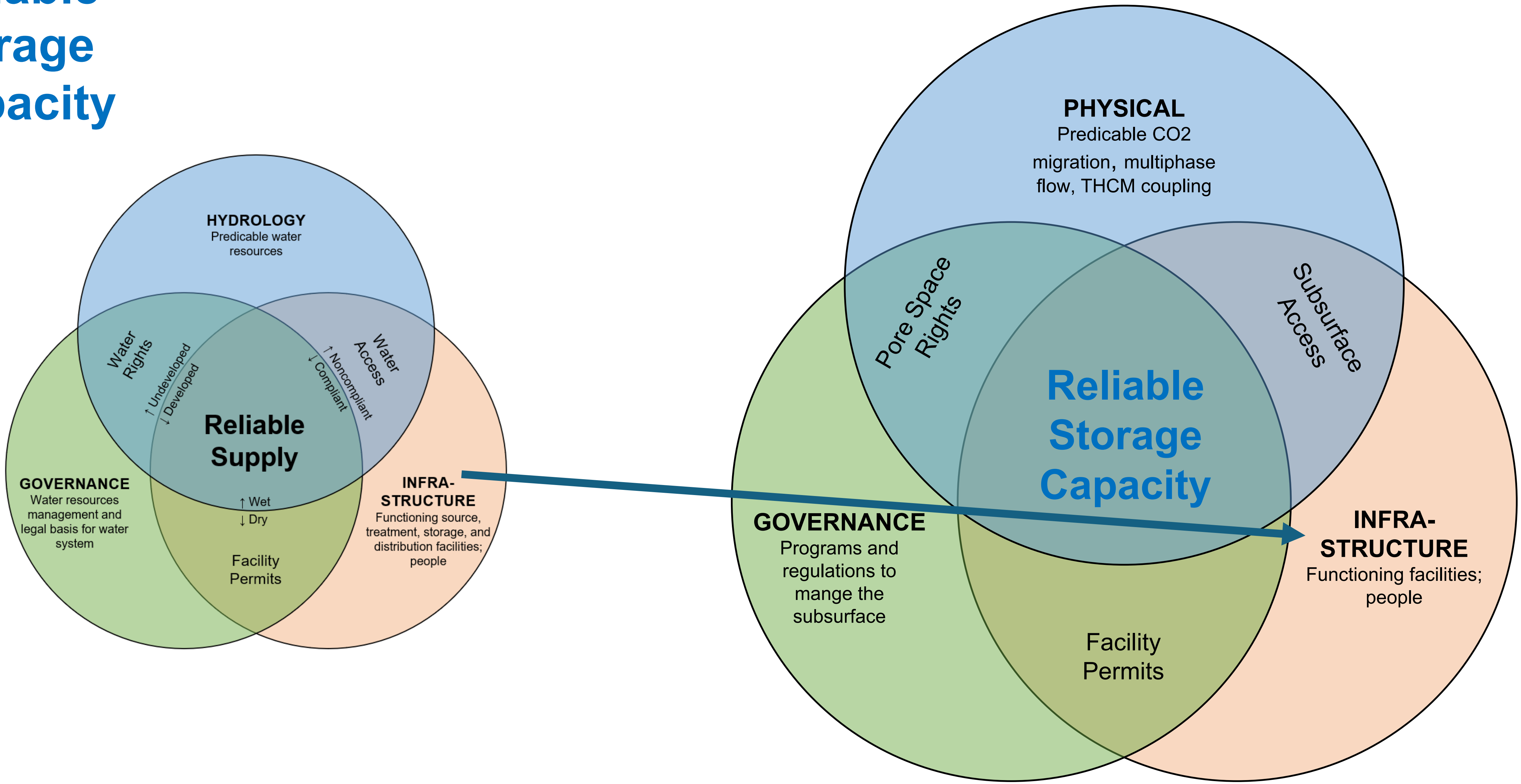
