U.S. Experiences: IWRM and River Basin Organizations

Antalya/ WWF5 Kick Off: March 2007

by Dr. Jerome Delli Priscoli
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Nile Initiative Guests USACE Nov. 16, 2007

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Mekong River Commission Study Tour to Columbia River System April 2008

by Dr. Jerome Delli Priscoli
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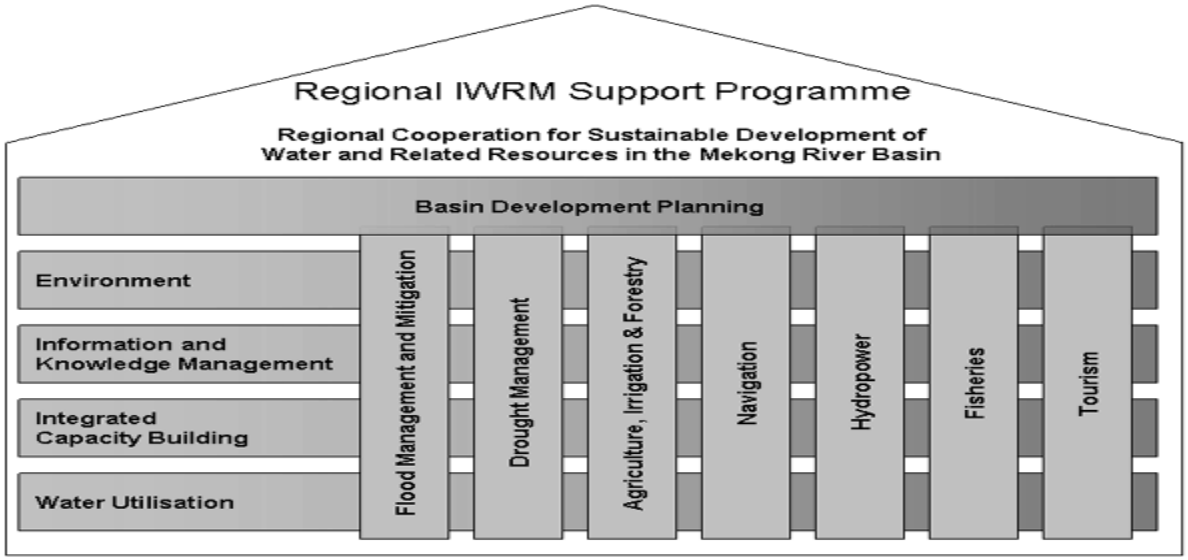
IWRM POLICY: Key Dimensions

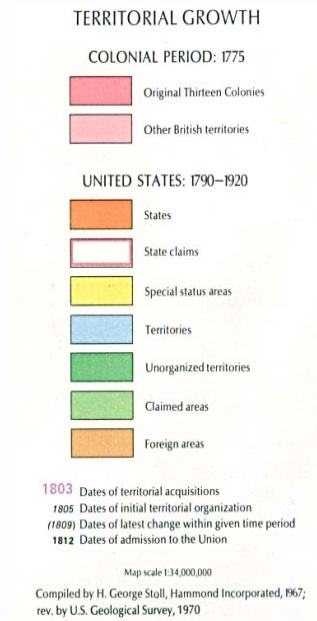
- **Decentralization – subsidiary**
- **Integration; uses - values**
- **Participation of Stakeholders**
- **Watershed –River Basins**

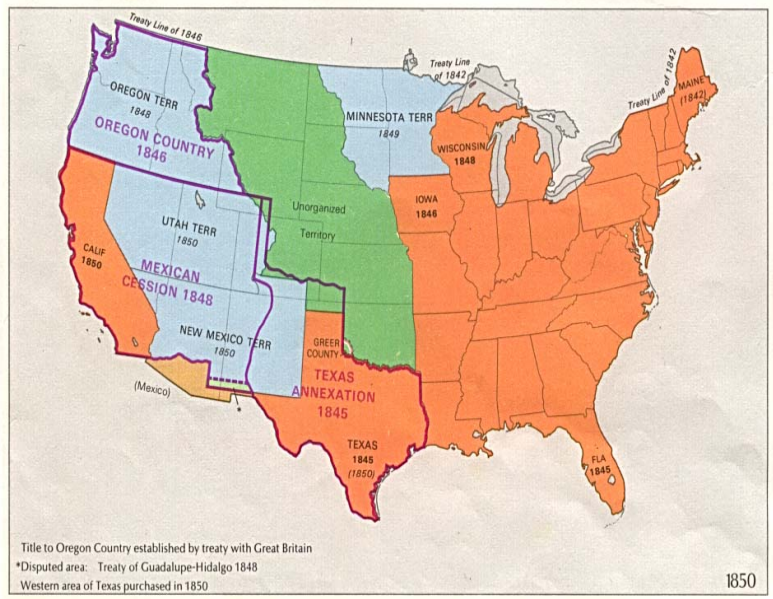
IWRM

Mekong IWRM



1. Decentralization Subsidiary

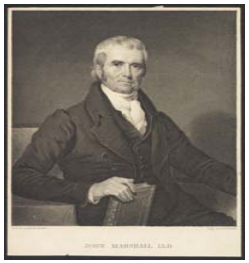




Water Ways &Establishing National Federal Interventions Over Interstate Issues

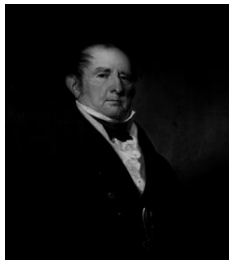
1808: Gallatin Report

Waterways to be used for:
Building Political Unity and Nation
National Defense
Economic Development



Marshal

Gibbons



Ogden

1824: GIBBONS VS. OGDEN

(Estbl. Federal Powers vs. States)

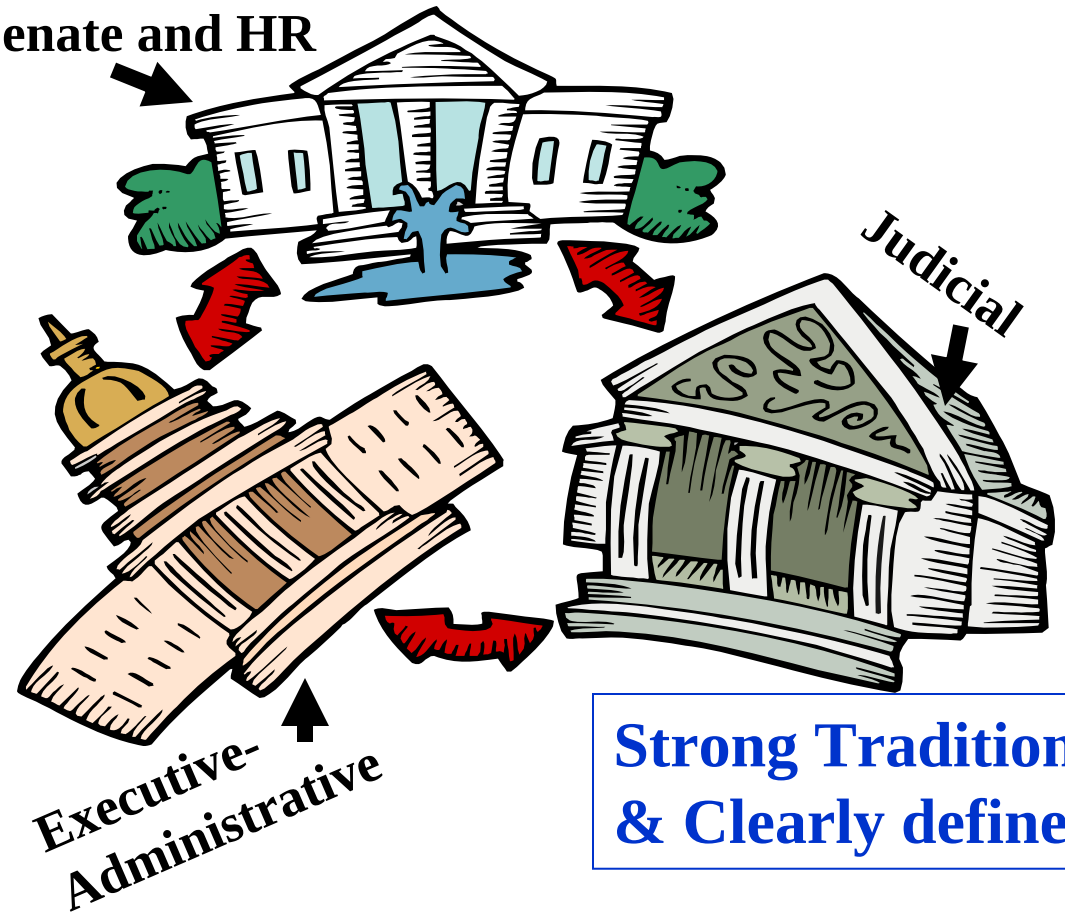
Claims are said to be repugnant–
1st. To that clause in the constitution which authorizes Congress to regulate commerce.
2d. To that which authorizes Congress to promote the progress of science and useful arts.

1920's -"308" Reports: **Congress Authorizes USACE do Comp. assessments of all major rivers of the US**

Water Must Fit US Political/Institutional Culture

Separation of Powers
Checks & Balances

Legislative
Senate and HR



State Sovereignty
- **Federal vs. State rights**
- **Regional authority vs. State & Federal**

Identification of:
- **Public interest**
- **Federal Interest**

Planning vs. Regulation
Regulatory Dominant

Strong Tradition of Private Ownership & Clearly define private rights

Some Water Basics in the US

- **US supplies 500,000 gals per person per year**
- **19 cents /gal average**
  - **Municipalities $1 / 1,000 gals**
  - **Industry and Agriculture less then 10 cents/1000 gals**
  - **Bottled water $4,000 per 1,000 gals**
- **US divided in middle 100th meridian**
  - **Most East rain fed and Arid West irrigation**
- **Two main legal Traditions of water rights Riparian in East and Prior Appropriation in West**
- **Federal System - States have primary control of water**
- **Federal Interests based on Interstate Commerce, National Economics benefits, Environmental and Public Health, managing transboundary conflicts**
- **Most people served by public water supplies**

Water Investments

- **By early 1990's over $400 billion for capital investment**
- **25,000 miles of inland waterways**
- **83,000 reservoirs and dams**
- **88,000 megawatts of hydro power capacity (= to nuclear)**
- **52,000 public utilities supply 24 billion gals per day to domestic users**
- **60 million acres of land irrigated**
- **15,000 municipal sewage treatment plants**
- **60,000 water pollution control permits**
- **BUT 60% of original inland wetlands converted to other uses**
- **BUT 50% of 1.5 million miles of streams and**

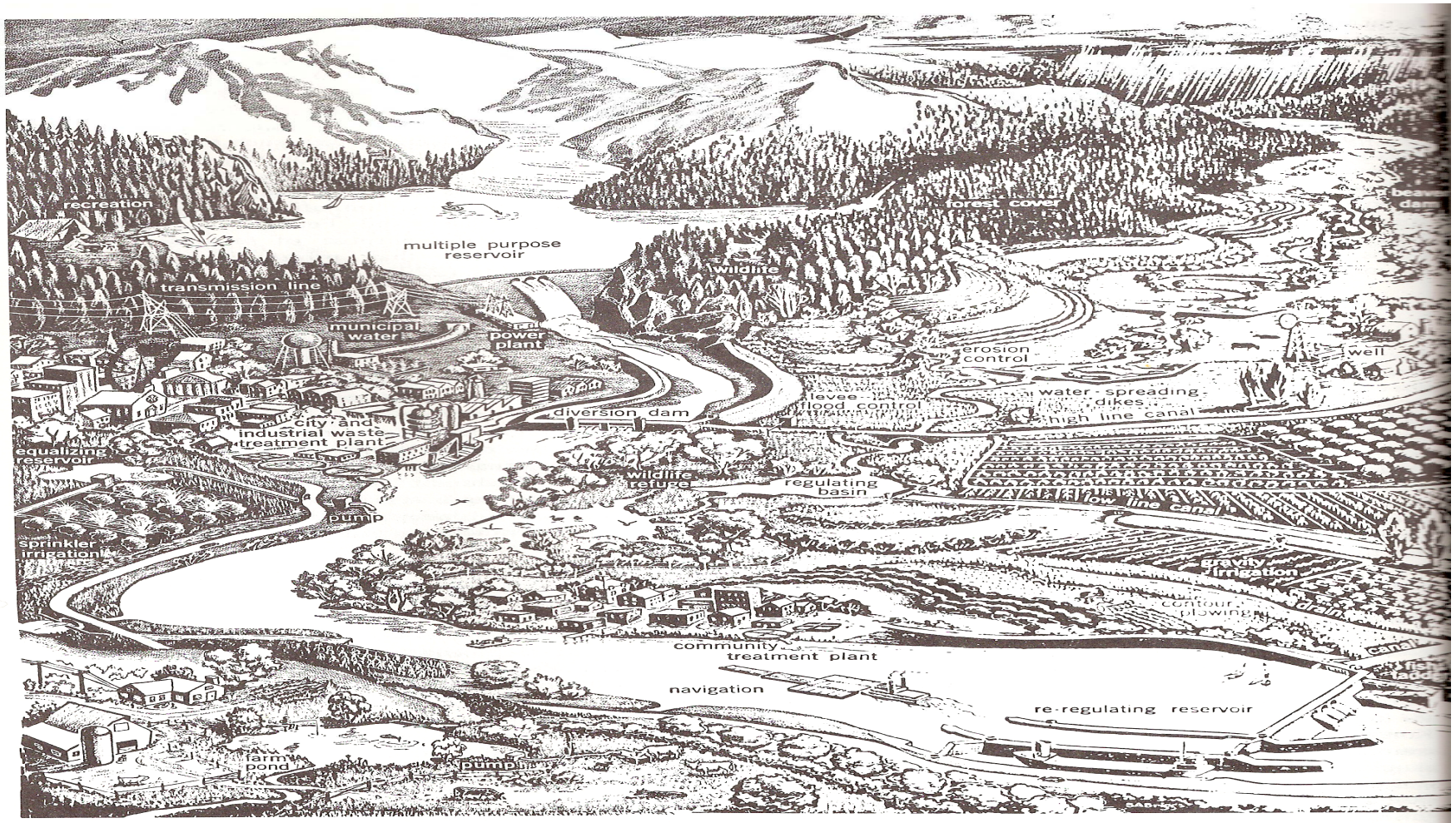
Water as an Industry in the US

- **No one Federal Policy: collection of incremental policies**
- **Annual expenditures is third - behind electric power and petro chemicals**
- **Most capital intensive**
- **Most highly regulated**
- **90,000 people in Federal Government**
- **Parts of 10 Cabinet Departments**
- **2 major Independent Agencies**
- **34 Smaller Water Agencies**
- **State and Local over 300,000 people**
- **Private sector and consultants over 50,000**

Recurrent Themes in US Water policy

- **Economic development**
  - **Regional vs. national**
  - **distribution of benefits**
- **Coordination**
  - **Legislative (Congress) vs. the President (Executive Branch)**
  - **Federal, State, Local: Decentralized vs. Centralized**
- **Conservation and environment**
  - **Wise use (Utilitarian) vs. Preservationist (absolutist)**
  - **Planning vs. regulation vs. markets in allocating**
  - **Land vs. water**

2. Integration of Uses



A Multiple-Purpose River Basin Development

(Reprinted from *A Water Policy for the American People*, The Report of the President's Water Resources Policy Commission, 1950.)

Integrated WRM

- ***Vertical Integration***: coordination and implementation of **policies** and **programs** from national level to regional and local levels
- ***Horizontal Integration***: coordination and implementation of policies and programs within **project** planning, across multiple agencies in a region
- ***Multidisciplinary Integration***:
- forming teams of specialists of various disciplines
- ***Multiobjective integration:***

  achieving social, environmental, economic

  and equity goals
- ***Integration into broader Soc./Ec./Dev. Issues***

  Then integration among uses
- ***Planning vs. Regulation***
- ***Technical vs. Political***

Principles and Guidance (P & G):
US Accounting System for Public Water Investments

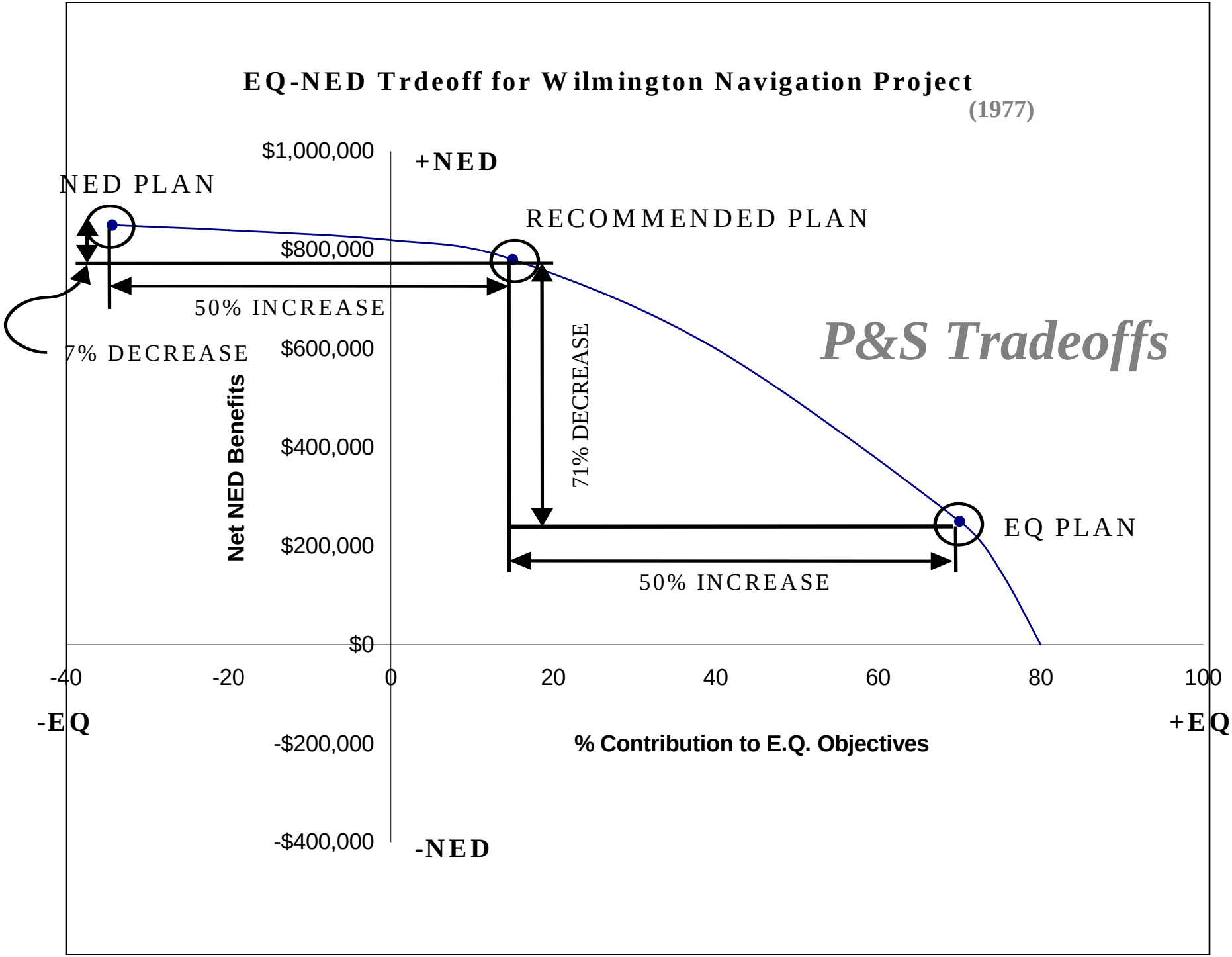
- National Economic Development (NED)
  - beneficial and adverse effects on the national economy in monetary terms
- Environmental Quality (EQ)
  - effects of plans on significant environmental resources and ecological, cultural and esthetic attributes
- Regional Economic Development (RED)
  - distribution of regional economic activity from each plan in terms of regional income and employment
- Other Social Effects (OSE)
  - effects on urban and community impacts, life, health, safety factors; displacement, long term productivity; energy requirements and energy conservation

P & G
US Accounting System for Public Water Investment

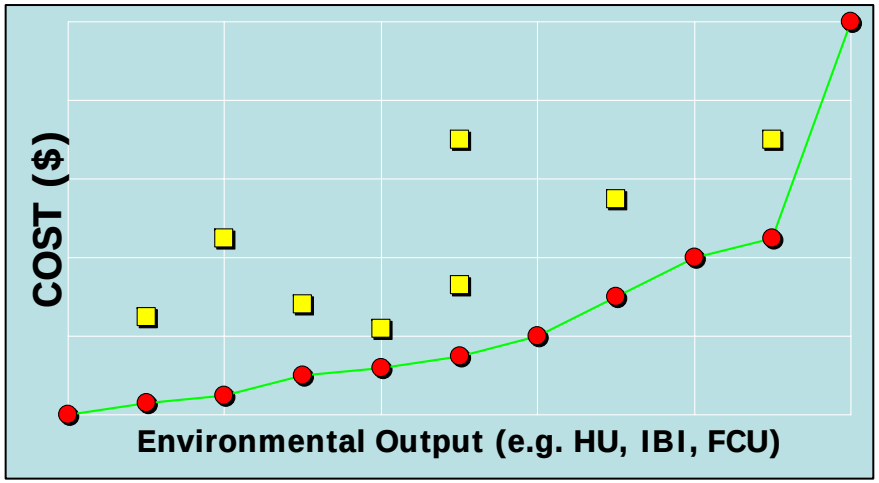
U.S. Water Resources Planning Framework

US Water Resources Planning Framework

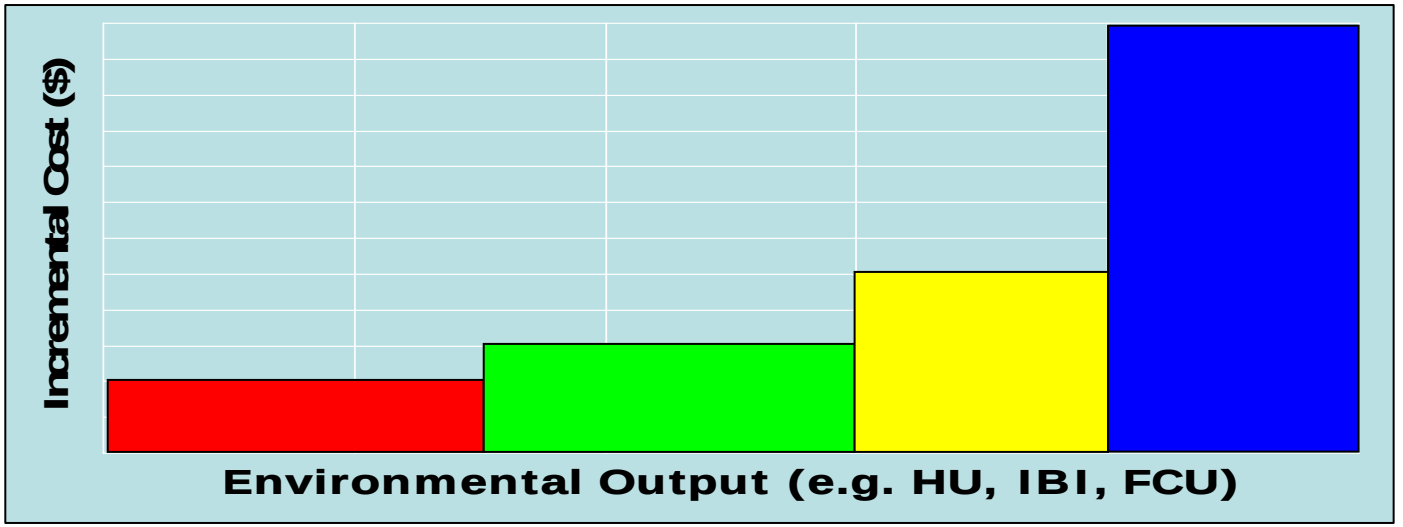
- Level A Region (many rive basins)
  - Macroeconomics, goal setting, Integrated economic resource use analysis, institutions, laws.
- Level B River Basin
  - Macro I-O, econometric models, water use sectors, priorities, system management, policy analysis
- Level C Project/Site
  - Microeconomics, economic efficiency, mitigation, design, O&M, cost-sharing, role, resp.


