

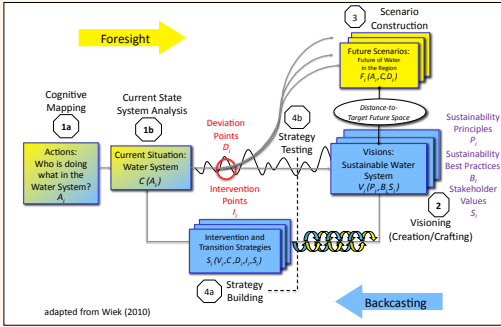


# Toward Developing a Sustainability Vision for the Water System in Central Arizona-Phoenix



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## A Transformative Research and Problem Solving Approach<sup>1</sup>



adapted from Wiek (2010)

### 1) Current state analysis

- a) Cognitive mapping: key components of the water system
- b) System analysis: key interactions between components

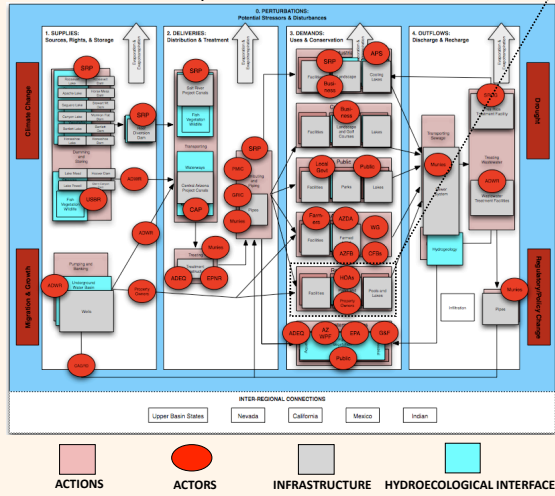
### 2) Creating a sustainability vision

- a) Sustainability principles, best practices, and stakeholder values
- b) Craft vision using Decision Theater

### 3) Develop alternative future scenarios

### 4) Develop strategies to achieve vision and avoid undesirable alternatives

## 1a) Cognitive Map (A<sub>i</sub>) of Water System in Central AZ-Phx<sup>2</sup>



## 1b) System Analysis C(A<sub>i</sub>): Creating a Coherent Sustainability Vision (V<sub>i</sub>)

Systems analysis is a tool to insure vision is internally consistent.

Identified components are used as variables in systems analysis conducted using SystAIM.

### Residential Water Demand as Example of System Complexity

(i) Residential Demand	(ii) Layers	(iii) Influence	(iv) Are Influenced by
<ul style="list-style-type: none"> <li>Drinking, Cooking, Sanitation</li> <li>Landscapes Maintenance</li> <li>Pool &amp; Lake Maintenance</li> <li>Property Owners</li> <li>HOAs</li> </ul>	<ul style="list-style-type: none"> <li><b>Actions &amp; Actors</b></li> </ul>	<ul style="list-style-type: none"> <li>⇒ Quantity of water stored for drought and dry season</li> <li>⇒ The amount of wastewater produced</li> <li>⇒ Household water consumption</li> </ul>	<ul style="list-style-type: none"> <li>⇐ Values such as aesthetics and comfort</li> <li>⇐ Needs e.g. clean water for drinking, cooking and sanitation</li> <li>⇐ City and state regulations</li> </ul>
<ul style="list-style-type: none"> <li>Homes, Community Spaces</li> <li>Yards, Parks</li> <li>Pools, Lakes</li> </ul>	<ul style="list-style-type: none"> <li><b>Infrastructure</b></li> </ul>	<ul style="list-style-type: none"> <li>⇒ The efficiency of water use</li> <li>⇒ What water is used for</li> </ul>	<ul style="list-style-type: none"> <li>⇐ The location of the home</li> <li>⇐ Building codes or HOA regulations</li> </ul>
<ul style="list-style-type: none"> <li>Turf Grass Land Cover</li> <li>Wetlands</li> <li>Fish</li> <li>Vegetation</li> <li>Wetlands</li> </ul>	<ul style="list-style-type: none"> <li><b>Hydroecology</b></li> </ul>	<ul style="list-style-type: none"> <li>⇒ The Urban Heat Island effect</li> <li>⇒ Household energy consumption</li> </ul>	<ul style="list-style-type: none"> <li>⇐ HOA landscape requirements</li> <li>⇐ Method of delivery of outdoor water</li> </ul>

