Adaptive Management and Water: The Importance of Science to Public Policy and Water Management
Organization

• Part I. The use of science in the Federal government
• Part II. Adaptive Management - concept to use
• Part III. Examples/projects that use of Adaptive Management for water management challenges
• Part IV. Summary and thoughts regarding use of science and adaptive management
Water Policy and Actions

Good water policy is dependent upon:

- Science
- Open process
- Debate and discussion
- Follow-through
- Implementation
- Monitoring and feedback
- Adaptive management
Historically water policy dominated by linear and monolithic thinking
Challenges to Monolithic and Linear Thinking

- Climate Impacts to hydrology
- Maturing Infrastructure
- Predictive Capacity and Tools
- Cascading and Compounding effects
- Funding Mechanisms
- Politics, Process and Decision Making
- More demands with less supply
- Structural Deficits

Structural Deficits
Silo-ed Water Policy in the Federal Government

26 Federal Agencies have “water” in their missions

Has led to “protected turf” and “structured thinking”
Science and the Federal Government

- Scientists embedded in each agency - initially
- 1941 – FDR initiated the Office of Scientific Research and Development/Science Advisory Committee
- Continued role in various forms 1941-2017
  - 1955 Science Advisor to the White House
  - Office of Science and Technology Policy (1976-2017)
- National Academy of Sciences – 1863 established by Congress and approved by President Lincoln
- Executive, Legislative and Judicial branches of government – authorization/appropriation
A Digression on Science and Politics

- **1970’s** implementation of new environmental laws
- **1980’s** – Era of environmental/holistic management began to emerge – nasty problems being addressed

1992 Clinton elected President – appointed Bruce Babbitt as Secretary of the Interior

1993 - SOI Babbitt desired to form a “National Biological Survey” to reshape how the science of the DOI was being used in agency decision making

Congress could not move fast enough so SOI Babbitt used Secretarial Orders to implement NBS – Wise use & public takings folks went berserk

1994 – Republicans take over Congress and immediately begin to undermine NBS. New Speaker of the House Gingrich’s “Contract with America”

1995 – SOI Babbitt renames NBS but runs out of options – no funding

1996 NBS ceases to exist – scientists rolled into USGS – DOI science impacted
Adaptive Management and Science

Empowering Science for Better Decisions on Water
Background

• Adaptive Management – is composed of:
  1. A structured, iterative process of robust decision making in an uncertain environment
  2. Goal is to reduce uncertainty over time by using system monitoring and assessment
  3. Gather scientific and ecosystem response information necessary to improve future management of resources
Origins of Adaptive Management

• As *common sense* - has been practiced for generations to help support multiple use of resources

• As a *scientific concept* – origins in early 1900’s as part of natural resource management – Gifford Pinchot and President Teddy Roosevelt

• *Passive* and *Active* adaptive management evolved in late 1970’s and early 1980’s through studies and efforts by Kai Lee, C.S. Holling and C.J. Walters
Reasons why Federal Government includes Adaptive Management

- Politically expedience
- Enshrine “status quo”
- Legacy resilience and sustainability in water management
AdapCve Management Examples

• Increasing Use of Adaptive Management language in government programs
• Initiated a review with Congressional Research Service
• Case studies that show the range of use of Adaptive Management in respect to rivers:
  – Florida Everglades
  – Missouri River Dam and Reservoir System
  – Upper Mississippi River
  – Rio Grande River
  – Glen Canyon Dam and Colorado River
Caveats: Rivers are Complex Ecosystems

River ecosystems function as complex, dynamic systems with nonlinear responses to:

- Internal forces
- External forces
- Feedback loops
- Thresholds
- Inherent unpredictability
Because Rivers are Complex:

Effective management tends to be difficult, complex, and dependent on the interdependency of multiple components and stakeholder commitment to solutions.
Complexity of the Issues may Determine the Appropriate Response

**Type I Problems.** Technical problems that have *clearly defined questions and mechanical*, straightforward solutions

**Type II Problems.** Definable problems but have no clear-cut solution
Proposal must be tested and refined
*Adaptive Management Lite*

**Type III Problems.** No clear-cut definition of the problems and no clear-cut technical solutions. Require continual learning to formulate the problem and adaptively work towards solutions.
*Adaptive Management Full*
Systemic Elements of Complex Ecosystem Management Issues

- Multi-Sectors
- Admin. Boundaries
- Multiple Stakeholders
- Ecosystem Services
- Future Unknown
Issue: Loss of wetlands in the Everglades

Reasons:
- Urban development
- Agriculture
- Draining of wetlands
- Water development