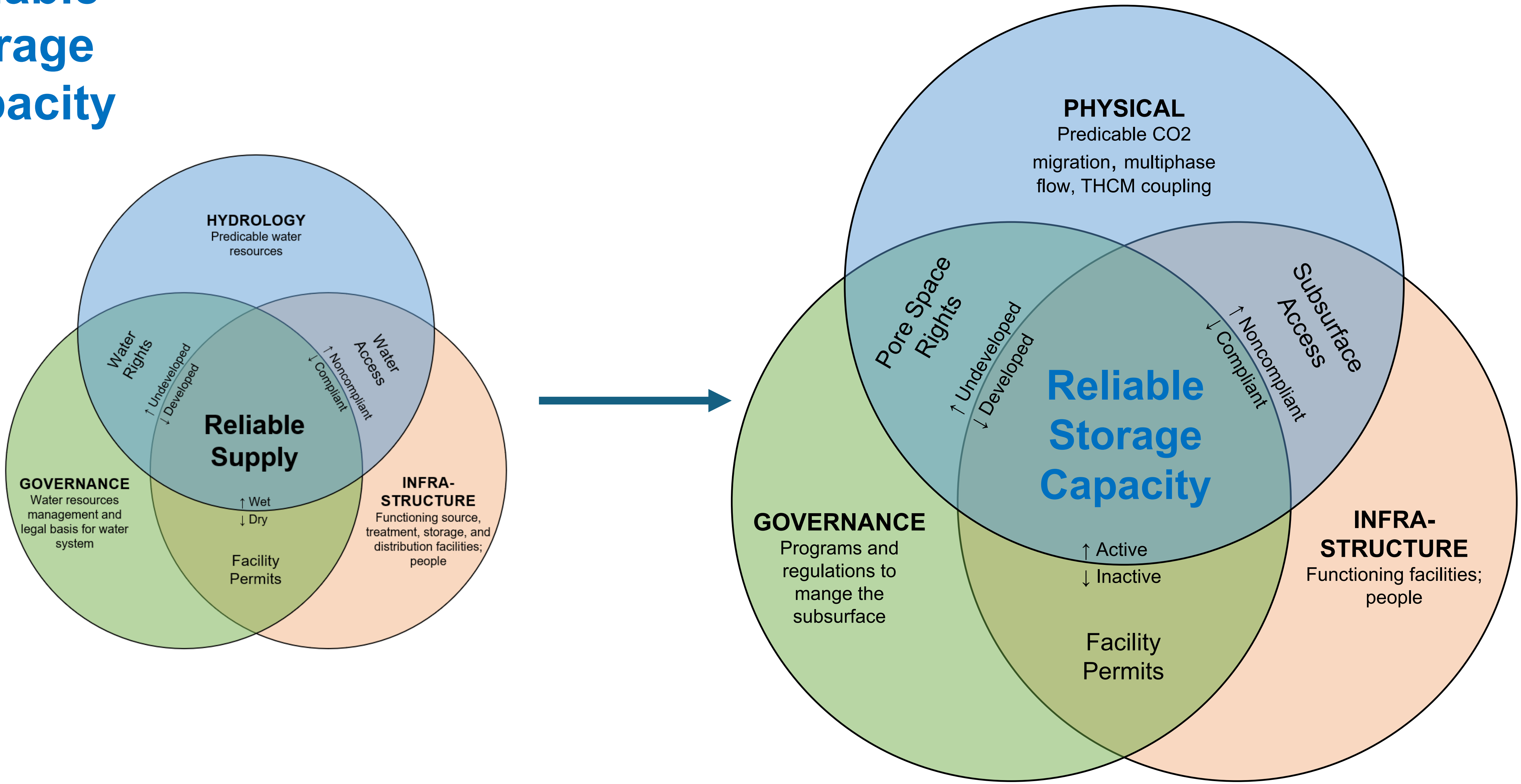