EQ-NED Trdeoff for Wilmington Navigation Project
(1977)
$1,000,000
+NED
NED PLAN
RECOMMENDED PLAN
$800,000
50% INCREASE
7% DECREASE
$600,000
Net NED Benefits
71% DECREASE
P&S Tradeoffs
$400,000
EQ PLAN
$200,000
50% INCREASE
$0
-40
-20
0
20
40
60
80
100
-EQ
+EQ
% Contribution to E.Q. Objectives
-$200,000
-$400,000
-NED

COST EFFECTINESS ANALYSIS



INCREMENTAL COST ANALYSIS

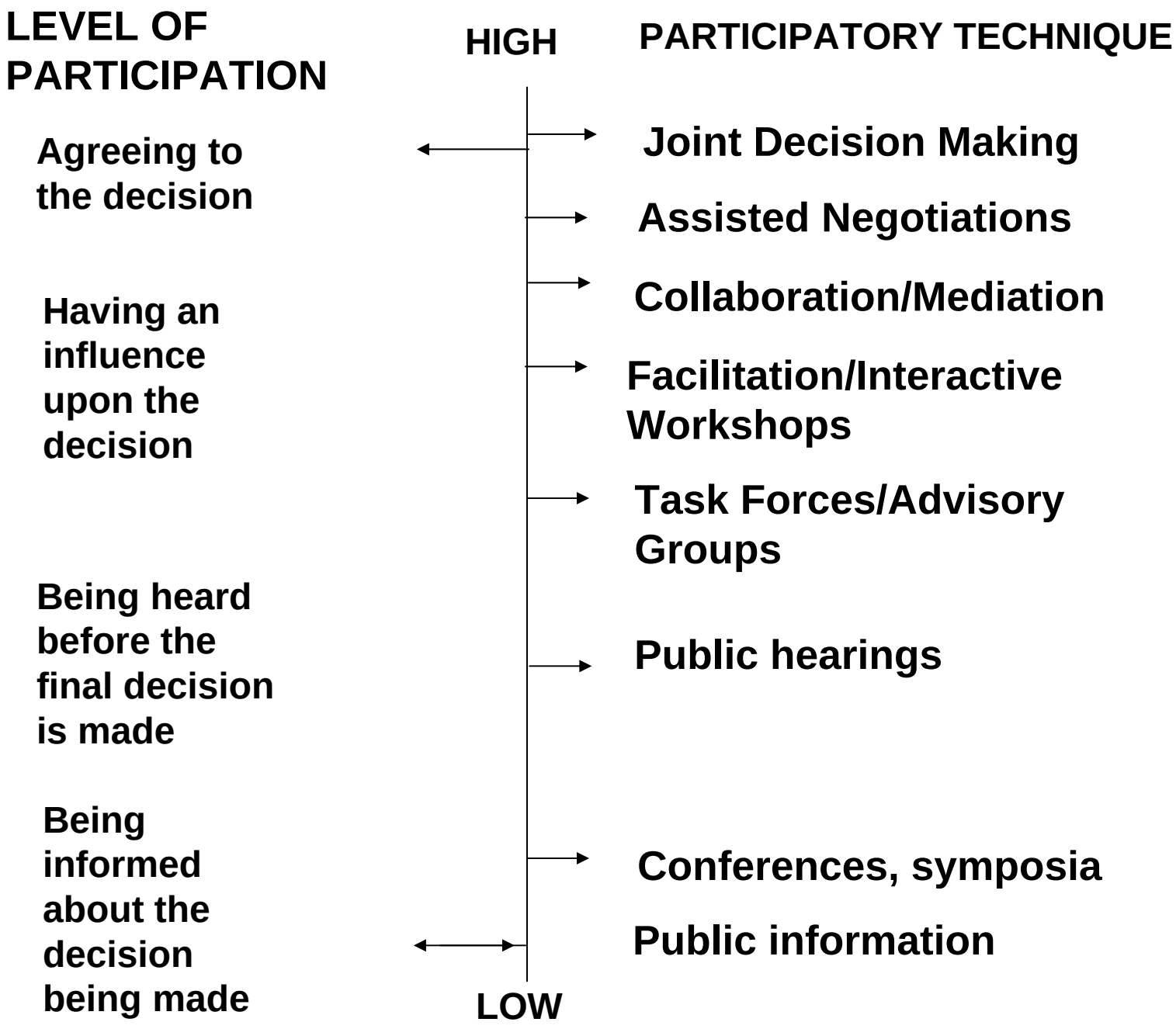


US Army Corps of Engineers ®
Walla Walla District

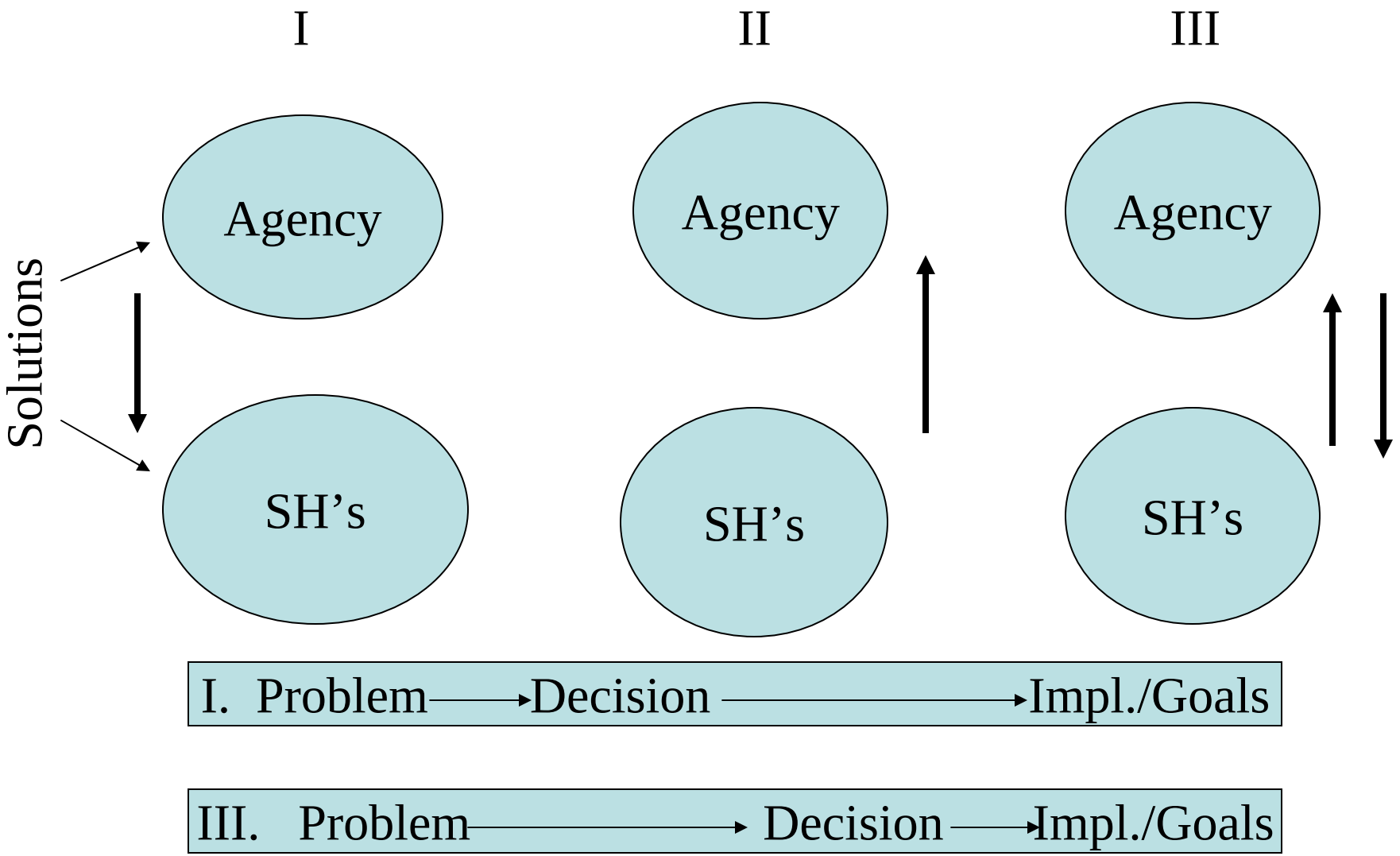
3. Public & Stakeholder Participation

Two Main Polarized Groups

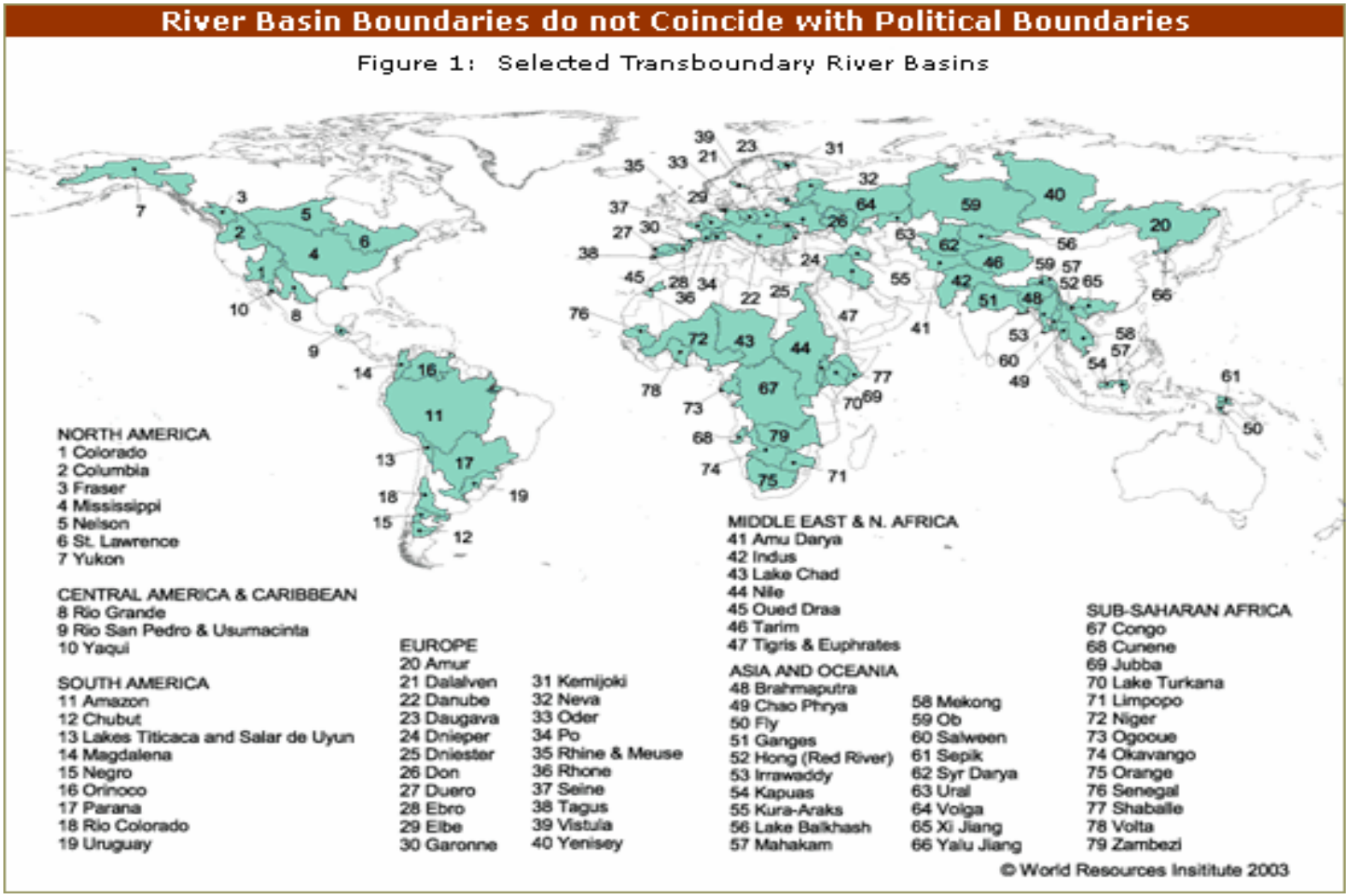
- **Pro Dam**
- **Pro Fish Anti Dam For Dam Breaching**


LEVEL OF PARTICIPATION
HIGH
PARTICIPATORY TECHNIQUE
Agreeing to the decision
Having an influence upon the decision
Being heard before the final decision is made
Being informed about the decision being made
Joint Decision Making
Assisted Negotiations
Collaboration/Mediation
Facilitation/Interactive Workshops
Task Forces/Advisory Groups
Public hearings
Conferences, symposia
Public information
LOW

Defining Role of Participation in Decisions



4. River Basins - Watershed



Watershed vs. RBO

	Watershed	RBO
Geographic Scope:	R.B. is a watershed Not all watersheds are R.B's	
Level of Authority:	less →	more
Participants:	Broader mix public + non public	More focused on formal public
Legal basis:	Informal →	Formal
Issues/services addressed:	Multi-issue more local	Multi- issue more regional
Catalyst events:	•Droughts, floods, •Fragmentation •Demographic mismatching	

But Hydrology and Organizations/Laws Rarely Fit:

Conceptual Model

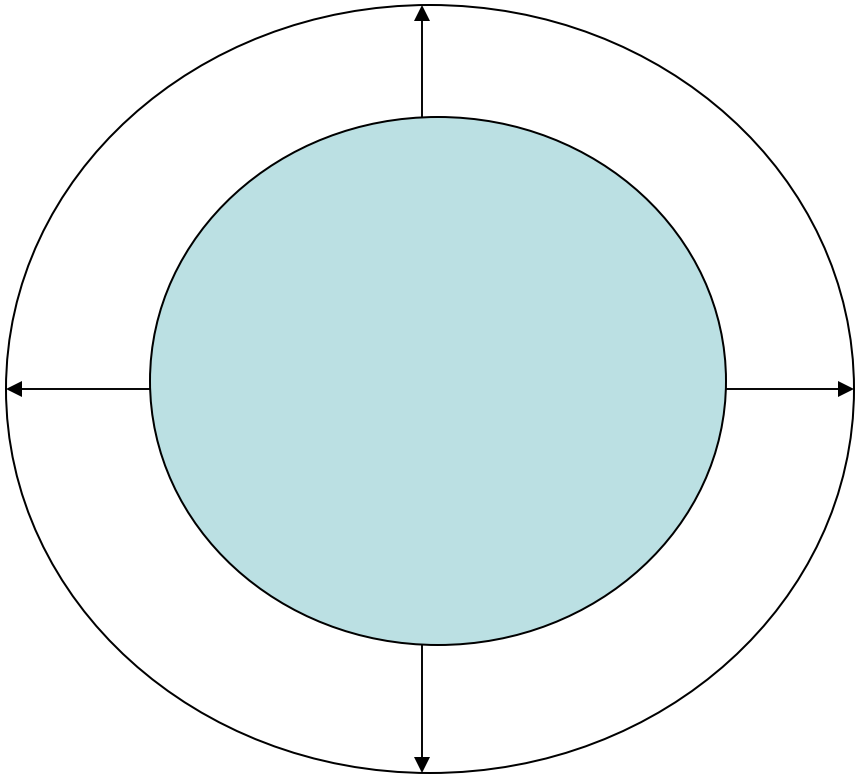
Interjurisdictional

Intersectoral

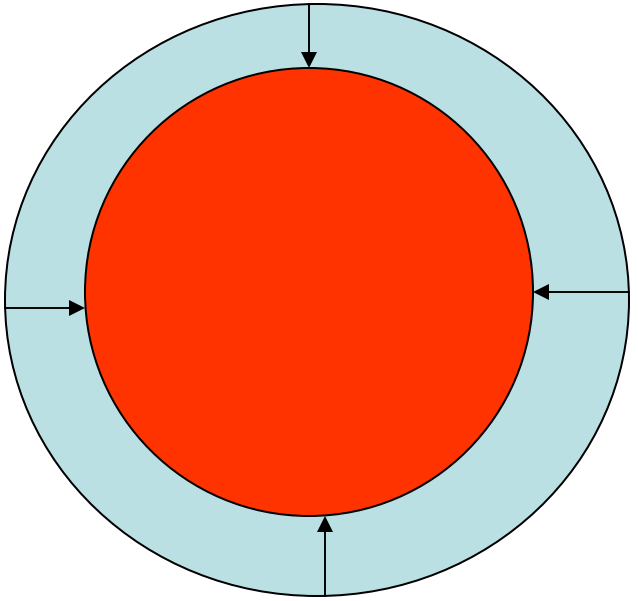
Jurisdict / Sector	Ja			Jb			Jc			J*n*		
	Ja1	Ja2	Ja*n*	Jb1	Jb2	Jbn	Jc1	Jc2	Jcn	Jn1	Jn2	Jnn
Sector1 (Agr.)												
Sector2 (Indust.)												
Sector3 (Trans.)												
Sector4 (Energy)												
Sector n (etc.)												

From Jerome Delli Priscoli

Negotiating Arenas: Benefits - Interests



Increasing the Pie
Benefits Created



Mitigating against
Decreasing Pie

Role of IWRM?

Collaboration: Machiavelli and Leonardo Da Vinci for Multipurpose Diversion of the Arno River

"The Rediscovery of engineering and the development of trade provided an important foundation for art and philosophy. After a long period of instability…scholars have described the period from around 1400 -1470 as the equilibrium of the Renaissance. Particularly in Italy, agriculture flourished and harvests improved, population stabilized and political conflict moderated. These transformations were slower to come in Northern Europe, particularly in regions where the technology of water control was not as well developed as in Italy. "(Masters 1998)

RBO's in the World

Key Topics

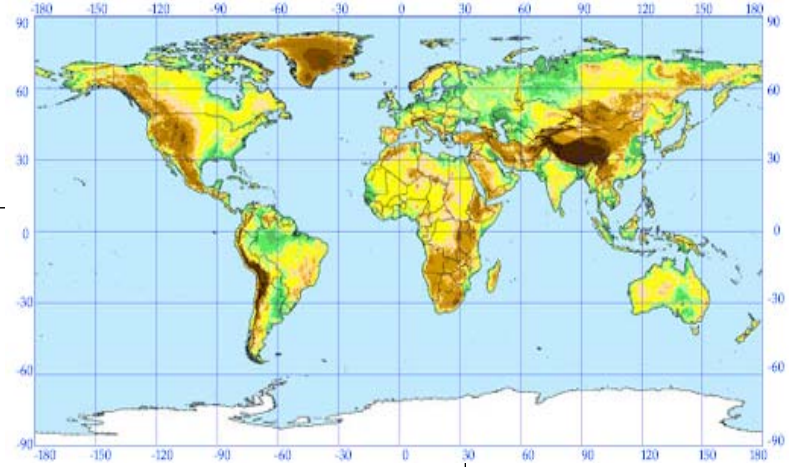
Basin tariffs

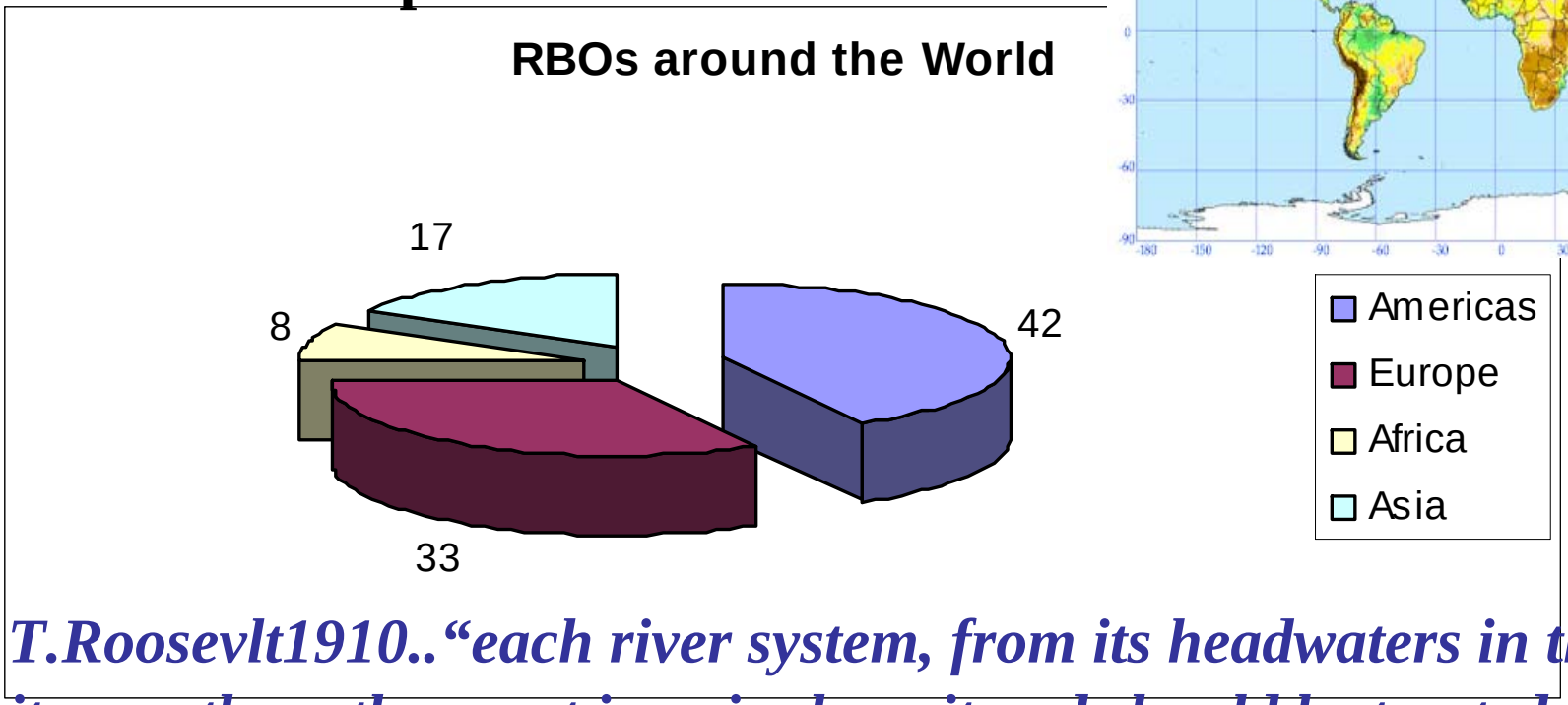
Planning: grass roots approach

Water rights allocation

Water pollution control

.. mid-1950s the UN SG… "river basin development is now recognized as an essential feature of economic development