Adaptive Management recognized as a water management approach
Corps of Engineers authorized to share in the costs of all operations and maintenance costs of restoration
Missouri River Dam and Reservoir System
Missouri River Dam and Reservoir System

Context: Water Development project by the U.S. Army Corps of Engineers and the Bureau of Reclamation for:

* Navigation
* Flood Control
* Hydropower
* Irrigation
* Recreation

Impacts: Loss of ecosystem integrity

Challenge: Operations and maintenance of the river system
Upper Mississippi River

Breadbasket of America
Upper Mississippi River

• Issues
  • Management of water quality, flooding, navigation, nutrient flows from farms
  • Loss of ecosystem integrity

• Impacts
  • Seasonal navigation – commodities
  • River control has reduced natural floodplain
  • Sediment movement reduced to delta

• Challenges
  • Multiple stakeholders
  • Economic impacts
  • Environmental issues
Middle Rio Grande River

Collaborative Program

20 plus years of contentious debate
Cochiti Dam and Spillway

Rio Grande, north of Albuquerque, New Mexico.
Glen Canyon Dam and Grand Canyon
Evolution of Adaptive Management at Glen Canyon Dam

Why the Need? *Monolithic thinking meets knowledge*

- Water development began in the Colorado River in the mid-1800’s. Based on limited data and limited assumptions
- Why:
  - Irrigation
  - Hydropower
  - Flood control
  - Development
- Impacts
  - Changing water quality
  - Changing natural water cycles
    - Seasonal shifts in water scheduling
    - Daily shifts in water releases
  - River integrity compromised
Glen Canyon Dam – Colorado River

Construction: 1956 – 1963

Modified sediment and water dynamics
Colorado River in the Grand Canyon
ECOLOGICAL INTEGRITY COMPROMISED BY
GLEN CANYON DAM
7 states
2 Countries
26 Tribes
Variable water supply
1400 miles long
Large elevation change
Adaptive Management at Glen Canyon Dam:
Water Management is Challenging

- **1922** – Colorado River Compact between the Upper and Lower Colorado River Basin States
- **1928** – Boulder Canyon Project Act – Hoover Dam and development
- **1944** – *Mexico/United States Treaty over the Colorado, Rio Grande, Tijuana rivers* – Minute 323 completed on September 27, 2017
- **1948** – Upper Colorado River Compact – allocation of water to Colorado, Wyoming, Utah and New Mexico (and a small part to Arizona)
- **1956** – Federal authorization to construct Glen Canyon Dam
- **1956** – construction begins
- **1963** – dam essentially completed – water storage begins
- **1968** – Colorado River Basin Act – directs water management in Lake Powell and Lake Mead
- **1969** – National Environmental Policy Act passed into Law
Adaptive Management and Glen Canyon Dam

- **1963-1980** – Lake Powell reservoir fills with water
- **1980** – Federal government proposed expanding hydropower at Glen Canyon Dam
  - Public outcry over dam operations and impact of dam on river
- **December 6, 1982** – Environmental Assessment on Glen Canyon Dam hydropower generators
- Glen Canyon Environmental Studies initiated – first systematic science
- **1983/1984** - high reservoir and river levels
- **1989** – GCES Phase II begins with EIS focus on dam operations
- **1992** - *Grand Canyon Protection Act* passes into law – Adaptive Management direction
- **1996** – Glen Canyon Dam EIS completed – Adaptive Management included. GCES program is terminated
- **1997** – USGS Grand Canyon Monitoring Research Center takes over
- **2016** – Long Term Experimental and Management Plan- EIS
Has Adaptive Management worked?
What is the role of science?
Does it make a difference?
Benefits of a Credible Adaptive Management Program

• Can initiate restoration efforts when scientific uncertainty exists.
• Potential to deal with changing circumstances over large time periods.
• Creation of formal monitoring networks and processes.
• Can increase stakeholder buy-in.
• Ability to serve as an oversight tool for ecosystem restoration initiatives.
• Ability to generate fundamental information.
Potential Problems of Achieving a Credible Adaptive Management Program

- Connecting Experimentation to operational changes
- Failure to resolve fundamental value conflicts
- Lack of flexibility to implement changes to a program
- Undefined objectives and performance metrics
- Use of uncertainty to delay action
- Defining roles
CONCLUSION:

Adaptive Management

An option but not a panacea
success depends upon many factors

Engaged stakeholders

Vision and political leadership

Educated decision-makers

And a lot of patience!
Multiple Roles, Responsibilities & Risks

No Time To Explain Just Get In

Water Resource Research Centers
Sec. 104 of P.L. 88379 1984
Thank you

Questions?