Reliable Storage Capacity



Importance of Governance

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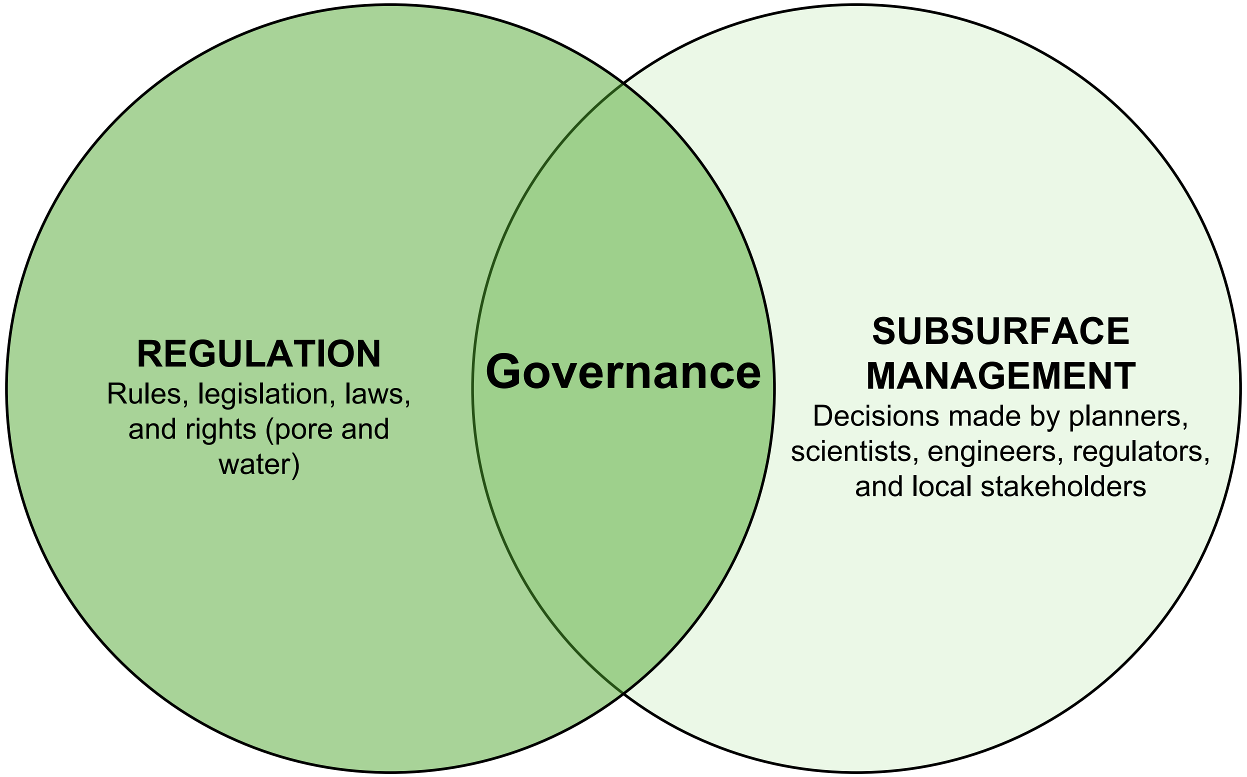


Interviewed Water Systems

Stakeholder	Organization	Service Type	Service Population	Water Sources	Setting
Stakeholder #1	Municipal	Retail	83,000	60% ground, 40% import	Urban
Stakeholder #2	Municipal	Retail	115,000	85% ground, 15% import	Urban
Stakeholder #3	Municipal	Retail	3,750	100% surface	Rural
Stakeholder #4	Water District	Wholesale/Retail	800,000	65% surface, 15% ground, 20% import	Urban
Stakeholder #5	Water District	Wholesale	1,500,000	Surface, ground	Urban, Rural
Stakeholder #6	Water District	Wholesale	700,000	Surface, ground	Urban