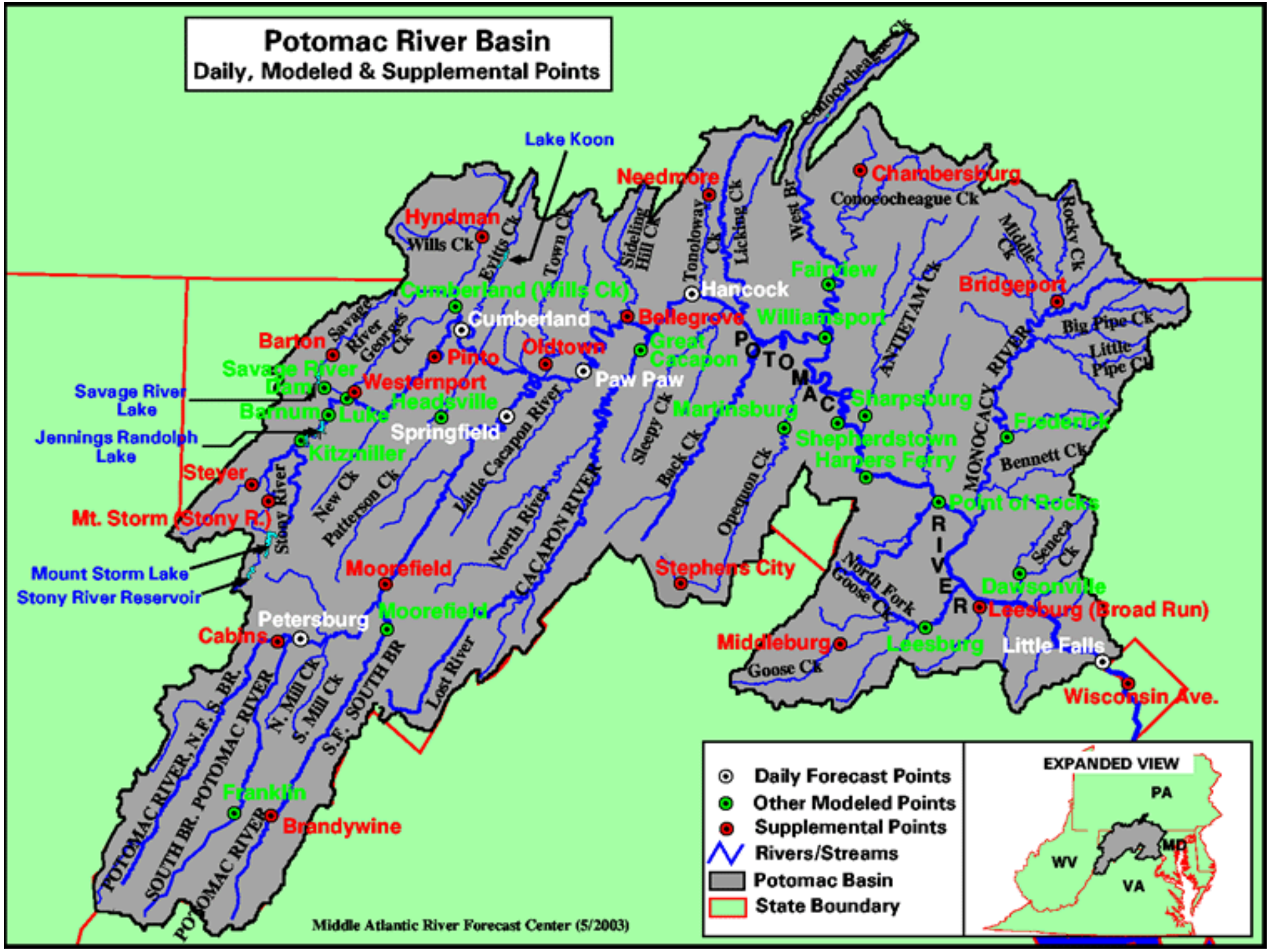
T.Roosevlt1910.."each river system, from its headwaters in the forest to its mouth on the coast is a single unit and should be treated as such."

U.S. - North American Experiences with RBOs

Some succeeded
Some failed
All are different

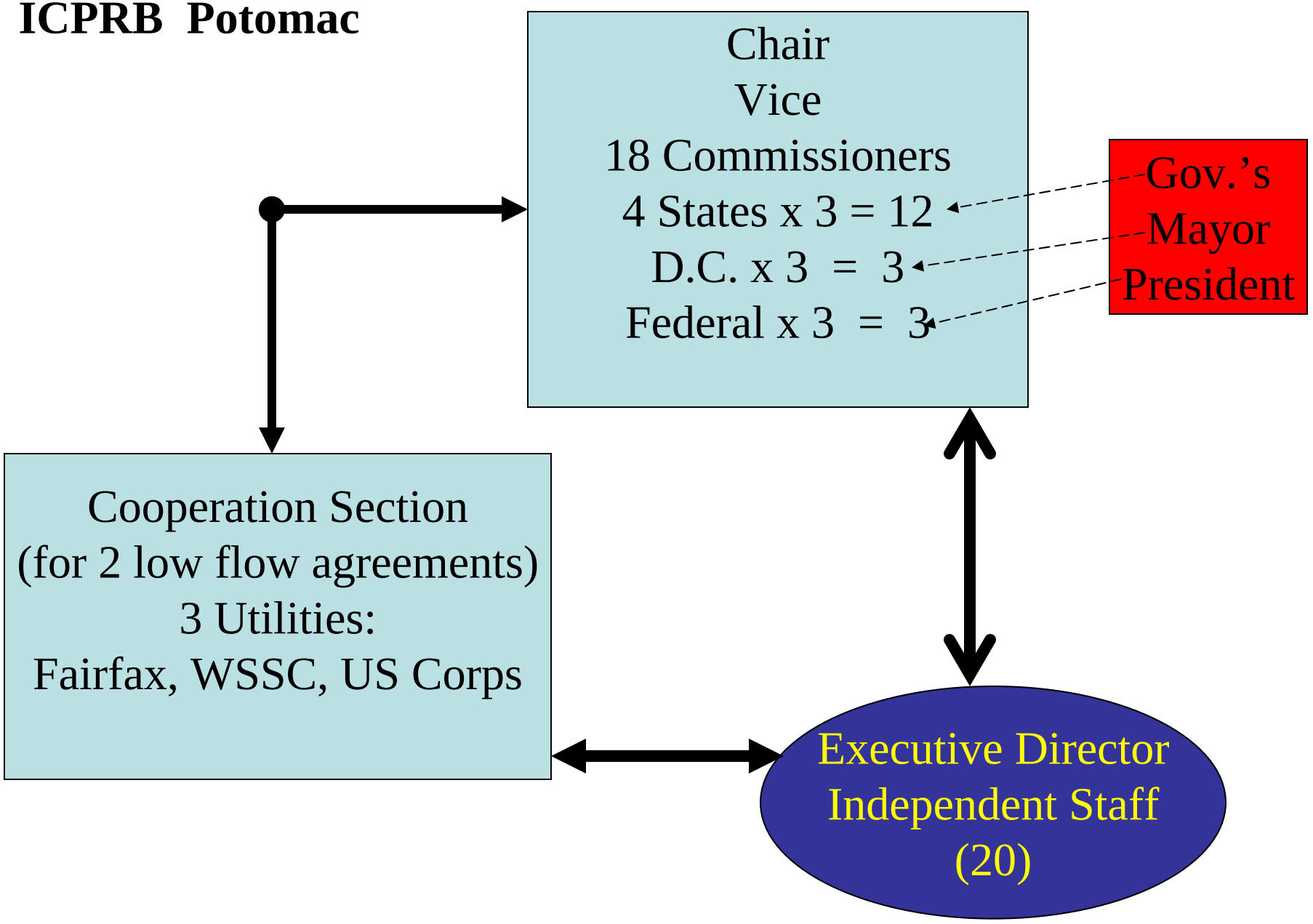
8 Types of RBO Coordinating Mechanisms

1. Interstate Compact Commissions
   (Potomac)
2. Interstate Councils
3. Basin Interagency Committees (Ad hoc)
4. Interagency - Interstate Commissions
   (Tittle II)
5. Federal - Interstate Compact Commissions
   (DRBC/SRBC)
5. Federal - Regional Agencies
   (TVA)
6. Single Federal Administrator
   (DOI Colorado)
7. Watershed Councils/ Process
   (American Heritage Rivers)


Potomac River Basin
Daily, Modeled & Supplemental Points
Lake Koon
Needmore
Chambersburg
Conococheague Ck
Hyndman
Wills Ck
Evitts Ck
Town Ck
Sideling Hill Ck
Tonoloway Ck
Licking Ck
West Br
Middle Ck
Rocky Ck
Fairview
Cumberland (Wills Ck)
Hancock
Bridgeport
Cumberland
Bellegrove
Williamsport
Big Pipe Ck
Little Pipe Ck
Barton
Savage River
Georges Ck
Pinto
Oldtown
Great Cacapon
POTOMAC
ANTIETAM Ck
MONOCACY RIVER
Savage River Dam
Westernport
Paw Paw
Savage River Lake
Barnum
Luke
Headsville
Springfield
Martinsburg
Sharpsburg
Frederick
Jennings Randolph Lake
Kitzmiller
Shepherdstown
Harpers Ferry
Bennett Ck
Steyer
Stony River
New Ck
Patterson Ck
Little Cacapon River
North River
CACAPON RIVER
Sleepy Ck
Back Ck
Opequon Ck
Point of Rocks
Mt. Storm (Stony R.)
Mount Storm Lake
Stony River Reservoir
Moorefield
Stephens City
RIVER
Seneca Ck
North Fork Goose Ck
Dawsonville
Leesburg (Broad Run)
Petersburg
Moorefield
Cabins
Middleburg
Leesburg
Little Falls
Goose Ck
Wisconsin Ave.
POTOMAC RIVER, N.F.
S. BR. POTOMAC RIVER
N. Mill Ck
S. Mill Ck
S.F. SOUTH BR
Lost River
Franklin
Brandywine
POTOMAC RIVER
Daily Forecast Points
Other Modeled Points
Supplemental Points
Rivers/Streams
Potomac Basin
State Boundary
EXPANDED VIEW
PA
MD
WV
VA
Middle Atlantic River Forecast Center (5/2003)

1. Interstate Compact Commission

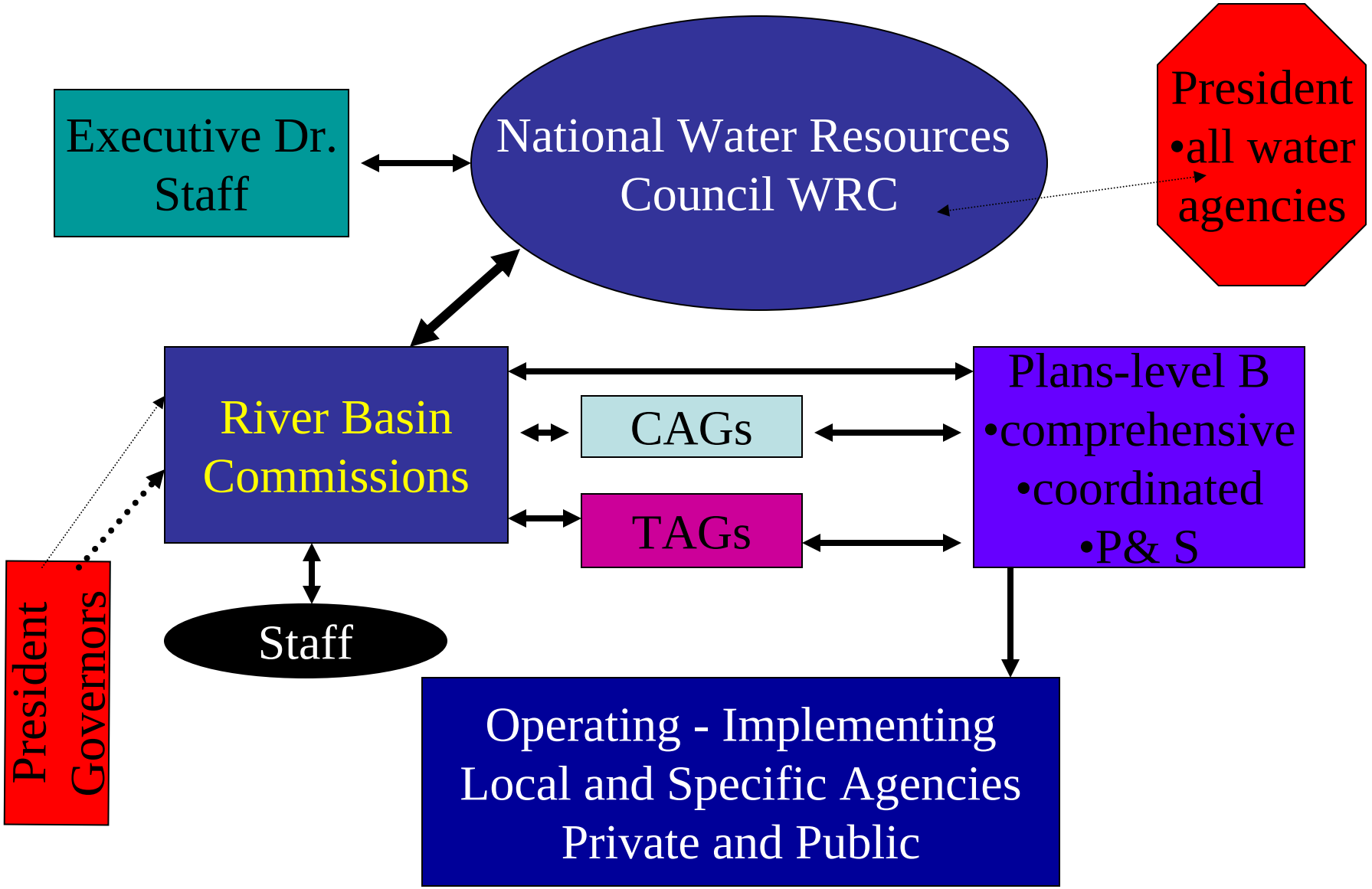
ICPRB Potomac



Interstate Compact Commission
Interstate Commission for the Potomac (ICPRB)

- Driven by drought contingency planning
- Little formal power – low flow agreement – data gathering – joint interactive stakeholder modeling
- But high influence and growing!
- 16 dams originally planned – actual 1 large and 1 minor dam
- Best use of non structural approaches of any basin
- System yield up by 50% - satisfying in stream needs and quality vs. 45% with dams

4. Interagency - Interstate Commission Tittle II (No longer exists)



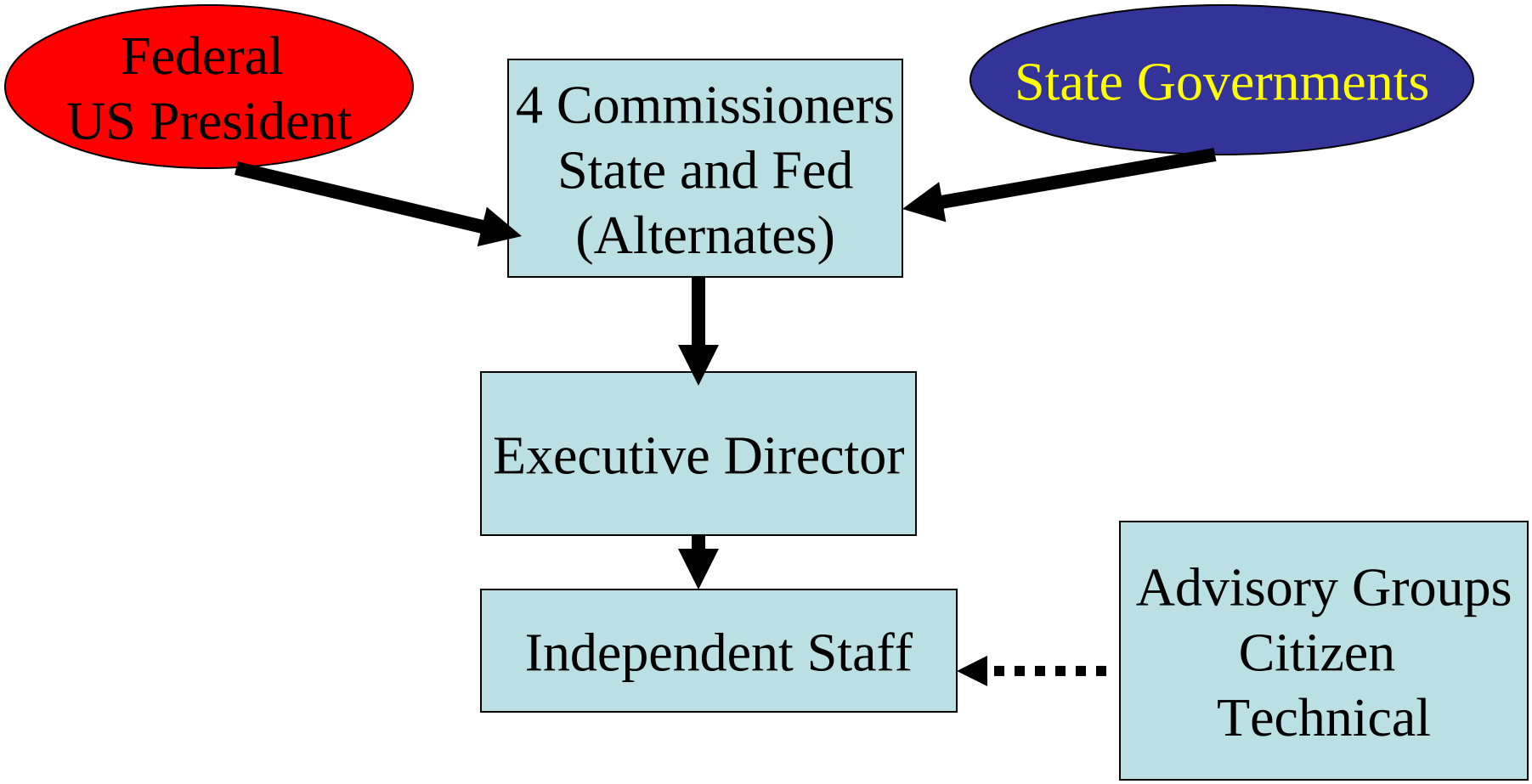
Interagency – Interstate Commissions Title II's

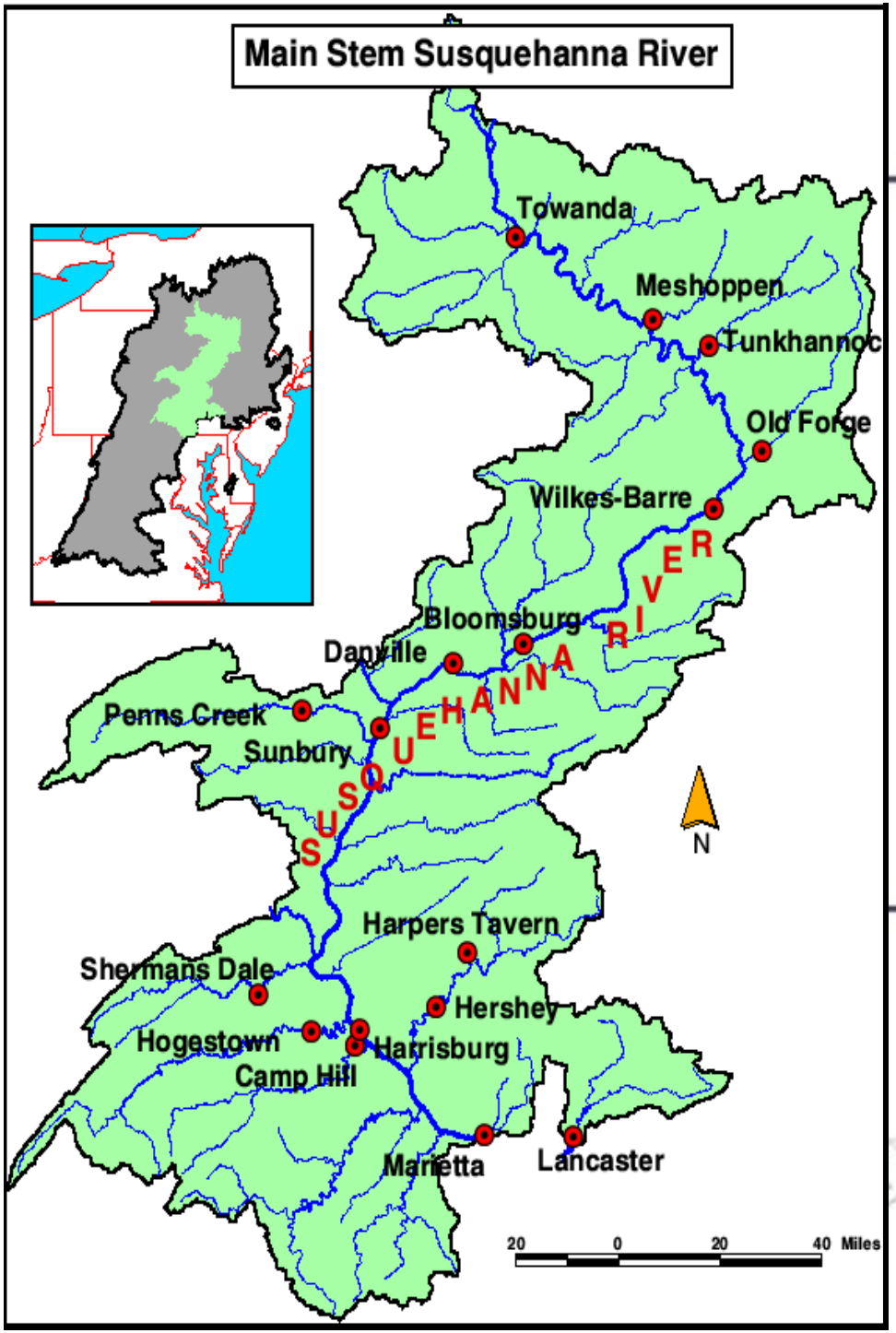
- Long Process 1940s – 50s – 60s – 70s
- To improve coordination through joint plan to guide Federal and other investments in water
- Water Resources Council at National level
- River Basin Commissions in country
- P&S (G) – analytical guidelines for water planning and national accounting
- Structure stopped in 1980 – no coordinating device today except budget process
  - 1970s focus to EQ grants and water quality