(i) "Demands": Boxes and circles are the key components of residential water demand

(ii) "Layers": Domains to organize key components

(iii) "Influence": Systemic linkages that are influenced by the particular layer within residential water demand

(iv) "Are Influenced by": Systemic linkages that influence the particular layer within the residential water system

## 2) Creating a Sustainability Vision (V<sub>i</sub>): Normative Components



March 6th, 2010 Visioning Workshop with the City of Phoenix Planning Department and Citizen Stakeholders

### Sustainability Principles (P<sub>i</sub>)

- Literature review

### Best Practices (B<sub>i</sub>)

- Interviews with water managers, experts and activists

### Stakeholder Values (S<sub>i</sub>)

- Visioning Workshop, Interviews\*

\*Stakeholder visioning workshops capture a diverse range of values and perspectives, though not all. Special effort will be made to reach out to underrepresented groups, in particular the local Native American community, through interviews with local members of the Gila River and Pima-Maricopa Indian Communities.

## 2a) Sustainability Principles (P<sub>i</sub>), Best Practices (B<sub>i</sub>) and Stakeholder Values (S<sub>i</sub>)

### P<sub>i</sub> Sustainability Principles<sup>3,4</sup>

- P<sub>i</sub> - Precaution & adaptation:** Decision-making that considers unintended, adverse effects and incorporates response strategies
- P<sub>ii</sub> - Socio-ecological system integrity:** Development and maintenance of human-ecological relationships to meet the current and long-term needs of the whole system
- P<sub>iii</sub> - Resource efficiency & maintenance:** Avoid waste, reduce damages, and decrease human use of natural resources
- P<sub>iv</sub> - Socio-ecological civility & democratic governance:** Participatory decision-making, collective understanding and responsibility
- P<sub>v</sub> - Inter- & intra-generational equity:** Equitable access for current and future populations to resources that support a decent life, opportunities for improvement, and dignity
- P<sub>vi</sub> - Interconnectivity of global system:** Incorporate into decisions at a local level the potential for global consequences and vice versa

### B<sub>i</sub> Best Practices<sup>4,5</sup>

- B<sub>i</sub> - Tiered water pricing structure**
- B<sub>ii</sub> - Network of smart meters for water use**
- B<sub>iii</sub> - Increase use of wastewater**
- B<sub>iv</sub> - Reduce outdoor water consumption**
- B<sub>v</sub> - Cover pools to reduce evaporation losses**
- B<sub>vi</sub> - Install high-efficiency water fixtures**

### S<sub>i</sub> Stakeholder Values<sup>6</sup>

- S<sub>i</sub> - Drought-tolerant, xeric landscape with native vegetation**
- S<sub>ii</sub> - Trees provide shade with lush canopies (no more palm trees)**
- S<sub>iii</sub> - Households reuse water (gray water/rainwater harvesting)**
- S<sub>iv</sub> - Outdoor water use should provide cooling benefits**
- S<sub>v</sub> - Households have urban gardens and green roofs**

## 2b) Crafting a Sustainability Vision (V<sub>i</sub>) in Decision Theater

- Tradeoffs in water management and use are inevitable and difficult
- Stakeholder values can be conflicting and need to be reconciled
- Develop model where stakeholders and decision-makers can make choices about water management and use
- Choices visualized in real-time using the Decision Theater
- Groups immerse themselves in the consequences of the needs, values, and formal and informal rules that determine their actions



Photo of Decision Theater at Decision Center for a Desert City, Arizona State University

### Sources

- <sup>1</sup>Wiek A (2010) Sustainability research and problem-solving frameworks. Working Paper. School of Sustainability, Arizona State University.
  - <sup>2</sup>Wiek A, Larson K (2011) *Water governance, people, and sustainability – A systems approach*. Unpublished manuscript.
  - <sup>3</sup>Gibson R (2006) Sustainability assessment: Basic components of a practical approach. *Impact Assessment and Project Appraisal* 24 (3), 170-182.
  - <sup>4</sup>Uphoff A (2010) Interviews with Phoenix Water Experts [audio files]
  - <sup>5</sup>SRP (2010) What can you do to save water? Retrieved 2/10/2011 from <http://www.srpnet.com/>.
  - <sup>6</sup>City of Phoenix Visioning Workshop. (2010). Unpublished raw data.
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