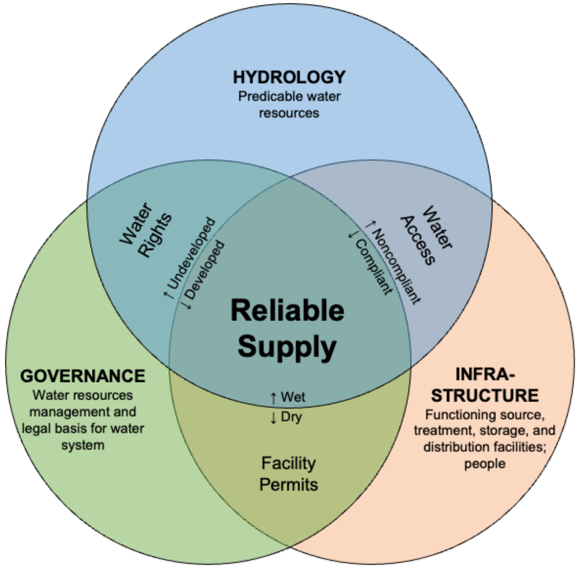
Needs for CCS

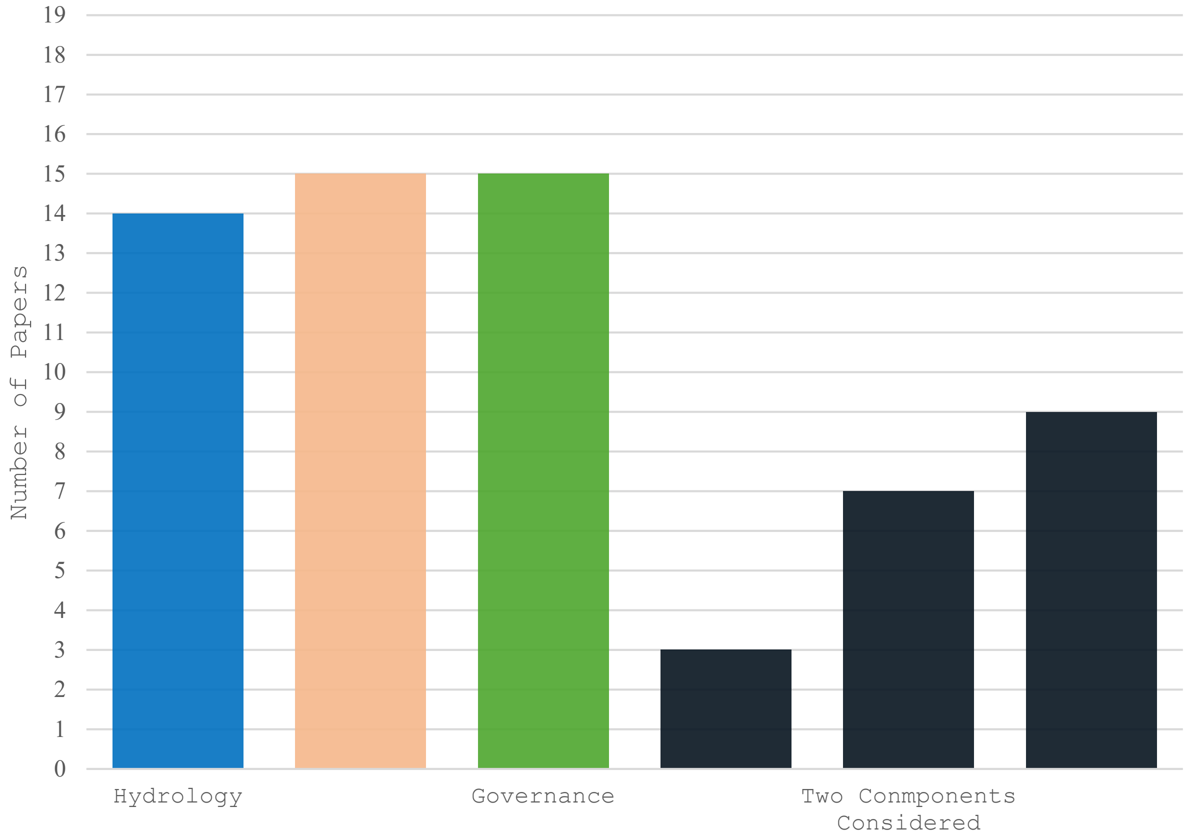
Interviews

1. **City Manager**
2. **County Commissioner**
3. **Water manager**
4. **Stakeholders**
5. **Etc.**

Data collection, literature review, etc.