5. Federal Interstate Compact Commission

DRBC - Delaware

SRBC - Susquehanna




Main Stem Susquehanna River
Towanda
Meshoppen
Tunkhannoc
Old Forge
Wilkes-Barre
RIVER
Bloomsburg
Danville
SUSQUEHANNA
Penns Creek
Sunbury
N
Harpers Tavern
Shermans Dale
Hershey
Hogestown
Harrisburg
Camp Hill
Marietta
Lancaster
20 0 20 40 Miles

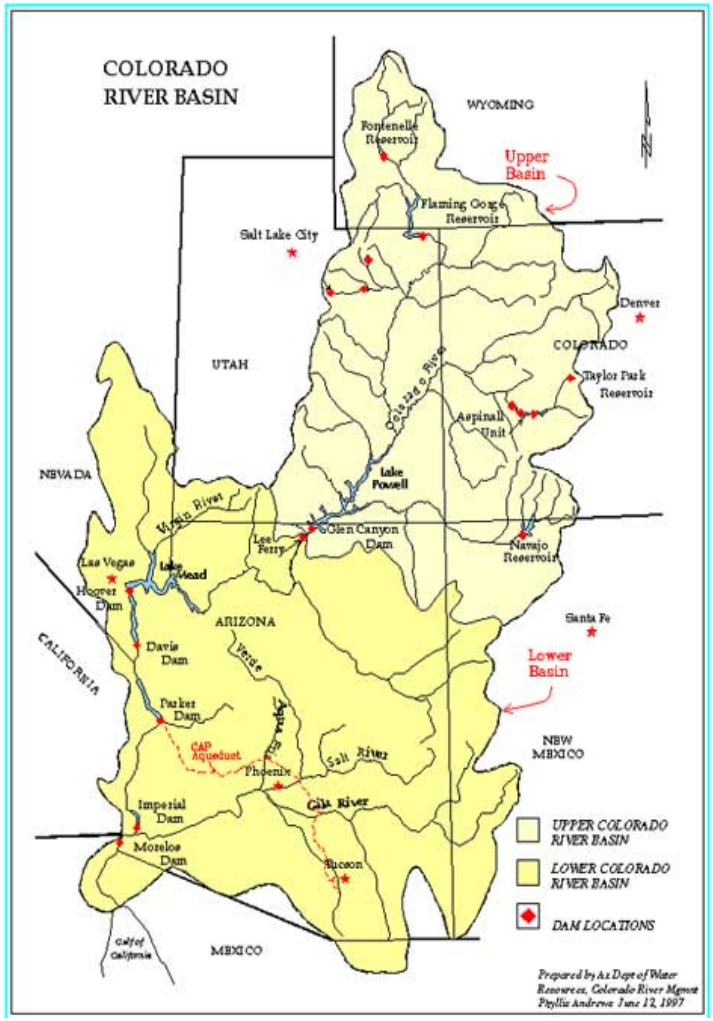

Delaware River Basin
PA
NY
Delaware River
Allentown
NJ
Philadelphia
MD
DE Bay
Atlantic Ocean
DE

Delaware River Basin Commission (Federal Interstate Commission)

- Since early 20th century droughts states used courts – dev. Equity principle but…
- Began to realize that courts too inflexible
- DRBC formed in 1960s
- Created capacity for information – technical analysts
- Cooperation grows – agreements signed in 1980s among states
- Power to block proposals not consistent with regional plans
- Multi purpose mandate
- Rely on State political leaders not bureaucracy to guide
- Balance of state autonomy and Federal supremacy
  - (delegation of power issues –
  - Federal can be subject to majority)

Single Federal Admin. Colorado and DOI

- Law of the River – basic allocation statues-interstate compacts –court decisions-treaties-operating rules -administrative decisions
- Based on AAF that is too high
  22k vs, 18.5k mcm
- 7 States tried to use interstate compacts but lacks trusted technical information source/staff
- Also international river - Indian rights
- No agreement among all – Upper and lower lower is essentially Federalized

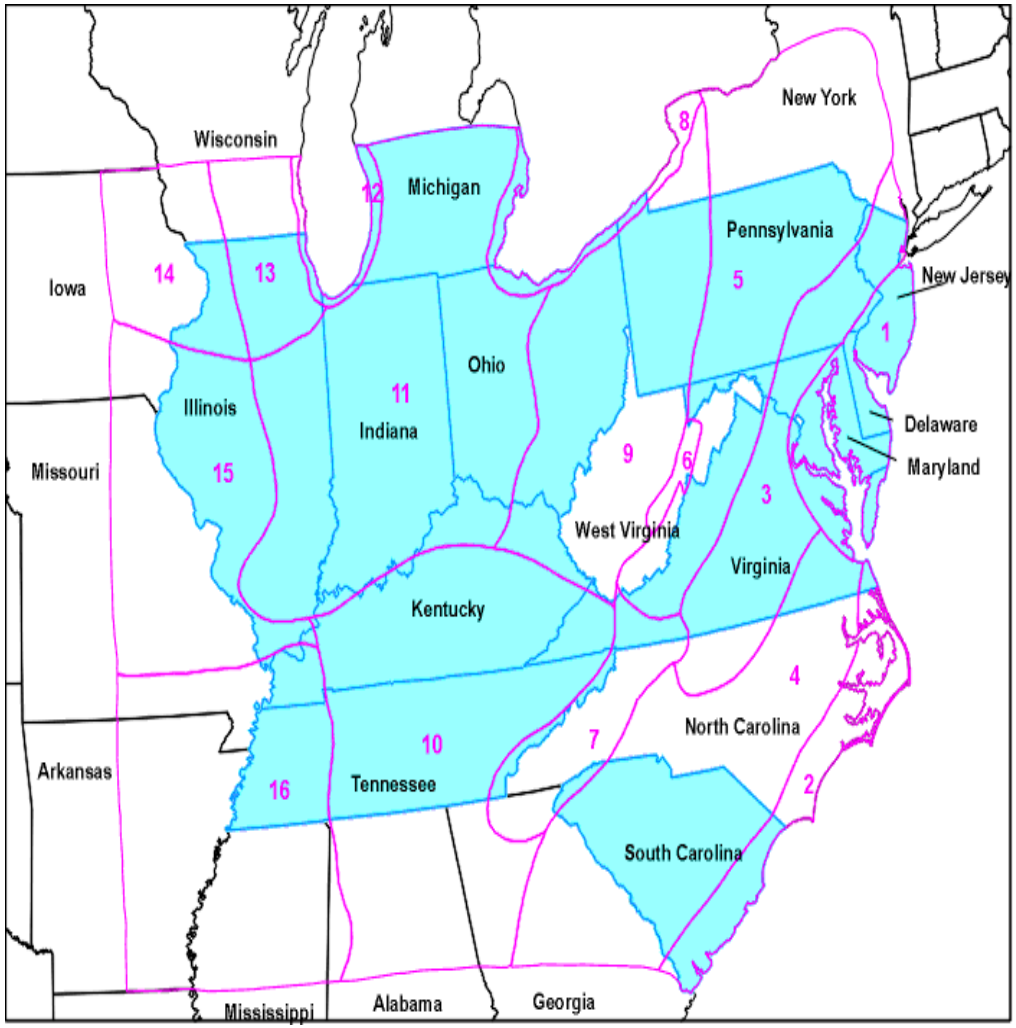


Colorado and DOI - Lessons

- **Law of river not flexible – no RBO means higher transaction costs**
- **Data is critical allocation base too high – no trusted technical expertise**
- **Water rights difficult so makes markets and trading hard**
- **Issue of “surpluses” will not go away – the need for consensus will not go away**
- **New rules for transfers needed**

Ohio River Valley Sanitation Commission

- 3rd largest river before joining Mississippi
- 14 States
- Several major cities
- Navigation, Hydropower
- 20 locks and dams 44 hydropower facilities



History

1936 Congress directs an interstate compact pollution
1948 Ratification among eight states
Illinois, Indiana, Kentucky, New York,
Ohio, Pennsylvania, West Virginia
Long time to get upstream to ratify because of powers of the agreement Created - Ohio River Valley Sanitation Commission

Authorities

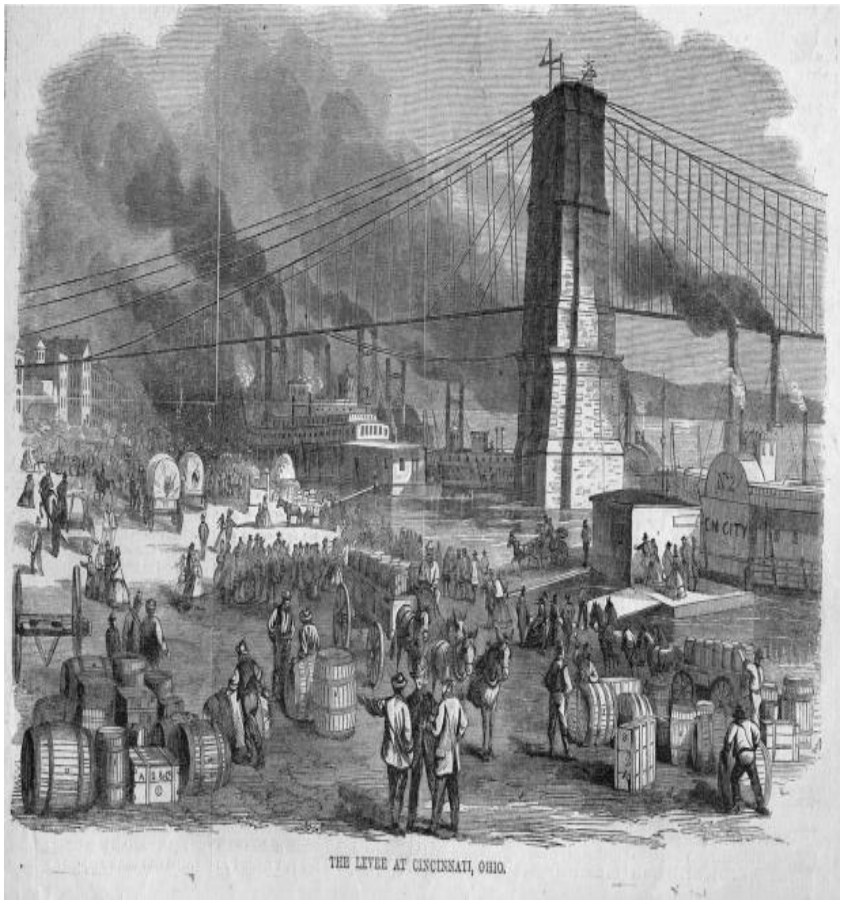
Water Quality
Waste water discharge
Water quality assessments
Waste water discharge standard setting + enforcement
1950s setting standards
Toxic substance control
Spill response
high pubic footprint

structure

27 commissioners:
3 from each State
3 from Federal Government

Public stakeholders can participate
as appointed commissioners
part of voluntary monitoring

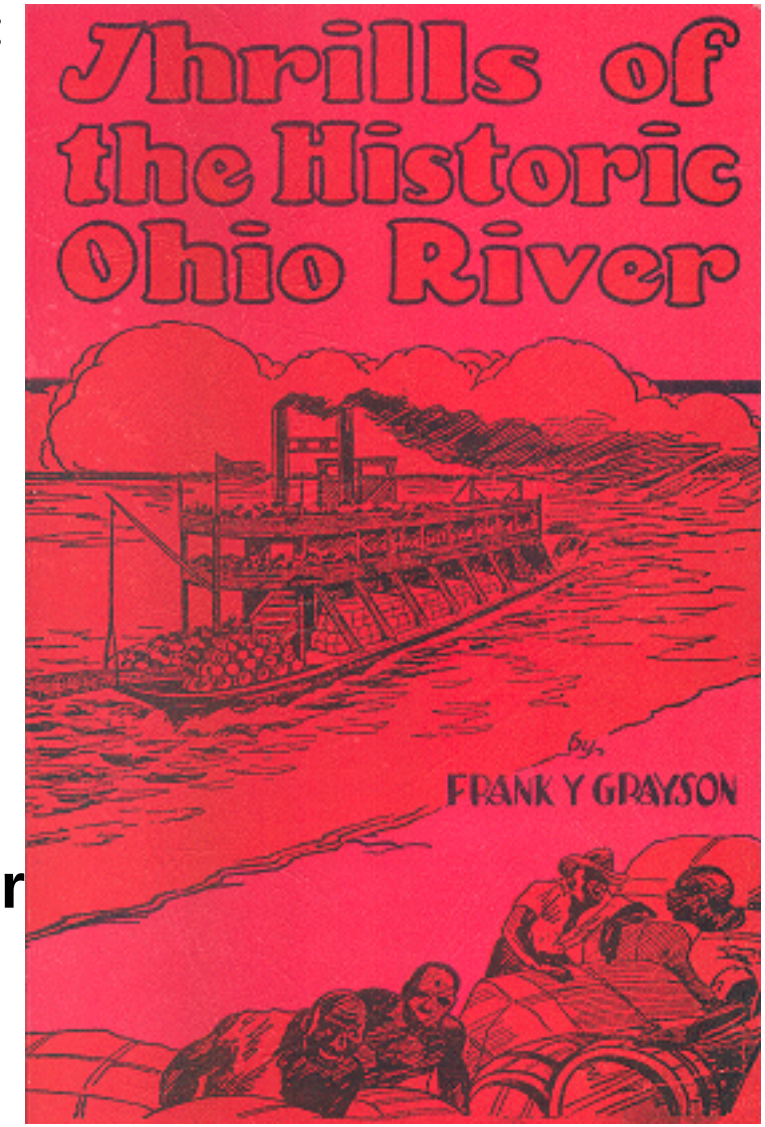
Framework of majority rule but:
veto power possible by majority of commissioners
within affected states
No voting power by Federal commissioners
Quorum = 1 or + from majority of states



18 Person technical staff
Decisions implemented by state and federal agencies
who also support technical staff
Standing committees

Has authority to order changes on discharge
unusual in Federal system of state sovereignty

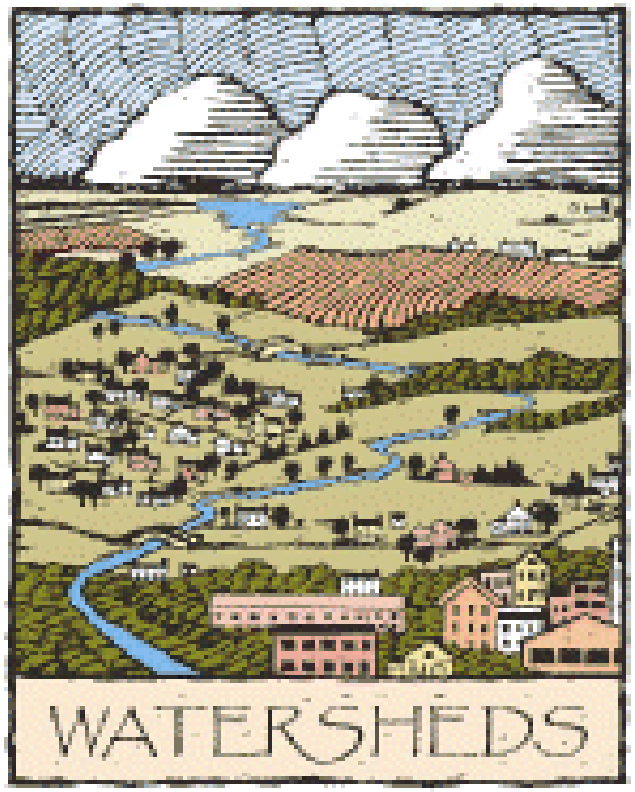
- **Financing: annual budget determined by commission**
- **Prorated proportions among states by:**
  - **1.5 proportion to population**
  - **1.5 land area**
- **1948 1% of sewered communities had treatment facilities**
- **1960s 99%**
- **Now 100%**
- **Highly Industrialized area with very low quality at start**

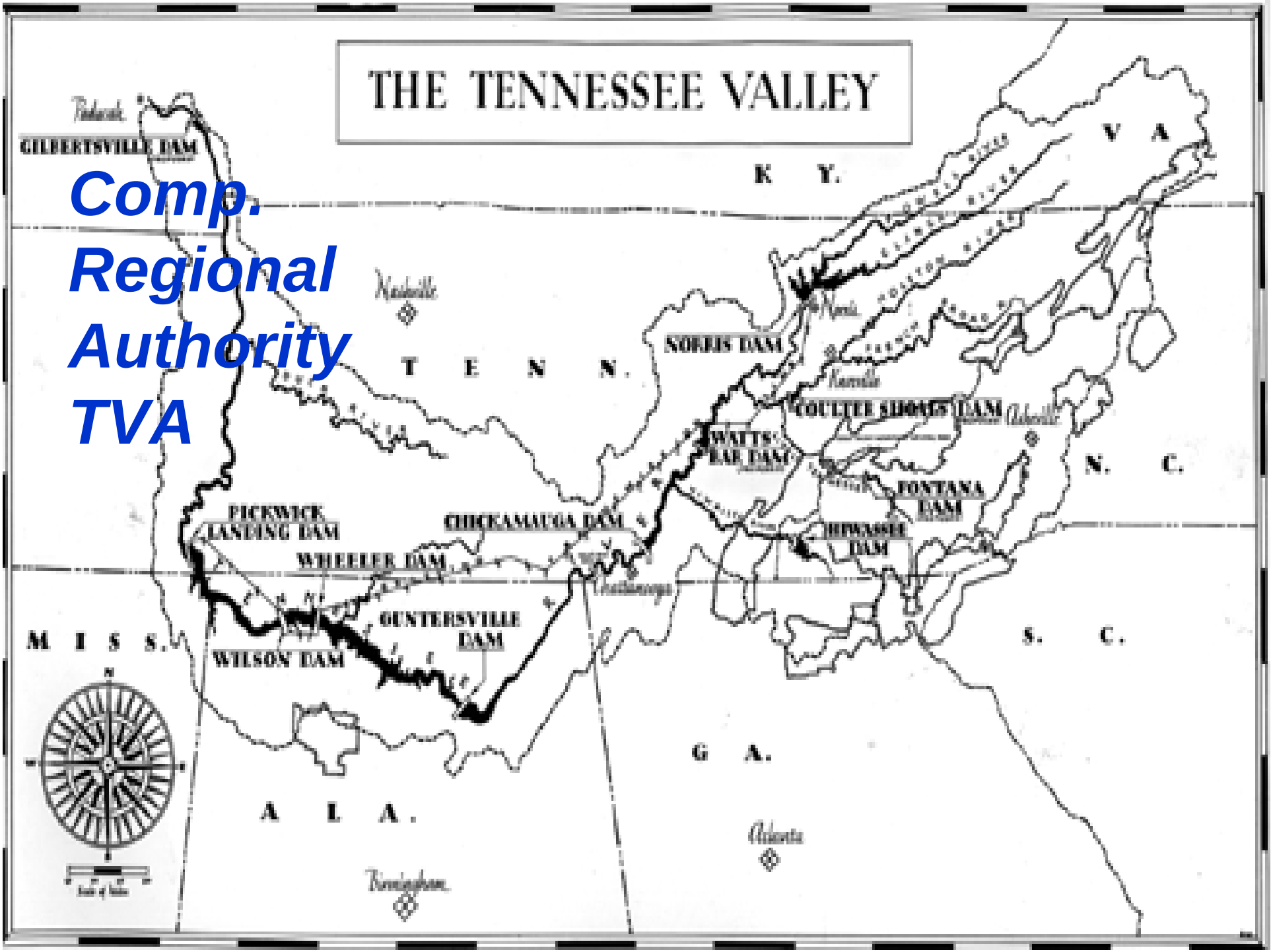


- **Slow to recognize combined sewer outflows**
- **Non point sources a problem**

Watershed Councils

- Renewing interest in RB's in US
- Center = consensus building
  - "nested hydrological units"
  - bottom up + top down
- +information exchange
- +holistic- adaptive approaches
- +venue for dispute management
- +coordination
- But consensus along is not = to RB management




THE TENNESSEE VALLEY
Comp.
Regional
Authority
TVA
GILBERTSVILLE DAM
KY.
VA
TENN.
NORRIS DAM
COULTER SHOALS DAM
WATTS BAR DAM
FONTANA DAM
HIWASSEE DAM
CHICKAMAUGA DAM
PICKWICK LANDING DAM
WHEELER DAM
GUNTERSVILLE DAM
WILSON DAM
MISS.
N. C.
S. C.
GA.
ALA.
Nashville
Knoxville
Asheville
Chattanooga
Atlanta
Birmingham

Imagine a Place Where:

- 94% of property owners/98% of tenants have **no electricity**
- 30% of owners/41% of tenants **no toilets or outhouses**
- 65% of owners/ 78% of tenants must go **300 yards for water**
- 8% owners/3% tenants owned radios
- Less the 50% of owners/25% tenants read newspapers
- Less then 26% of owners/16% tenants own cars or trucks
- Over **60% of the horsepower required was from horses**/ 6% from electric stations
- More then 90% have **no lighting**
- More then 90% **no refrigeration** – thus loss of more then 25% of meat
- Most live on **subsistence farming**
- Over used **ruined soil**
- **Flooding** serious and repetitive to soil and cities

THIS IS NOT A PART OF AFRICA TODAY – IT IS THE TENNESSE VALLEY IN 1935

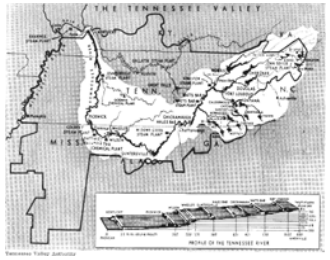
A European Traveler noted:

"Even when I visited the better-off farms, I discovered that a very large percentage of them had kitchens with ovens burning wood –the poor cooking in pots and pans over a little fire on the hearth, as in the Middle Ages; that they were lighted by dim, smoking, smelly, oil lamps, that the washing of clothes was done by hand in antiquated tubs; that the water was brought into the house by the women and children, from wells invariably situated at inconvenient and tiring distances……"

In a Generation ++

- $224 million flood damages prevented
  - **in Tenn valley –Ohio - Miss rivers each year**
- $4.9 billion flood damages prevented in Chattanooga
- $5.4 Billion in whole valley
- Literacy almost 100%
- Life expectancy in 70's – small pox, malaria, typhoid gone
- Industrial production up over 500% -vibrant silicon valley industry
- Almost 700 miles of navigable water links to sea
- Tonnage increased from 32 million ton-miles in 1933 to 161 million ton-miles in 1942.
- Innovations in soil conservation, integrated watershed management, land use, non-structural FC, other areas
- Median incomes at national levels

TVA



On May 18, 1933, Congress passed the TVA act FDR asked Congress to create *"a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise."*

Regional Authority with power – authority – bonding authority – independence

- **Also a Federal Corporation**
- **Broad economic and Social Dev.** ***bring region out of poverty***
- **Integration, planning, development, management based on basin**
- **"Valley authorities" movement attacked by other Bur. + private power**

TVA (con.)

- **Hydro revenues used for community development**
- **At start – high level of support**
- **Orientated to community (within norms of era)**
- **Clear accountability**
- **Built knowledge base and technical expertise**

Observers Said:

John Paul Sartre: (in 1940s visit wrote articles in French about TVA)

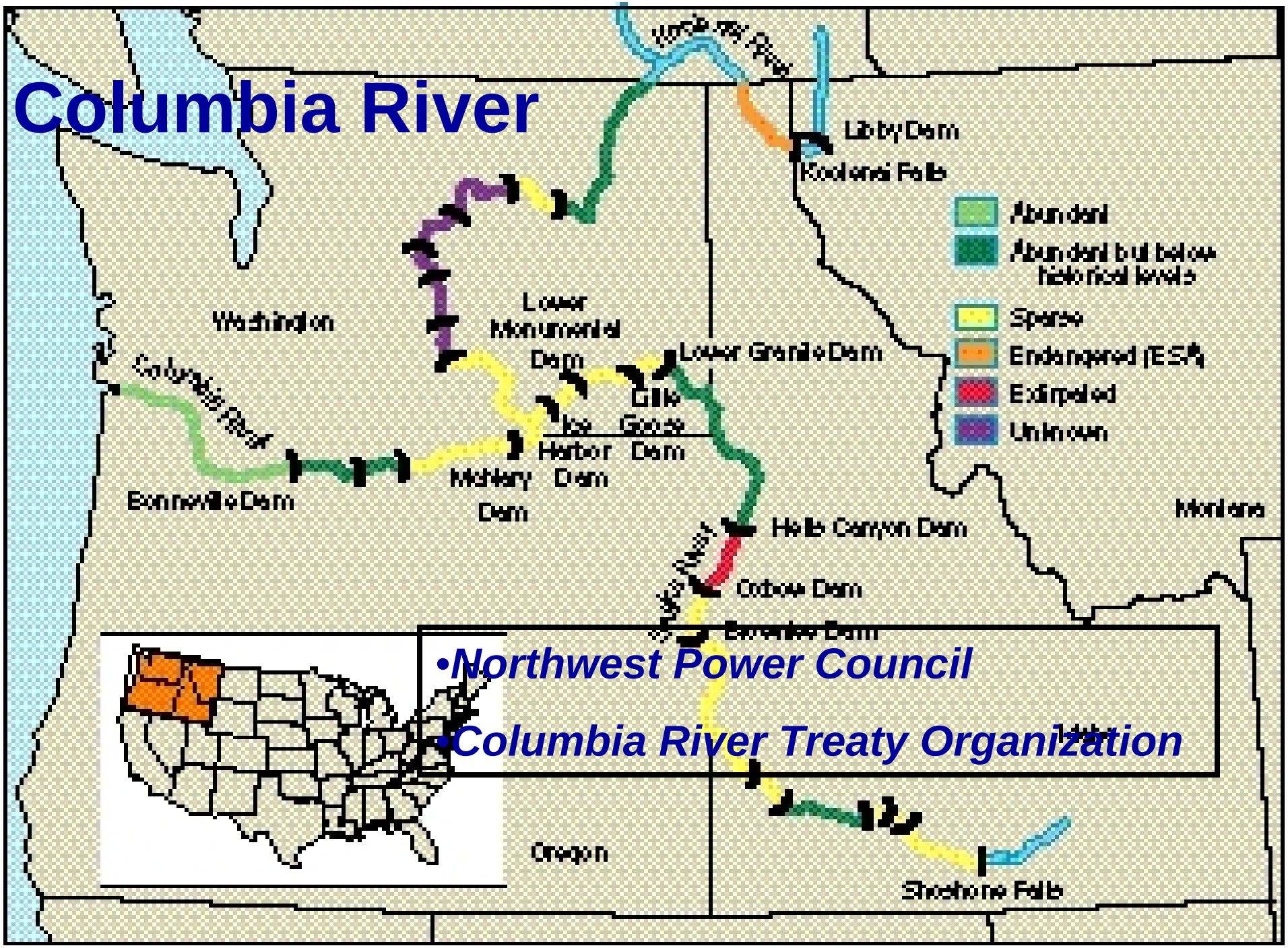
- TVA was “a democratic effort,” - “a vast cooperative.”

John F Kennedy:

- “It is one of our nation’s greatest assets, not only for what it has accomplished for the Tennessee Valley and for the nation, but also for its great contribution to the free world’s efforts to win the minds of men.”
- *TVA, was “the best ambassador that the United States has ever had in the Middle East and Africa and Asia. If we want people to follow us, we have to lead.”*

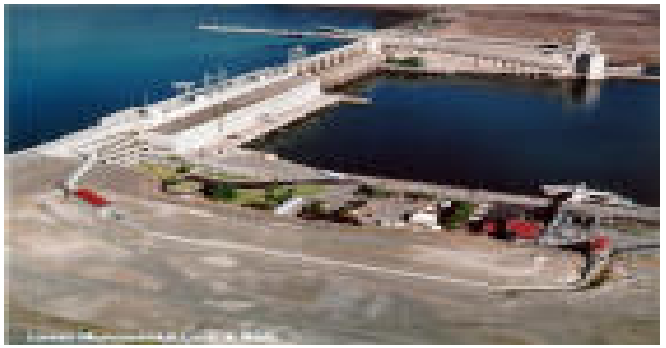
20th century US writer -John Gunther:

- After all, what impressed him most about TVA was
- its bottom line. TVA, he wrote, “proves that the idea
- of unified development works, that national resources
- can be developed with politics excluded and without
- prejudice to private enterprise.

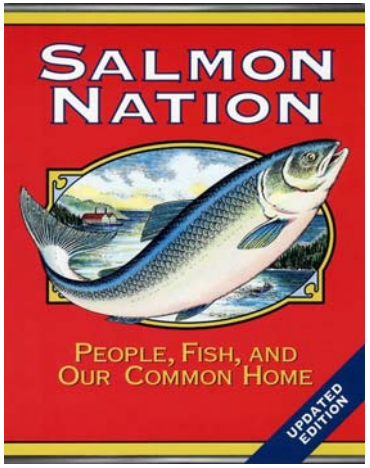

Columbia River
Libby Dam
Kootenai Falls
Abundant
Abundant but below historical levels
Sparse
Endangered (ESA)
Extirpated
Unknown
Washington
Lower Monumental Dam
Lower Granite Dam
Ice Harbor Dam
Dam
Hells Canyon Dam
Cobow Dam
Montana
Oregon
Idaho
Shoshone Falls
•Northwest Power Council
•Columbia River Treaty Organization

Columbia River

- **Worlds leading hydropower river with huge impact on fish, navigation, irrigation, recreation, indigenous cultures**
- **Oregon Montana, Idaho, Washington, Canada**
- **Basin 4th largest in US = size of France; 1,214 miles long; drains 259,000-square-mile basin**
  - **10 x flow of Colorado**
  - **2.5 x flow of the Nile**
- **79 facilities, 13 large dams 11 in US and 2 in Canada**
- **High Variability; depends on Snow mass; complex path in and out of Canada**



River Symbol of Unity: Diversity within Unity



The river has shaped humans and humans the river

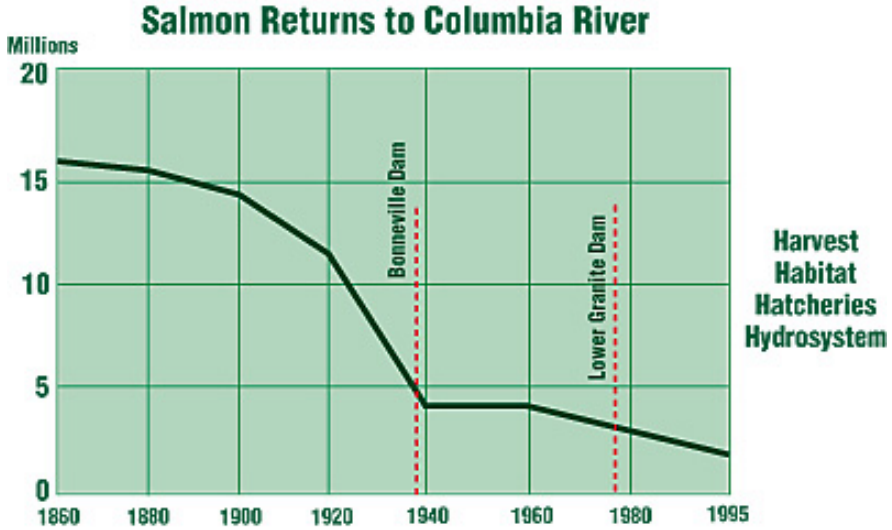
Invocation of the divine by all:

- Native Americans - Salmon based cultures
- Environmental Notions of Preservation
- Engineered Utilitarian view of the River (at the Dalles 1915)

"This mighty work symbolizes the stern, unfaltering determinations of the people That our waters shall be free – free to serve the uses and purposes of their creation by a divine Providence....it is one river – our river in which we all have a common Share.."

Salmon: Disputes -Summits-Studies

- Balance sought but system still had to deliver power
- Hatcheries no longer seen as solution to wild salmon declines
- Only fish harvesting and hydropower on the table – not other uses
- Large and growing number of interests
- 7 year drought & poor ocean conditions made balance impossible

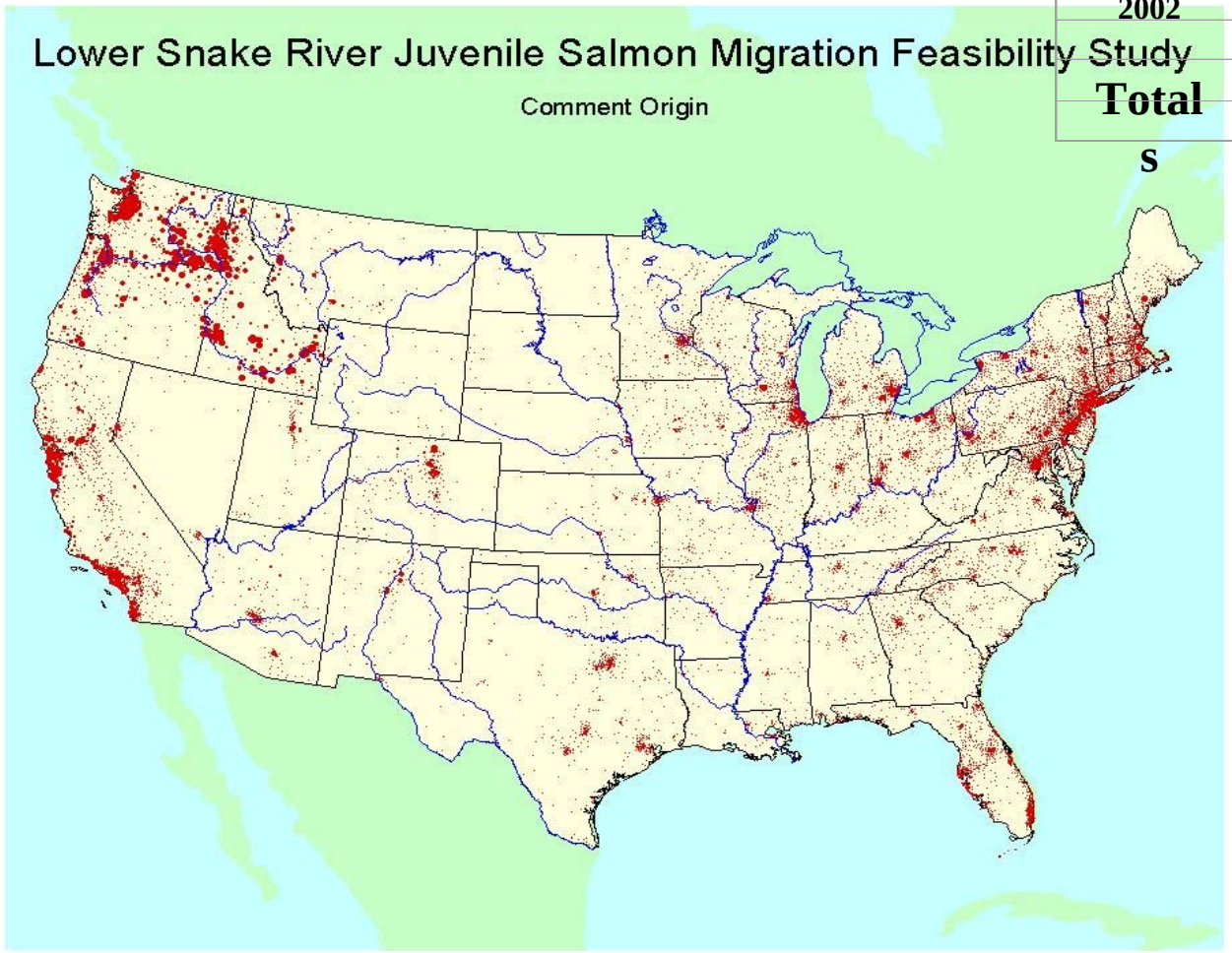


1956 – 1992 222 official studies on Salmon and Environment
1981 – 1996 Agencies spend $3 Billion on Salmon Protection

US Army Corps of Engineers ®
Walla Walla District

Public Comment Process

YEAR	PROGRAMS	TOTAL AUDIENCE
1995	4	130
1997	18	773
1998	55	11,699
1999	86	8,656
2000	53	17,436
2001	12	335
2002	8	215
Totals	236	39,244



Interest Values Go Beyond Geography

History of Basin Organizations

- Followed Crisis – Responses Cycle historically
- The 14 federal dams called: *Federal Columbia River Power System*
  - USACE, BuRec., BPA. Public and Private Utilities
- Corps 308 Plans
- 1940s - Attempt at Columbia Valley Authority - TVA type organization
- PNW Coordination Agreement – coordinating among non Federal and Federal entities
- Title II RBO
- Columbia River Treaty
- Federal Interagency agreements; BPA, BuRec, USACE
- Northwest Power Council
- *Two Rivers Concept* – Snake in Idaho and Federal system
- Uncertainty Today

Northwest Power Council

Interstate Commission

Followed old Title II Pacific Northwest River Basin commission

Federal legislation 1980 established to:

- **dev. 20 electric power plan for region**
- **dev. program to protect fish**
- **creation of forum among all stakeholders**

8 appointees by governors – two from each state

- **3 year terms**

NO Federal Gov. representatives!

- **47 person technical staff**

If States did not act, then Federal would create Federal council

Northwest power council

- **Authority: congress powerful coordinating means with little disruption**
- **Congress tells USACE, BRec, FERC to obey planning guidance of NWPCC**
- **Tension with Federal Agencies**
- **No authority in water rights**
- **No authority to modify State agency and tribal governments**

Budget requests within Bonneville Power Authority BPA
Builds on tradition of cross subsidies of hydro for other purposes; *hydro funds fish mitigation*

Complex decision Rules: Majority vote based on a quorum of majority

Columbia River Treaty Organization

* Established by TREATY ** Established by ENTITY *** Established by PEB

Columbia River Treaty Organization

- Driven by droughts and floods
- Canada has 15% of basin area but 30% flow
- 1944 – 1959 IJC studied cooperation options – treaty signed 1964 by all
- Canada – US – BC
- Complex system of selling downstream power benefits in exchange for upstream storage benefits on 30 year basis
- 6 year assured operation planning AOP
- Yearly detailed operation planning DOP

Columbia River Treaty Organization

- US entity = USACE = CDE + Bonneville
- Canadian entity = CEO BC Hydro
- Treaty coordinators are liaisons among entities
- Operating committee does technical work
- ***Show how to negotiate creation and use of benefits versus fighting over allocation of flow (Integration of hydro and flood storage benefits)***

Socio-Economic Progress

	Tennessee Valley		Columbia[1]	
	BEFORE	AFTER	BEFORE	AFTER
	1920s-30s	One generation	1920s -30s	One generation
Access to Water	**2%** of farms reported water piped in the house in 1920 (10% U.S. wide)	**75%** of homes were supplied with water by the public system or a private company in 1970 - (82% U.S. wide)	**23%** (12-29%) of farms reported water piped in the house in 1920. (10% U.S. wide)	**79%** (70-86%) of homes were supplied with water by the public system or a private company in 1970 (82% U.S. wide)
Toilets sanitation				
Units with flush toilet	**35%** in 1940 (65% U.S. wide)	**72%** in 1960 (90% U.S. wide)	**63%** (45-74%) in 1940 (65% U.S. wide)	**93%** (89-95%) in 1960 (90% U.S. wide)
Units with plumbing facilities	**24%** in 1940 (55% U.S. wide)	**85%** in 1970 (93% U.S. wide)	**55%** (38-65%) in 1940 (55% U.S. wide)	**96%** (95-97%) in 1970 (93% U.S. wide)

[1] Data for the Columbia river are averages of the States of Washington, Idaho and Oregon. Data in parenthesis show the range for all three States.

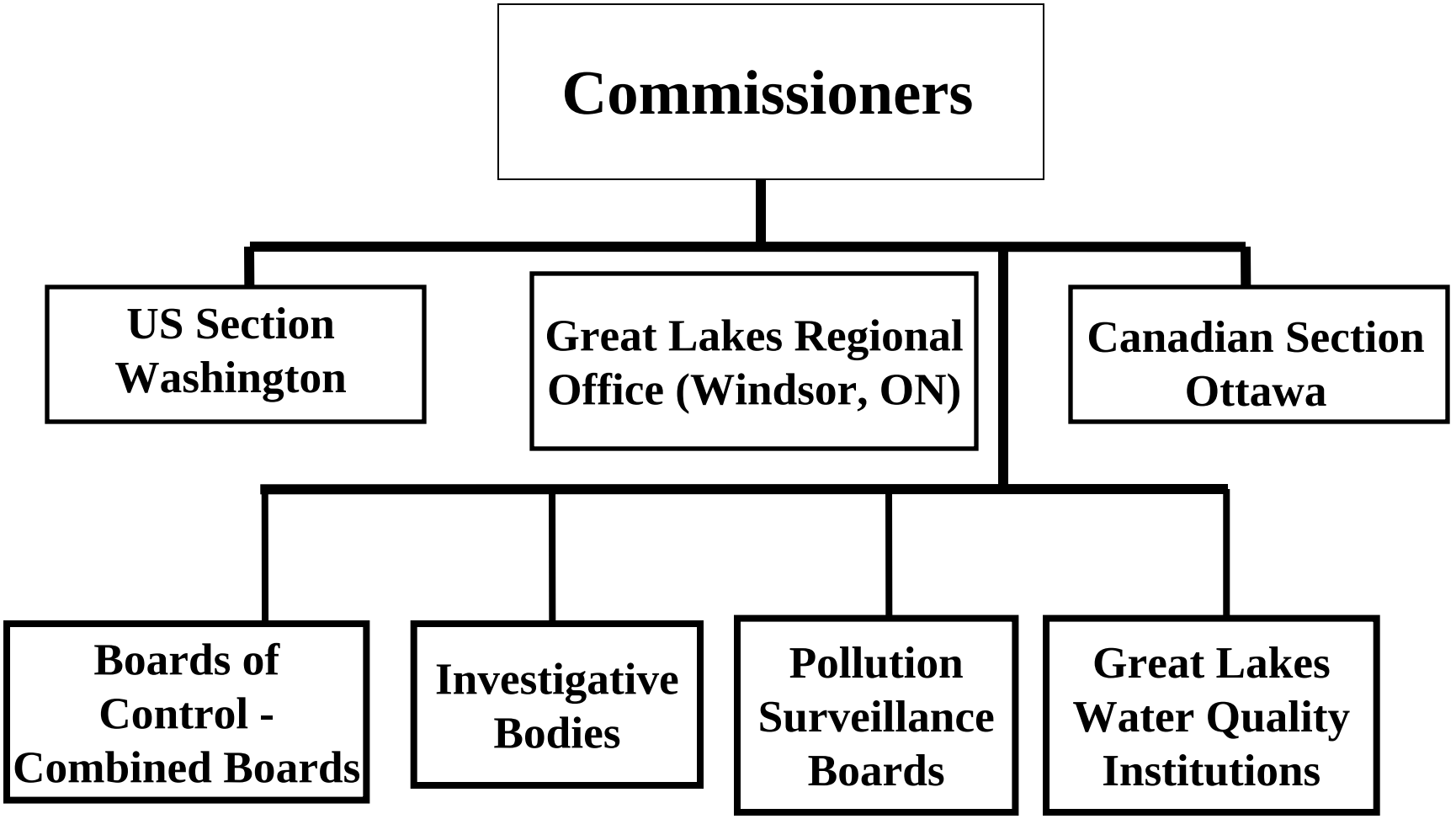
Socio-Economic Progress

	Tennessee Valley		Columbia[1]	
	BEFORE	AFTER	BEFORE	AFTER
	1920s-30s	+ One generation	1920s -30s	+ One generation
Personal Income per Capita	$320 in 1930	$2,700 in 1968	$590 ($500-$660) in 1930	$3,400 ($2,900-$3,800) in 1968
Life Expectancy	4.3% of the population aged 65 years and over in 1920 (4.7% nationwide)	9.7% of the population aged 65 years and over in 1970 (9.7% nationwide)	4.4% of the population aged 65 years and over in 1920 (4.7% nationwide)	9.6% of the population aged 65 years and over in 1970 (9.7% nationwide)
Illiteracy	10.3% illiterate among the population of 10 years old and over in 1920 (6% U.S. wide) Urban = 7% (4.4% U.S.) Rural = 11.6% (7.7% U.S.)	Quasi No illiteracy by 1920's census definition. 94% of persons 14 to 17 years old in school (93% U.S. wide)	1.6% illiterate among the population of 10 years old and over in 1920 (6% U.S. wide) Urban = 1.5% (4.4% U.S.) Rural = 1.6% (7.7% U.S.)	Quasi No illiteracy by 1920's census definition. 88% of persons 14 to 17 years old in school (93% U.S. wide)

[1] Data for the Columbia river are averages of the States of Washington, Idaho and Oregon. Data in parenthesis show the range for all three States.