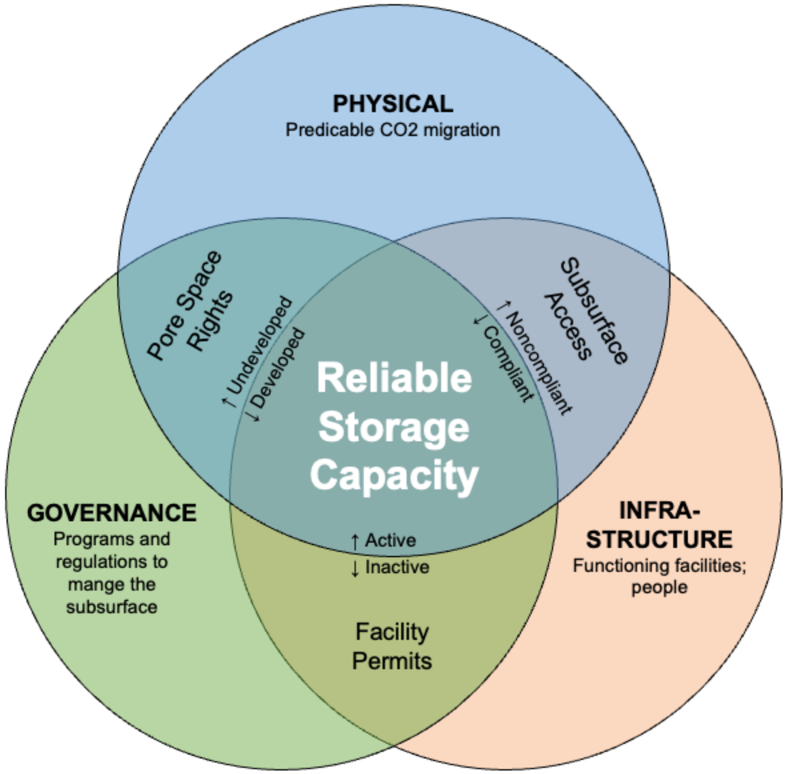
Reliable Water Supply in Literature





Component	Factors (% of papers)	
Hydrology	- Climate change (42%) - Water availability (11%) - Drought (16%) - Environment (11%)	- Limited resources (5%) - Aquifer depletion (5%) - Contamination (5%) - Change in precipitation (5%) - Weather (11%)
Infrastructure	- Looped distribution (5%) - Technology performance (11%) - Treatment (5%) - Leakage loss (5%)	- Delivery mechanisms (11%) - System capacity (11%) - Pipe failures (5%)
Governance	- Customer input (5%) - Social conditions (16%) - Institutional conditions (11%) - Water rights (11%) - Political conditions (5%) - Policy decisions (5%) - Operational management (5%)	- Demands (32%) - Conservation (5%) - Water use restrictions (5%) - Growth rates/population projections (26%)
Multiple	- Water quality (26%) - Cost/economy (42%)	