Arctic Ocean
Canada
Iceland
Ellesmere I.
500 km
500 miles
U.S.
Greenland
Beaufort Sea
Banks I.
Baffin Bay
Victoria I.
Fairbanks
Whitehorse
Mackenzie R.
Great Bear L.
Baffin I.
Davis Strait
Pacific Ocean
Yellowknife
Great Slave L.
Atlantic Ocean
Hudson Bay
Edmonton
Churchill R.
Saint John's
I. of Newfoundland
Victoria
Vancouver
Saskatoon
Lake Winnipeg
Regina
Seattle
Winnipeg
Thunder Bay
Quebec
Sudbury
Halifax
Montreal
Ottawa
Toronto
Boston
L. Superior
L. Ontario
L. Erie
San Francisco
Chicago
Detroit
New York
United States
60
150
30
45
120
90
60

IJC Organization



Boundary Waters Treaty of 1909

- **No Obstructions or Diversions of Boundary Waters Affecting Natural Level or Flow Without Approval of the IJC (or Special Agreements Between the Governments) (III)**

- **No Works on Transboundary Waters That Raise Levels Upstream on Other Side of Boundary Without Approval of IJC (or Special Agreements Between the Governments) (IV)**

Boundary Waters Treaty of 1909

- **IJC is obligated to Protect Interests on One side of the Boundary from Actions on the Other Side**
- **IJC Will Observe Precedence of Uses:**
  - **Domestic and Sanitary**
  - **Navigation**
  - **Power and Irrigation (VIII)**

IBWC International Boundary Waters Commission

- Two commissioners – licensed engineers
- Neutrality + expertise
- Pressure to more activist
- More on environmental
- Broader public access to its deliberations

Practical Aspects of Designing Transboudnary and River Basin Organizations

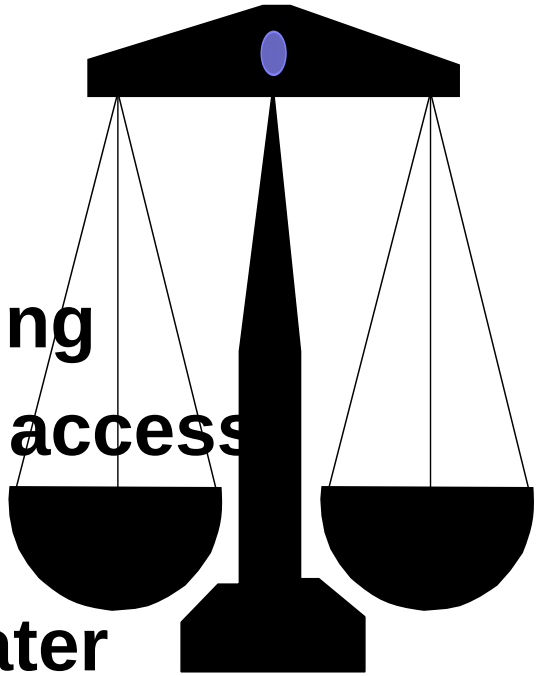
- **FUNCTIONS AND RESPONSIBILITIES**
  - **Soft, Hard, Others**
- **MEMBERSHIP AND PARTICIPATION**
  - **Technical, Admins, political, power sharing, NGOS,**
- **OPERATING RULES**
  - **Consensus, majority, access**
- **AUTHORITIES**
  - **Soft, hard, positive roles,**
- **LEGAL BASIS AND STRUCTURES**
  - **Formal, informal**
- **FINANCING METHODS**
  - **External, internal, # sources,**

Some Design Principles

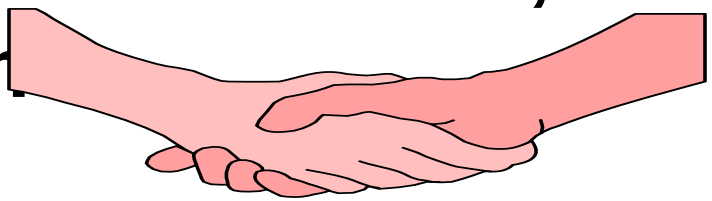
- High Political (Ministerial) commitment
- Meaningful community input
- Move beyond “impact fixation”
- Bring operational and implementation interest into design
- Open and transparent rules of behavior
- Foster norms of collaboration
- Creating trusted technical capacity
- Establish means for resolving disputes
- Separate administrative and policy
- Promote flexibility and creativity
- Foster regional shared visions of river

Water Decisions = Ethical Decisions

- **Water debates mirror debates of social ethics**
  - **water as a common good**
  - **water and human dignity**
  - **water as facilitator of well being**
  - **rights and responsibilities to access**
  - **water and social justice**
  - **wealth generation roles of water**

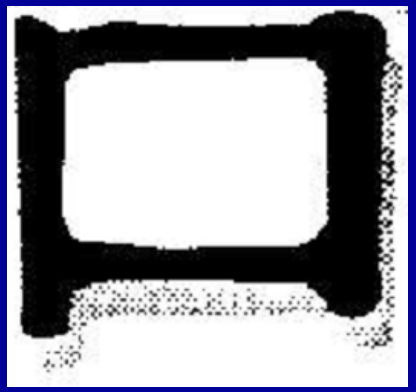


- **Water as symbol of reconciliation, healing, regeneration**



Water management (and water reform) is ALWAYS political…..

Ancient Chinese Characters describing water management


river + dike = Political order

治水 治国

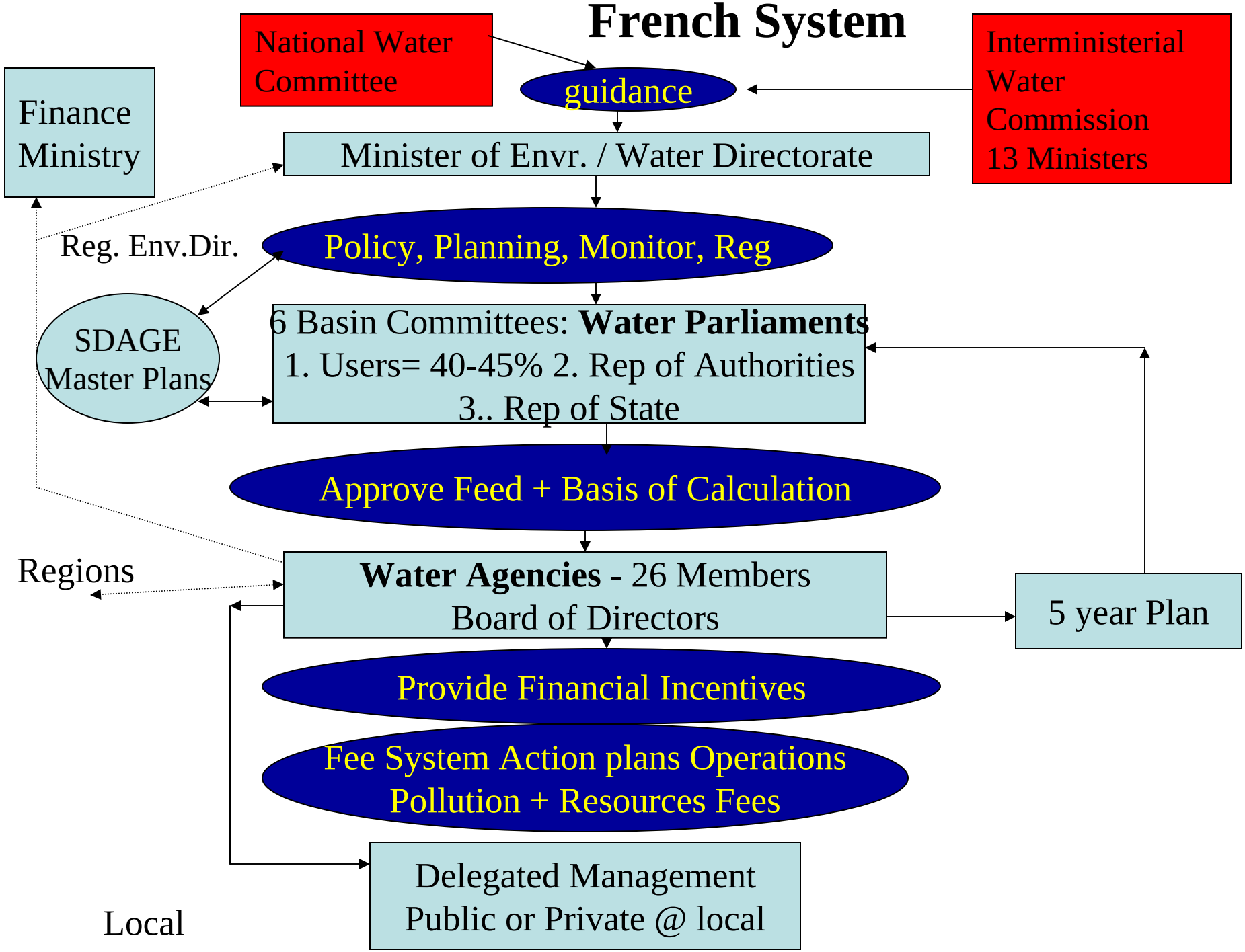
Only one who can govern water,

He can govern a country.

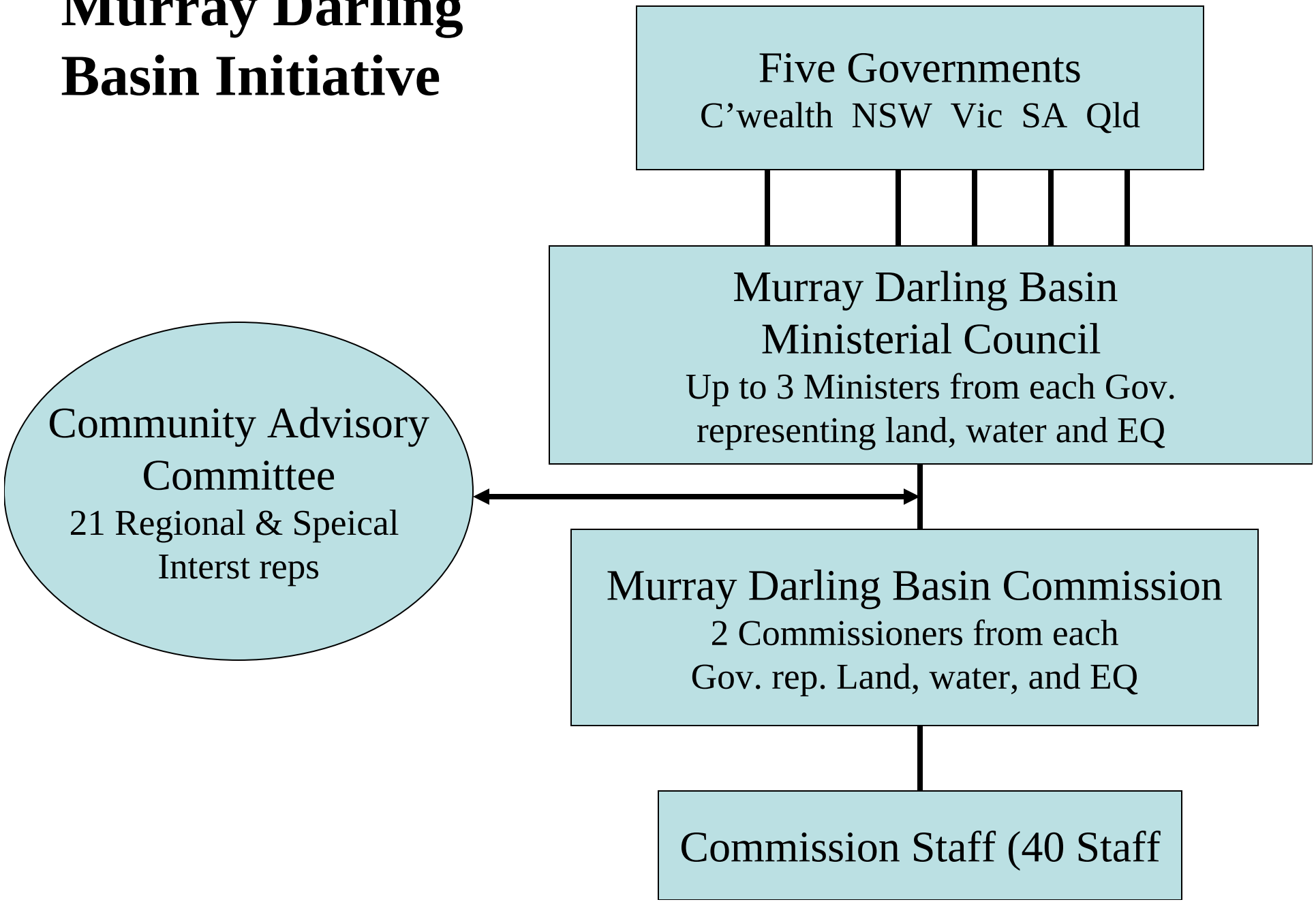
One who wants to govern his country

Should govern water first.

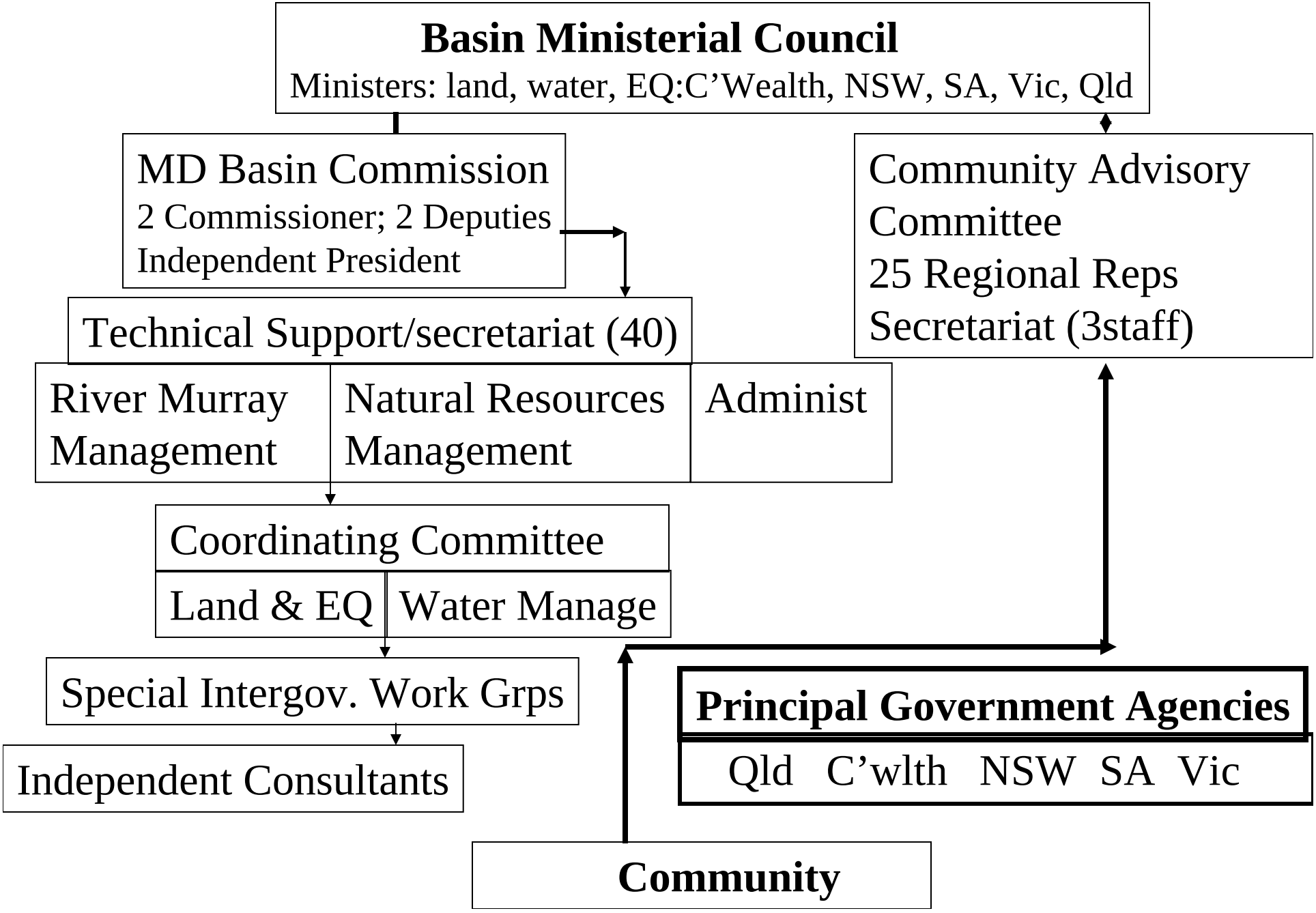
French System



Murray Darling Basin Initiative



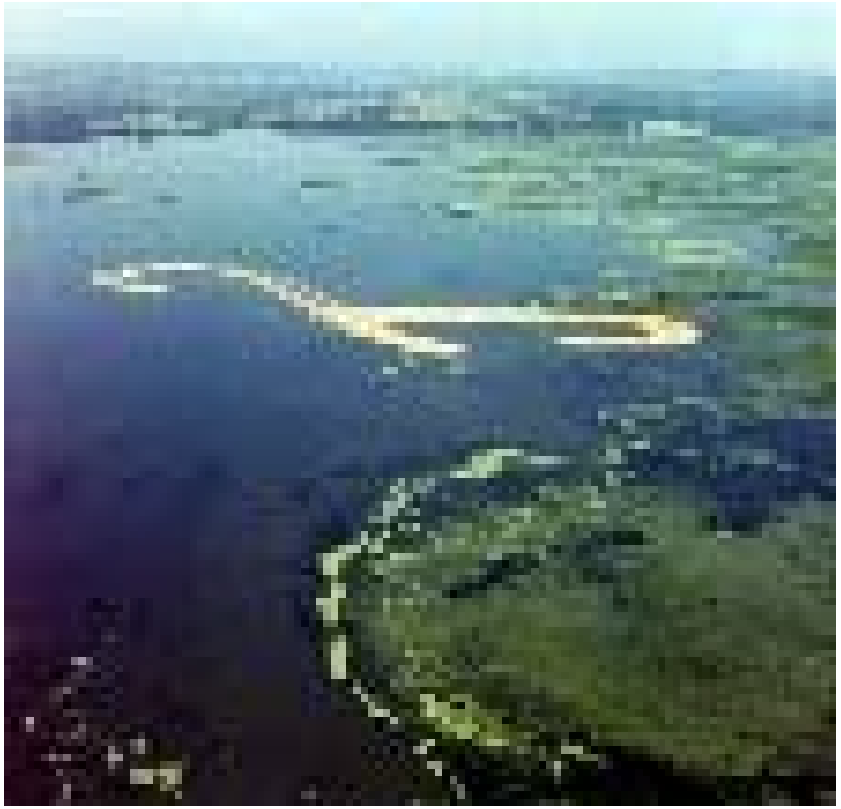
Murray Darling Basin Ministerial Council Structure



Restoring the Environment

From Preservation to Design

- Ecosystems continue to be destroyed
- Lack of environmental data
- Coordination between agencies
- Treat environmental benefits the same as economic benefits

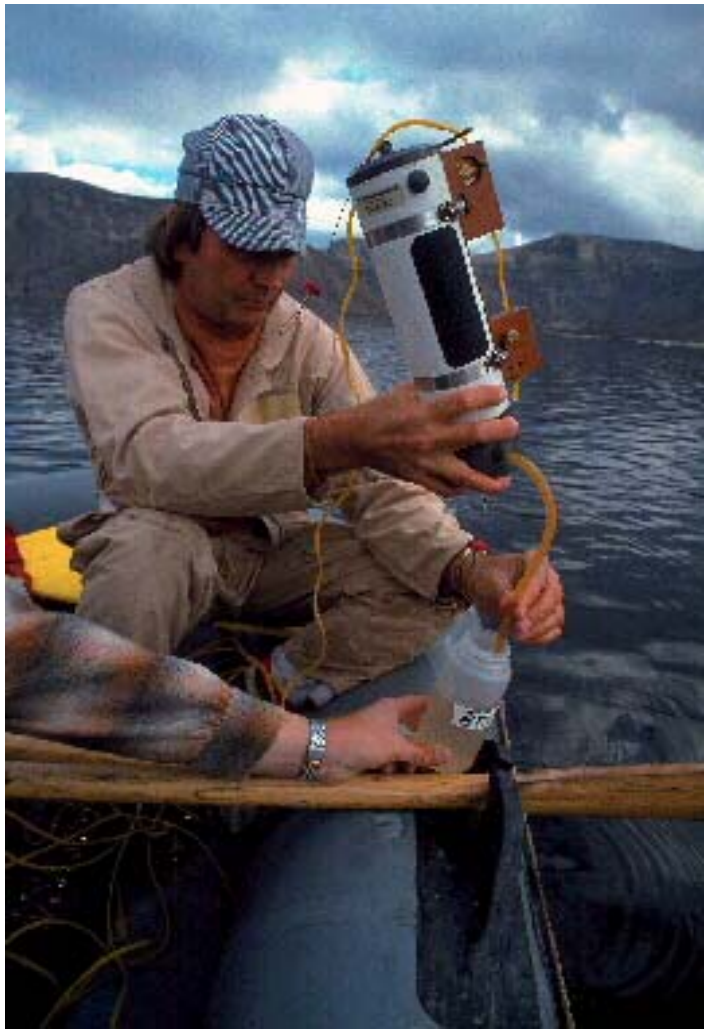


Restoring the Environment

- Over 53% of wetlands have been lost as a result of human actions
- About 35% of all endangered species live in or depend on wetlands
- Watershed approach is required to understand cumulative impacts
- Wetlands provide annual benefits of $14.8 billion

Suggested Actions

- Watershed approach
- Funding for assessing and monitoring
  - Environmental health
  - Testing mitigation techniques
  - Develop environmental friendly technologies
- Educate public on env. issues
- Collaborate with other agencies - consistency in environmental regulations
- Make environment a co-equal with economic benefits



Suggested Actions

- Incorporation of sustainability principles
- Reducing time lags and delivering projects faster
- Full stakeholder participation in Decision making and early participation
- Beyond “impact fixation” Include consideration of economic and social and environmental benefits during project formulation
- More consistent interpretation of NED benefits

Columbia River

- **Worlds leading hydropower river with huge impact on fish, navigation, irrigation, recreation, indigenous cultures**
- **Oregon Montana, Idaho, Washington, Canada**
- **Basin 4th largest in US = size of France; 1,214 miles long; drains 259,000-square-mile basin**
  - **10 x flow of Colorado**
  - **2.5 x flow of the Nile**
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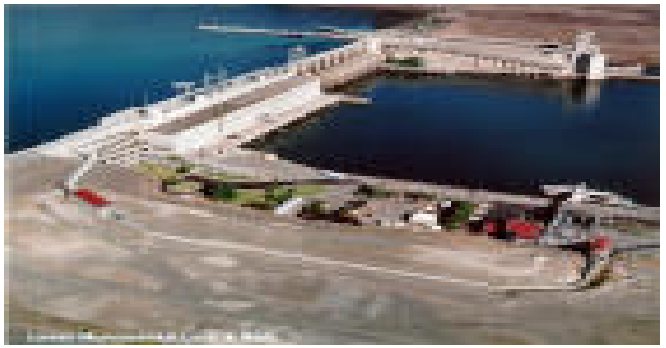
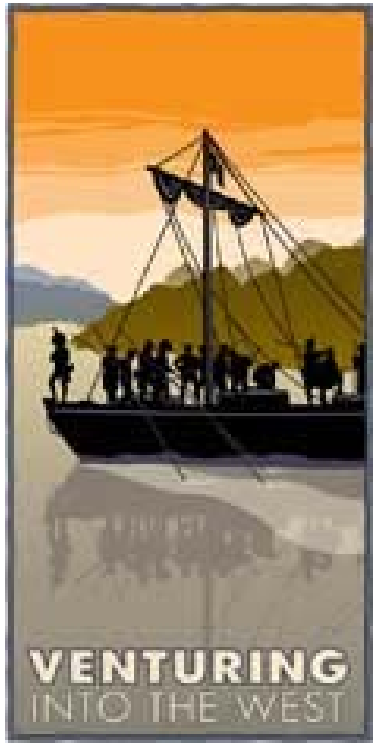


Columbia Overview

- **Benefits**
  - **Flood protection, cost based (non market power), navigation corridor to interior, reclamations projects financed by congress, hydropower; recreation; half the electricity used in the NW**
- **A financial Bargain for the Region**
  - **Low interest loans long term repayment schedules**
  - **BPA has great autonomy as long as keeps up repayments**

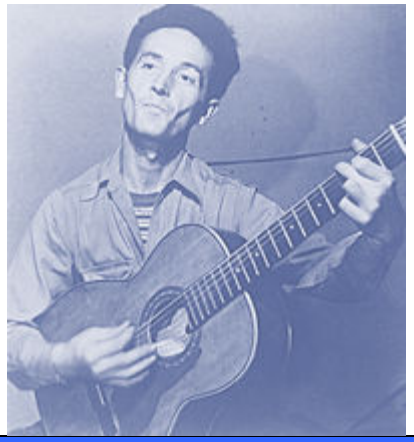
History

- Early history is of Salmon and Indigenous cultures –trappers, explorers Jefferson, Lewis and Clark, Western Expansion
- Irrigation grows from the federal 1902 Reclamation Act but achieves about half of planned coverage
- Navigation initially slow and not economic
- 1930s Federal New Deal - Bonneville, Grand Coulee
- Energy Demand Grows, Industrial development grows
- WWII huge demand Congress authorizes Chief Joseph, Albeni Falls, Libby, John Day the Dalles dams.
- 1948 Corps 308 report recommends more dams but; Movement toward non-Federal development
- 308 recommends 20 million acre feet of storage but not enough to support growth
- Leads to Treaty with Canada up – downstream agreements



History Early 20th Century

- *1920's* **Private reaction to public roles by private power**
  - **Single purpose power licensing**
    leads to congress law for 308 basin reports on all rivers in US by Corps
  - **Search for political constituencies and financing for large projects leads to multipurpose larger public+federal role**
  - **Reductions of private role on rivers**
  - **Reduction of single purpose**
  - **Pinchot view vs. Muir view of resources (Utilitarian vs. Preservationist)**



Woodie Guthrie, "Talking River Blues.." 1920's

"…thought about a river going to waste. ..thought about the people….thought the land.….them Salmon Fish are pretty smart too….They got Senators and a Politician or two…just like a President they run every 4 years…."

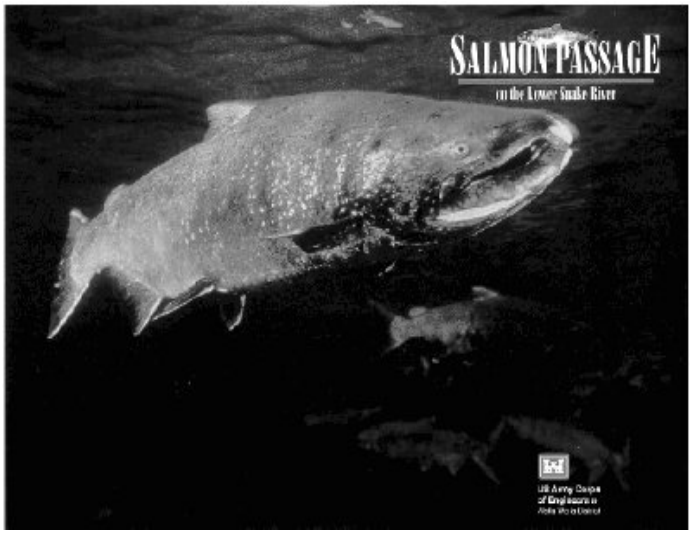
Modern Era

New Values - Limits

- 1980s Utilities fighting over entitlements to low cost energy from system
- Growing tribal assertion fishing rights – most traditional grounds on upper reaches
- Reduced aquifer recharge due to increased efficient irrigation – conflict between senior hydro and junior irrigator rights – hydro wins
- Formation of Northwest Power Planning Council to consider the EQ, hydro, efficiency, fish and wildlife.
- New fish and wildlife statutes
- Agreement to comprehensive Snake River water adjudication

1990s

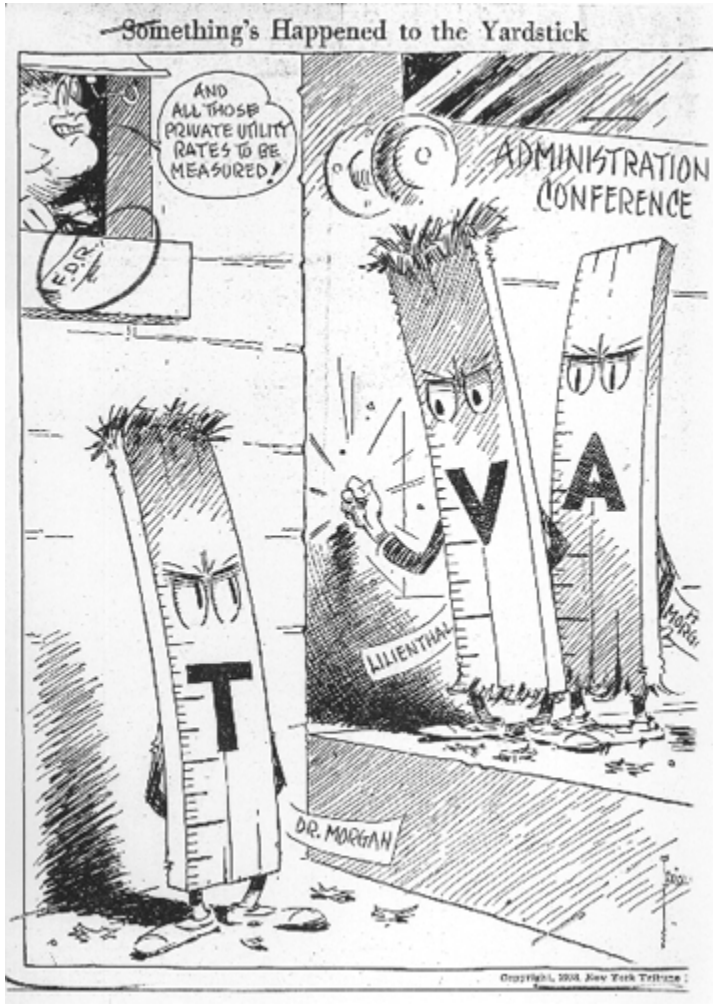
- Energy surplus of 1980s disappears
- Movements to markets away from centralized BPA model
- Salmon summit – but no consensus
- Rethinking of science behind Salmon – emergence of "core" habitant notion – all buried in reservoirs
- PATH modeling to test different approaches
- Taking dams out more likely that salmon would recover but uncertain.
- Federal Agencies study again
- Concept emerges that the tributary and estuaries are the most important – attention drawn away from Snake dams
- Opinion proposes aggressive *all HS process* – hatchery, hydro, and harvests – still in mediation



Cheap Electricity

Roosevelt - the idea of a Government "yardstick" for utility rates in 1932

"The average cost of power for all 29 hydroelectric projects in the FCRPS is about 0.7 cents/kWh. When factoring in the costs for transmission, conservation investments (protecting salmon runs), renewables, nuclear costs and the regional exchange the total cost of BPA's power is about 2.3 cents/kWh. This is the rate at which the regional ratepayers are charged."
(http://www2.kenyon.edu/Projects/Dams/bec03wilsona.html)



Bonneville Power Administration

- **Self-financed federal agency** under the Department of Energy.
- BPA is a **not-for-profit** agency. Legally mandated to recover all of its costs in the rates it charges customers for wholesale electricity and transmission services.
- Funds all ongoing operations and **repays**, each year, the **Federal investment** in the Federal Columbia River Power System (FCRPS), **including costs of hydropower dams and transmission system, through the sale of wholesale electricity and transmission services.**
- The federal system **provides about 45 percent of the Pacific Northwest's electric energy and 75 percent of its high voltage transmission.**

Sustainable Development "Overarching Elements"

- **Economic Efficiency**
- **Environmental Health**
- **Social Well-being and Equity**
  "the three elements are interdependent and must be pursued simultaneously and in a balanced way if sustainable development goals are to be met" ***(sounds like the original Principles and Standards of 1973/80!)***

Canada – Prairie Water Board (PWB)

- Monitors flows, provides oversight on water quality, advises on disputes, uses fact-finding and technical committees.
- Built on a master agreement among the Canadian Prairie provinces of Alberta, Saskatchewan and Manitoba.
- Within master allocation agreement, provinces reach bilateral agreements. Requirements defined at the borders of jurisdictions.
- Each jurisdiction manages their own water in inside their jurisdiction.
- The PWB monitors flow at the borders.
- Operates by consensus. It maintains strong technically credible support.
- Flexible - rules can be redefined as it grows.
- Dispute resolution mechanisms are defined.
- Facilitates information exchange.
- ***Many of these lessons are echoed in other basin initiatives. Indeed, a similar process is underway on the Mackenzie River.***

Some Lessons

- **INCENTIVES**
- **SUPPORT**

- Intervenors with Resources/power
- Facilitators of dialog
- Incentives vs. threat or force
- Bottoms up: regional, sui-generis
- Real participation of SH’s

Some Lessons (con.)

- **EVOLUTIONARY**
  - Begins as secure forum for dialog and grows
  - Org's change: purposes/uses added as values change

Sources of Fragmentation

- **POLITICAL**
- **BRANCHES OF GOVERNMENT**
- **FUNCTIONS - INTERESTS**

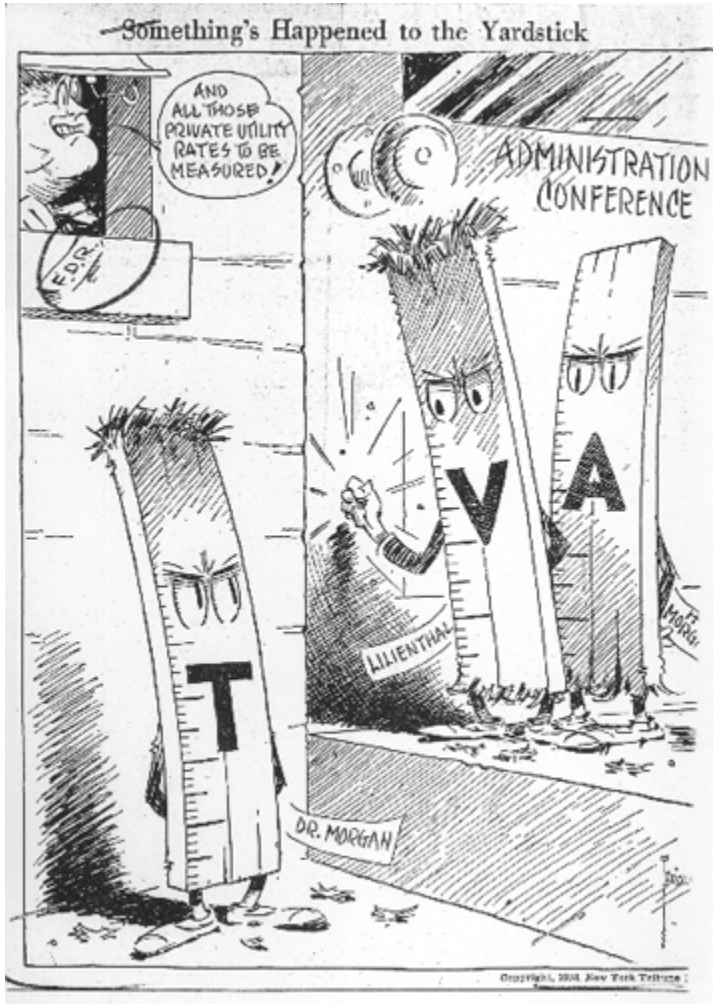
- Externalities
- Asymmetries
- Symmetries
- Executive
- Legislative
- judicial
- Agencies and constituencies defined functionally (fc, ws,)
- But resources are integrated

Sources of Fragmentation (con.)

- **LEGAL DOCTRINES**
  - Different Levels of rights
  - Different legal regimes (ground vs.. surface.. Riparian vs.. appropriate)
  - Preservation vs. wise use
  - Ec Dev vs. Ecology
- **CONFLICTING IDEOLOGIES - VALUES**

FDR, TVA and Press Cartoons

Roosevelt - the idea of a Government "yardstick" for utility rates in 1932

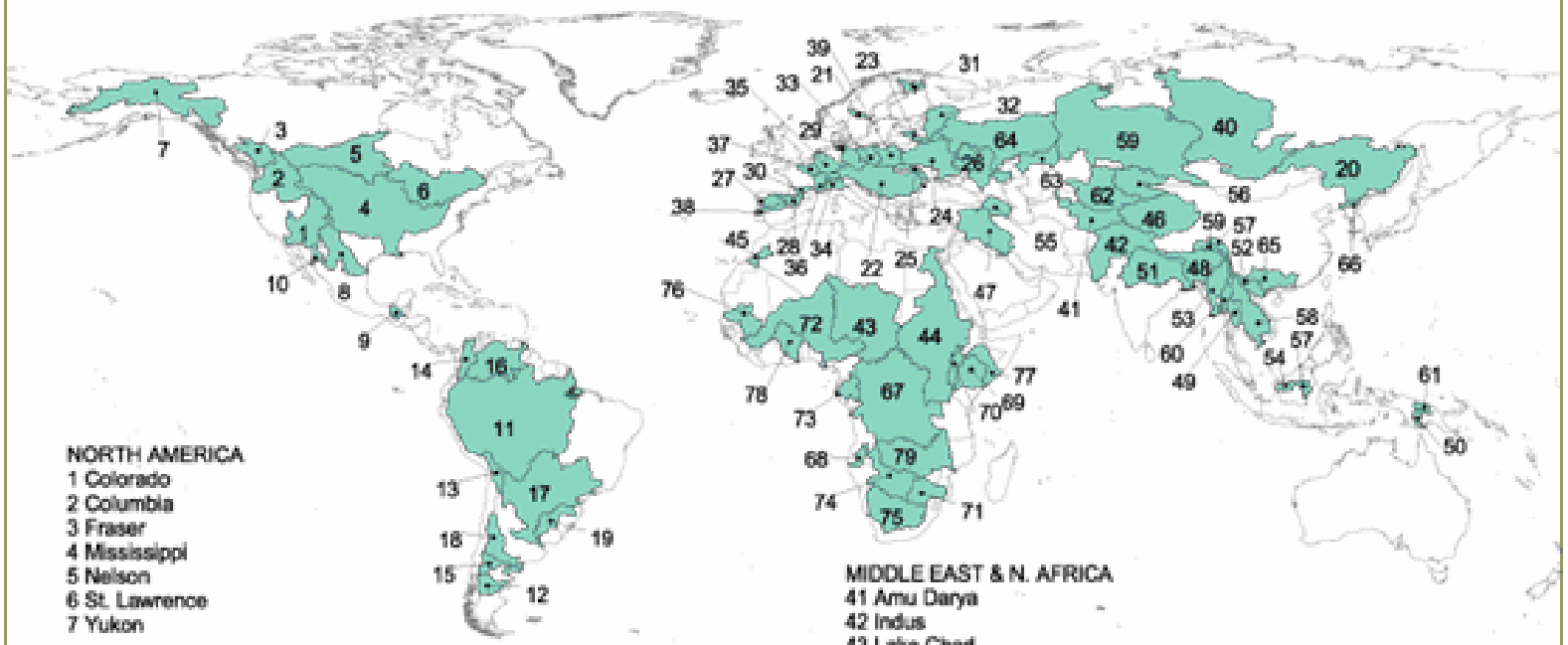


In a Generation ++

- $224 million flood damages prevented
  - **in Tenn valley –Ohio - Miss rivers each year**
- $4.9 billion flood damages prevented in Chattanooga
- $5.4 Billion in whole valley
- Literacy almost 100%
- Life expectancy in 70's – small pox, malaria, typhoid gone
- Industrial production up over 500% -vibrant silicon valley industry
- Almost 700 miles of navigable water links to sea
- Tonnage increased from 32 million ton-miles in 1933 to 161 million ton-miles in 1942.
- Innovations in soil conservation, land use, NSF and other areas
- Median incomes at national levels
- Dams were a popular destination for tourists 1000 people a day visited Wilson, Wheeler and Norris Dams in 1930s.
- Fertilizer program on the farms now twice as productive per acre as the average American farm.
- Electricity drew industries into the region, provided jobs
- By 1950 had become the nation's largest electricity supplier – in 1959 total self financing power
- Today revenues are $7 Billion/yr: a no public federal funding in navigation, flood control, environmental research, and land management-all of its programs are paid for with power revenues.
- Today TVA pays taxes of $338 million - one of the largest "taxpayers" in Tennessee and Alabama.

River Basin Boundaries do not Coincide with Political Boundaries

Figure 1: Selected Transboundary River Basins



NORTH AMERICA
1 Colorado
2 Columbia
3 Fraser
4 Mississippi
5 Nelson
6 St. Lawrence
7 Yukon

CENTRAL AMERICA & CARIBBEAN
8 Rio Grande
9 Rio San Pedro & Usumacinta
10 Yaqui

SOUTH AMERICA
11 Amazon
12 Chubut
13 Lakes Titicaca and Salar de Uyun
14 Magdalena
15 Negro
16 Orinoco
17 Parana
18 Rio Colorado
19 Uruguay

EUROPE
20 Amur
21 Dalalven
22 Danube
23 Daugava
24 Dnieper
25 Dniester
26 Don
27 Duero
28 Ebro
29 Elbe
30 Garonne
31 Kemijoki
32 Neva
33 Oder
34 Po
35 Rhine & Meuse
36 Rhone
37 Seine
38 Tagus
39 Vistula
40 Yenisey

MIDDLE EAST & N. AFRICA
41 Amu Darya
42 Indus
43 Lake Chad
44 Nile
45 Oued Draa
46 Tarim
47 Tigris & Euphrates

ASIA AND OCEANIA
48 Brahmaputra
49 Chao Phrya
50 Fly
51 Ganges
52 Hong (Red River)
53 Irrawaddy
54 Kapuas
55 Kura-Araks
56 Lake Balkhash
57 Mahakam
58 Mekong
59 Ob
60 Salween
61 Sepik
62 Syr Darya
63 Ural
64 Volga
65 Xi Jiang
66 Yalu Jiang

SUB-SAHARAN AFRICA
67 Congo
68 Cunene
69 Jubba
70 Lake Turkana
71 Limpopo
72 Niger
73 Ogooue
74 Okavango
75 Orange
76 Senegal
77 Shabelle
78 Volta
79 Zambezi

From China 2000 years ago ++ Lao Tze….

The sage's transformation of the World arises from solving the problem of water. If water is united, the human heart will be corrected. If water is pure and clean, the heart of the people will readily be unified and desirous of cleanliness. Even when the citizenry's heart is changed, their conduct will not be depraved. So the sage's government…. consists of talking to people and persuading them, family by family. The pivot (of work) is water.