Reliable Storage Capacity



Need to identify and quantify risks and associated mitigation measures

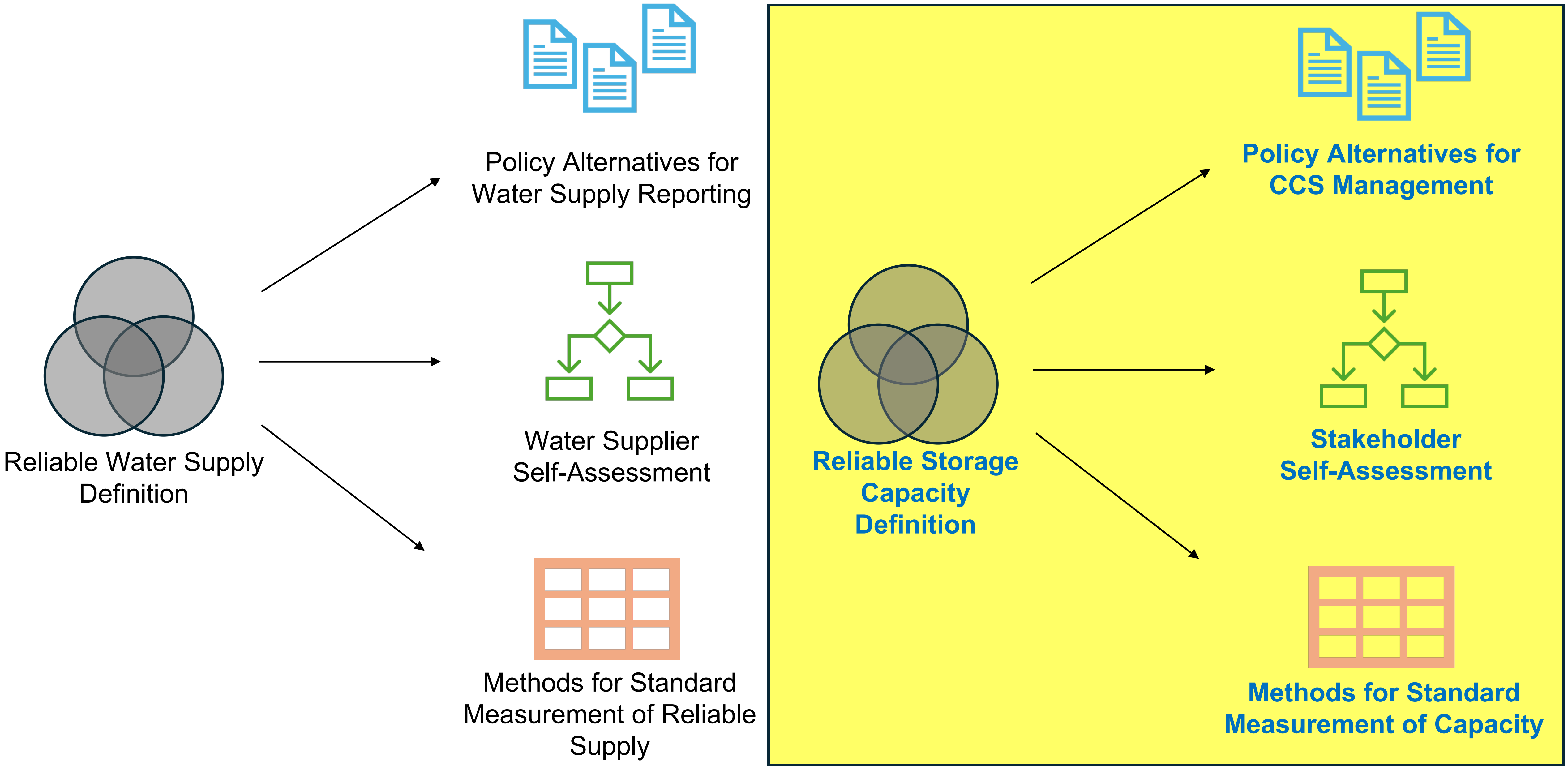
Component	CCS Factors
Physical	- Climate change - Reservoir/system characterization - Brine displacement - CO2 migration into unintended strata - Leakage to the surface - Induced seismic events - Etc.
Infrastructure	- Gathering systems - Pipelines - Compression facilities - Monitoring equipment - Etc.
Governance	- Socioeconomics - Stakeholder input - Sociopolitical conditions - Policy decisions - Operational management - Permitting - Etc.

Identified Gaps

1. There is no widely adopted definition (framework)
2. Variability between water systems makes a universal definition and framework difficult
3. Decisions made by water resource engineers are important to reliable water supply

1. **The evolving framework for CCS includes the Class VI UIC permit and the 45Q tax credit qualification**
2. **Variability between locations makes each Class VI and 45Q unique**
3. **Decisions made by stakeholders are important to reliable storage capacity**

Laying the Foundation



Approach

Perform case studies on 5 (+) water systems in Utah

- Interview water managers to understand the constraints of their supply
- Begin to develop preliminary values of available water supply based on hydrology (surface water and groundwater), infrastructure, and governance
- Compare estimates to planned water usage
- Develop policy alternatives that implement water management strategies focused on maximizing supply while supporting all planned uses and other unknown variables

Perform case studies on 5 towns in the four corners region

- **Interview local stakeholders to understand the constraints to their water resources and future possible CCS**
- **Begin to develop preliminary understanding of storage capacity based on physical, infrastructure, and governance**
- **Develop policy alternatives that implement water management strategies focused on maximizing capacity while supporting all planned uses and other unknown variables**

Objectives

- Clear understanding of available water supply
  - Establish state-wide definition and method
- Identify constraints to the water supply
- Foundation for long-term sustainable planning that balances hydrology, infrastructure, and governance

- **Clear understanding of storage capacity**
  - **Correspond to population and develop "tiers" of impacts and planning**
- **Identify constraints to the storage capacity**
- **Recommendations for programs that support future growth, CCS, and any other unknown variables**
- **Maximize benefits and minimize negative impacts**
- **Foundation for long-term sustainable planning that balances physical, infrastructure, and governance**

Thank You

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