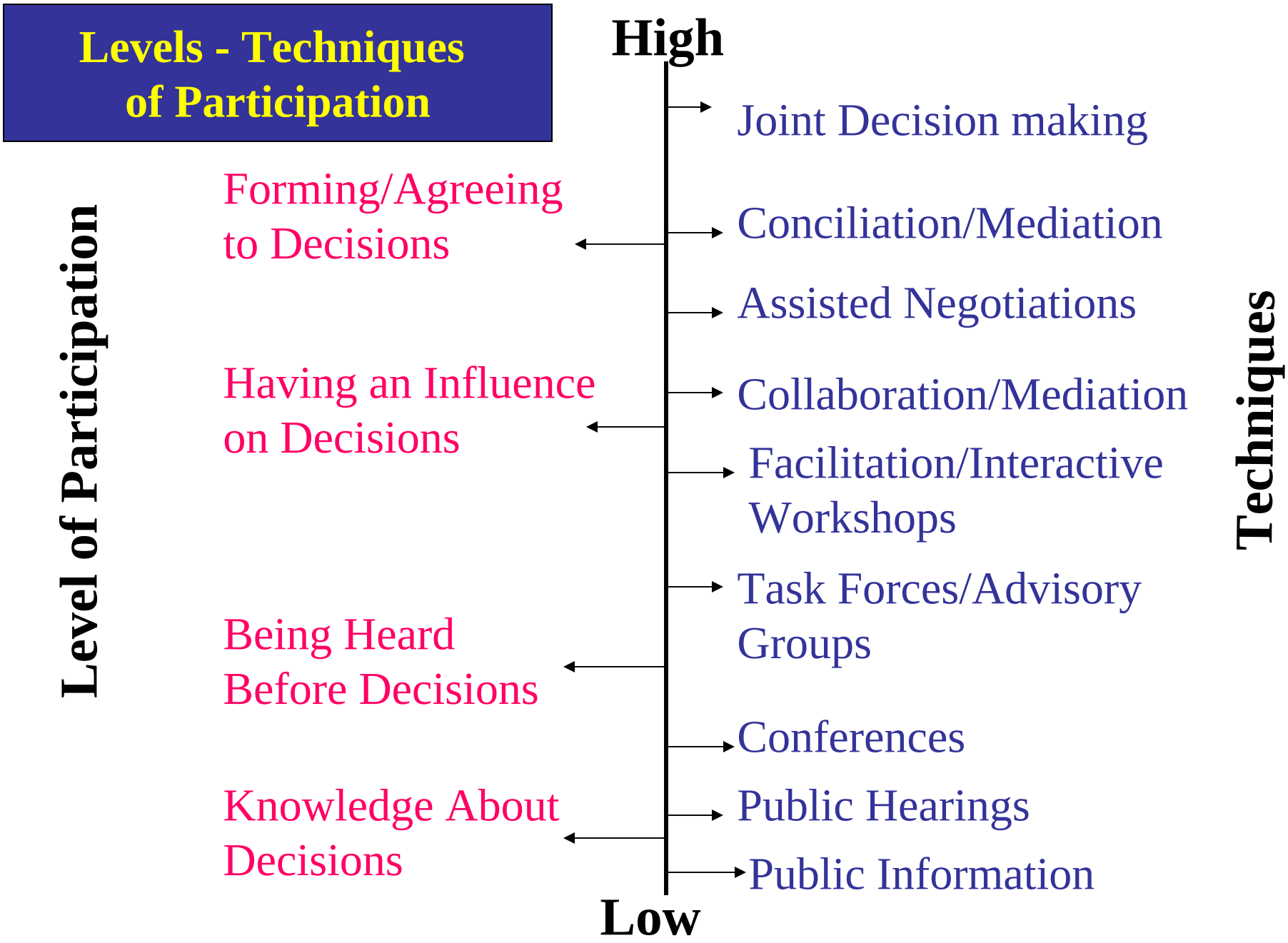
Building River Basin Organizations Conditions for Success

- High Political (Ministerial) commitment
- Meaningful community input
- High knowledge levels
- Clear accountability among participants
- Flexibility and creativity in the RBO
- Design structures based on functions/missions
- Fostering perceptions of basin as a whole
- Using process tools
- Means for Conflict Management
- Separating Admin. and policy: Regulating and constructing

IWRM and Planning

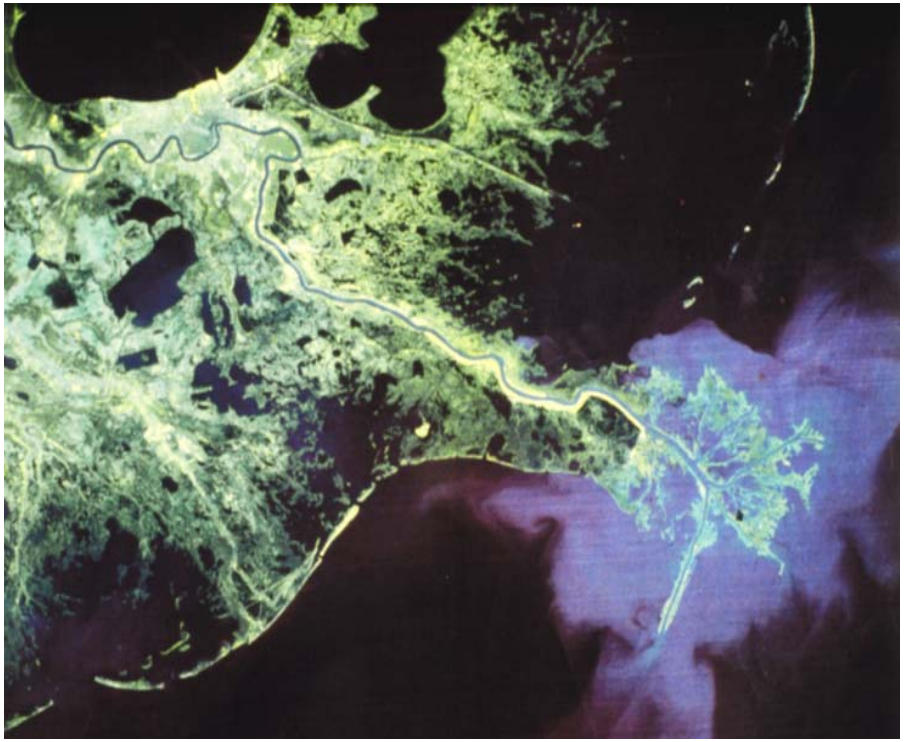
IWRM Achieved through complex ratios of cost sharing that vary by purposes - all make up Multiple uses and lead to calculation of BCR at Federal level

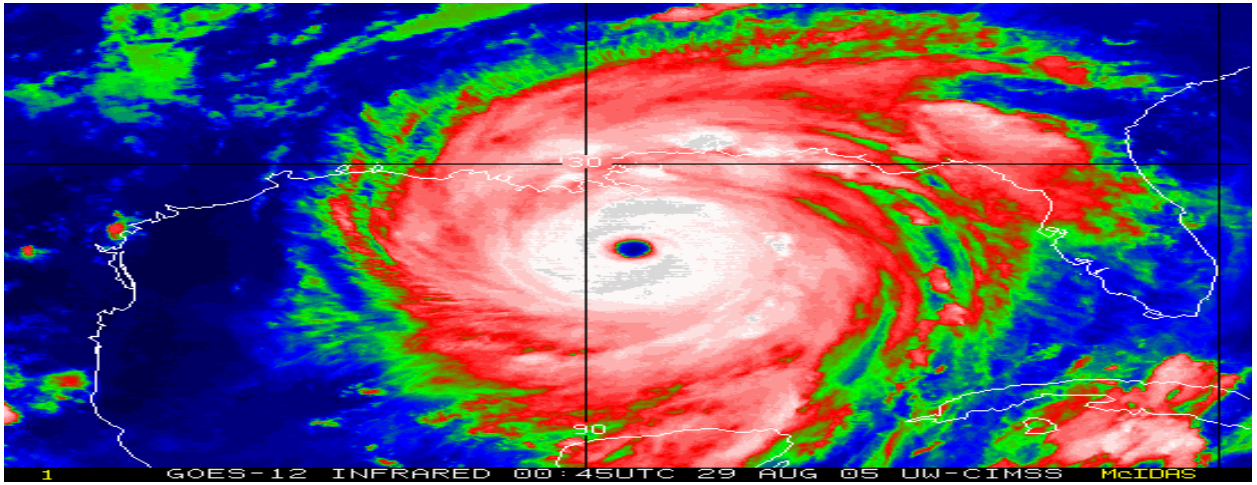
Purposes – Uses	Cost Sharing = % of costs born by entities sponsoring
Flood Control	Federal
Navigation	Federal – Local partnerships – ratios changing
Hydropower	Local - Federal
Eco Systems	Federal – Local
Irrigation	Federal – Local
Water Supply	Local
Recreation	Local


Levels - Techniques of Participation
High
Low
Level of Participation
Techniques
Forming/Agreeing to Decisions
Having an Influence on Decisions
Being Heard Before Decisions
Knowledge About Decisions
Joint Decision making
Conciliation/Mediation
Assisted Negotiations
Collaboration/Mediation
Facilitation/Interactive Workshops
Task Forces/Advisory Groups
Conferences
Public Hearings
Public Information


RIVER VALLEY
WATER CONSERVATION DISTRICT

COASTAL LOUSIANA






Comprehensive
Everglades Restoration Plan

TVA – Start and Purposes

On May 18, 1933, Congress passed the TVA act
FDR asked Congress to create *"a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise."*

TVA built dams to harness the region's rivers to control floods, improve navigation, and to generated electricity.

TVA weighed each issue in relation to the others -- power production, navigation, flood control, malaria prevention, reforestation, or erosion control…….

- Dams were a popular destination for tourists 1000 people a day visited Wilson, Wheeler and Norris Dams in 1930s.

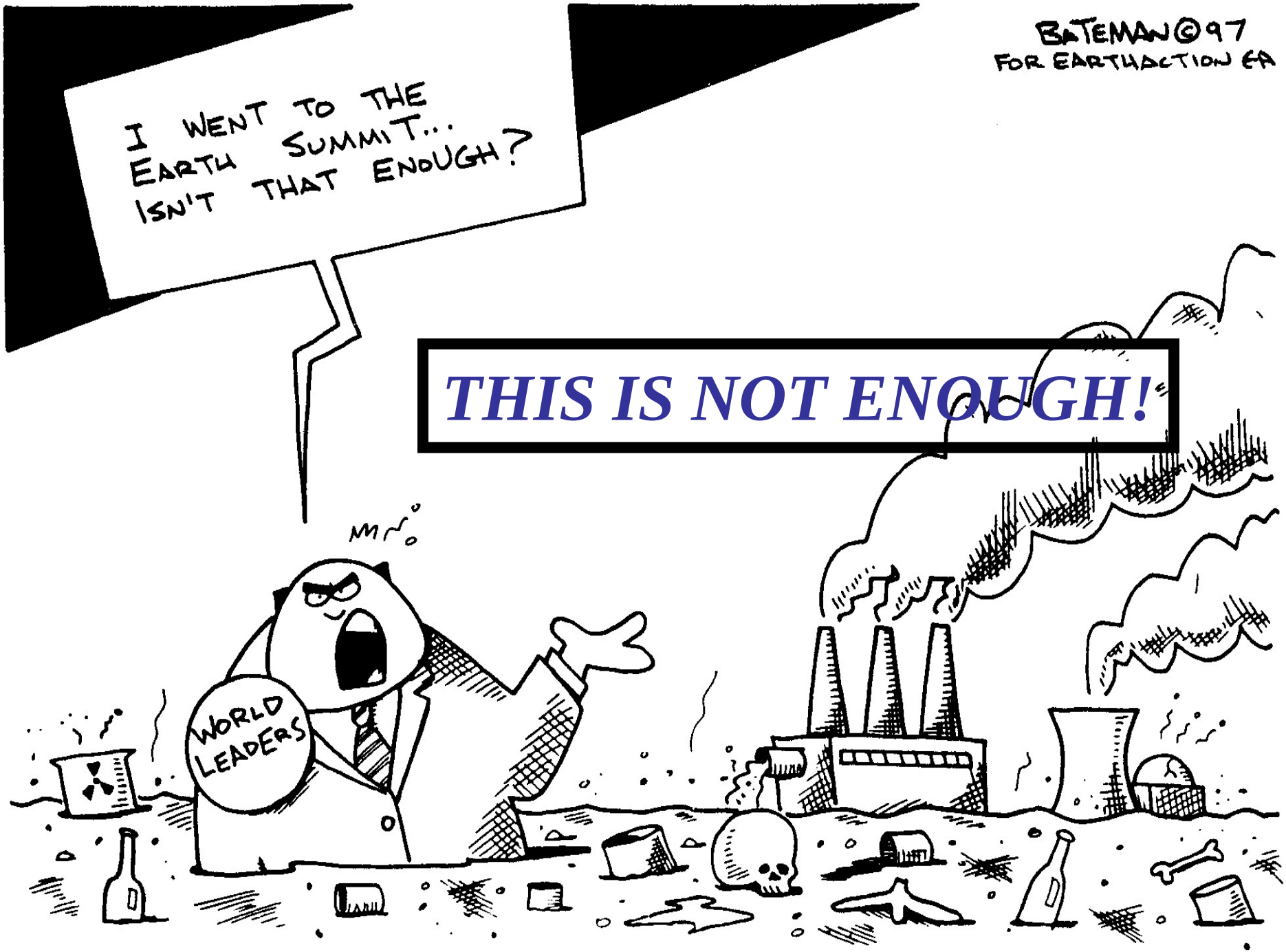
- Fertilizer program on the farms now twice as productive per acre as the average American farm.

- Electricity drew industries into the region, provided jobs

- By 1950 had become the nation's largest electricity supplier – in 1959 total self financing power

- ***Today revenues are $7 Billion/yr: a no public federal funding*** in navigation, flood control, environmental research, and land management-all of its programs are paid for with power revenues.

- ***Today TVA pays taxes of $338 million - one of the largest "taxpayers" in Tennessee and Alabama.***


I WENT TO THE EARTH SUMMIT... ISN'T THAT ENOUGH?
BATEMAN ©97
FOR EARTHACTION EA
THIS IS NOT ENOUGH!
WORLD LEADERS

Lyndon Johnson,
The Creator of U.S. War On Poverty

On: Water, Role of Government,
Water and Poverty, His Public Achievements

Breaking the Cycle of Poverty
Platform for Growth

"Of all the endeavors on which I have worked
In public life, I am proudest of the accomplishments
In developing the Colorado River. It is not the damming
of the stream or the harnessing of the Floods in which
I take pride. But rather in the ending of the waste of the
region. The region – so unproductive in my youth - Is now
a vital part of the national economy and potential. More
important, the wastage of human resources in the whole
region. Has been reduced. Men and women have been
released From the waste of drudgery and toil against the
Unyielding rocks of the Texas hills. ***This is the true
fulfillment of the true responsibilities of government"***
(Lyndon Johnson 1958)

Water and People

Mutli purposes

Water is Everyone's Business: Recycling through us All

Throughout History Thousands of years of History – B.C. to Today - Poets have written allegorically:

……Water as …. Humanities Carrier of its Collective Memory

Today Scientists:

…….speak of the same water recycling through us over Time and space

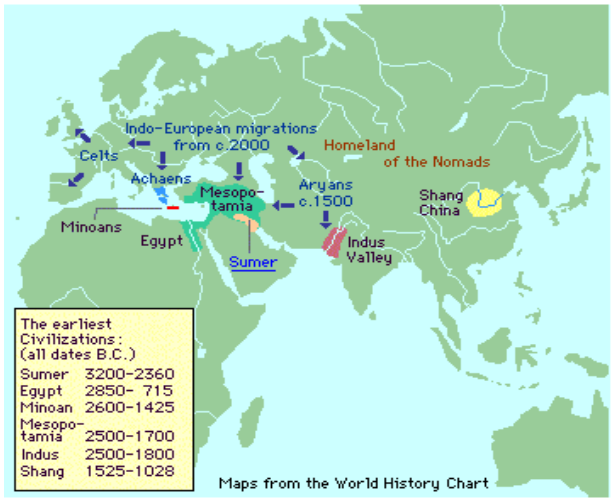
……and of molecules carrying information…..

C.J. Jung

….water as the symbol of the unconscious

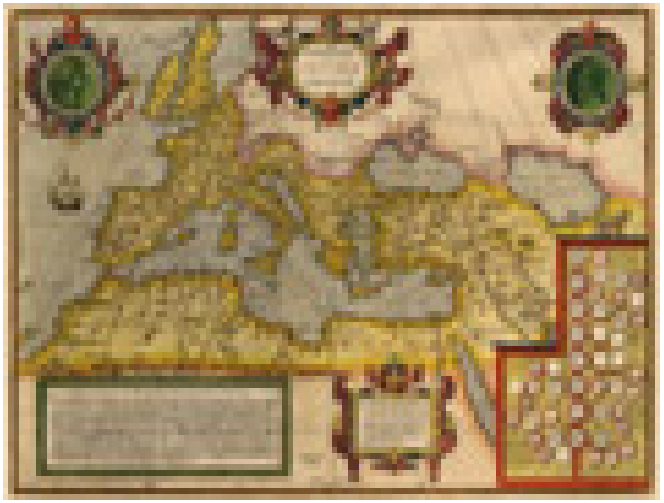
Ancient Evidence

Evidence of functional cooperation or unification of sates around river Basins can be found in Hammurabi's' code on operations of irrigation trenches

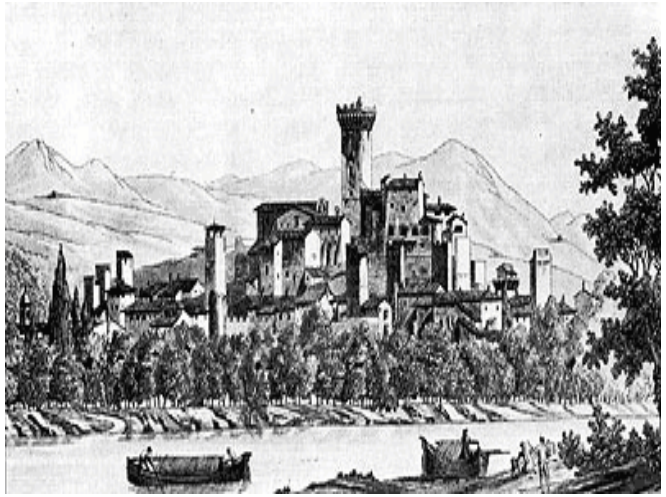


…Or, in Chinese book of the Tang on operation of water wheels

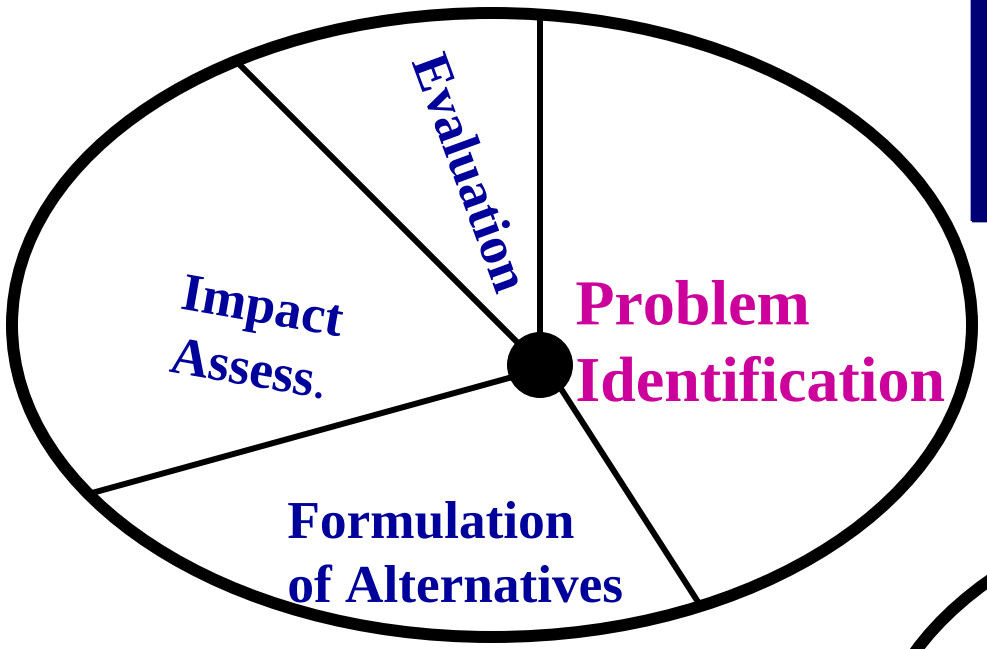
Rome and European Rivers



..Boatsman associations and organizing the whole river
..special offices for arbitration on river uses..



Planning Process: Phases

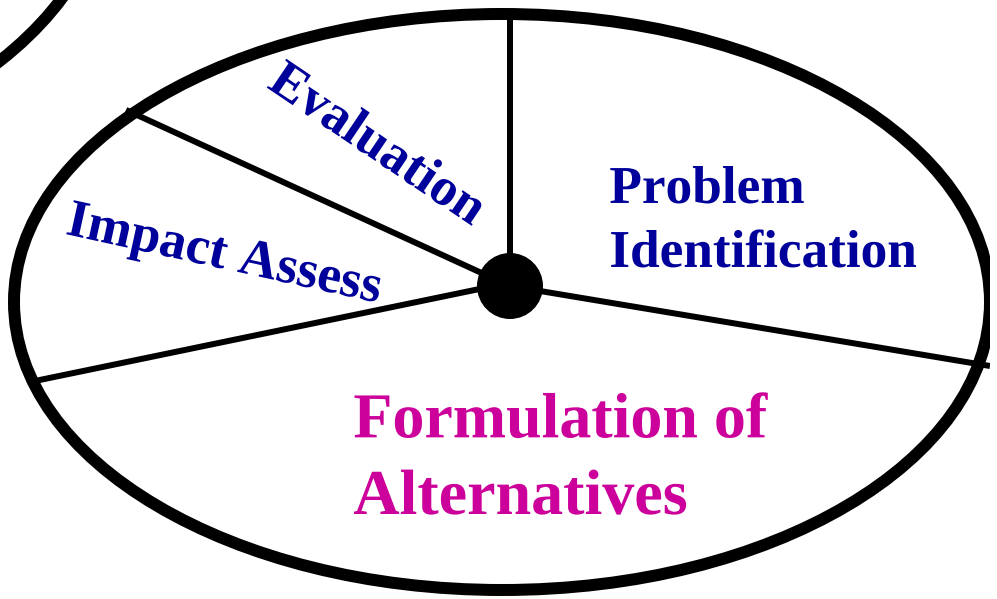


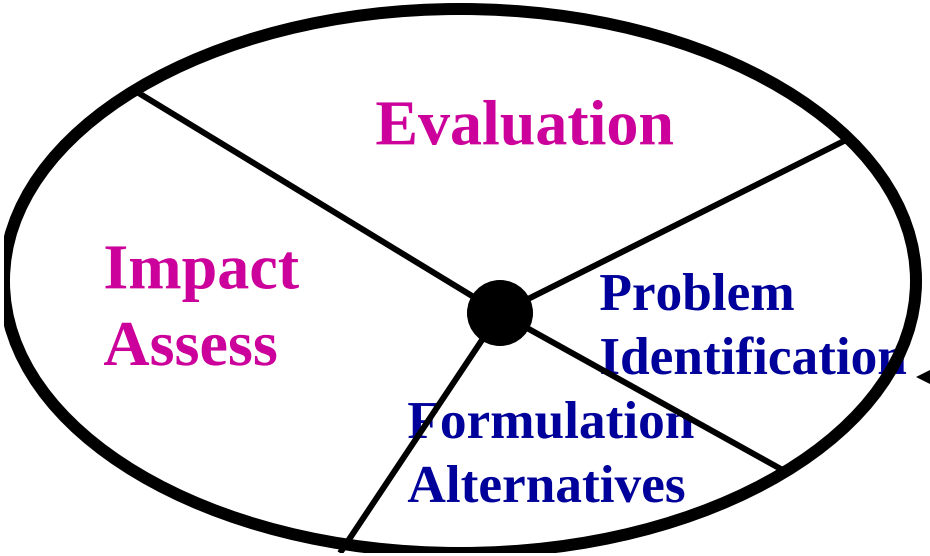
Phase 1

Develop Plan of Study

Phase II

Develop Intermediate Plans





Phase III

Develop Detailed Plans

Some Lessons

- **MANY MODELS**: Depends on conditions
- **CRITICAL ROLE OF PRECIPITATING EVENTS - RECURRENT CONDITIONS** (Floods, Droughts, etc.)

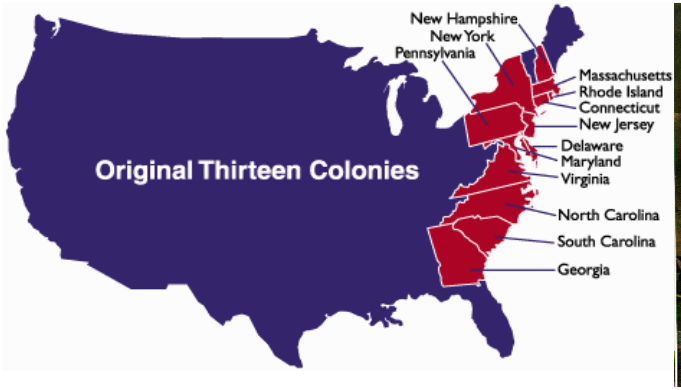
•EVOLUTIONARY	Begins as secure forum for dialog and grows
	Org's change: purposes/uses added as values change
•INCENTIVES	Intervenors with Resources/power Facilitators of dialog
	Incentives vs. threat or force
•SUPPORT	Bottoms up: regional, sui-generis Real participation of SH's

Some lessons (con.)

- **FUNDING**
- **RIGHTS**
- **STAFF**
- **DATA**

- Stability (esp.. early)
- Some independence
- Stability in access rights
- Evolution of trusted technical support
- Develop, accept, share: information, data bases

The 19th Century Water Infrastructure and Social Transformation



"Great natural waterways go far to explain the rapid pace of economic development and economic power n North America. .(Lafayette in post Rev. War visits to the US)

"….by increasing the volume of goods and entering trade and commerce, the transportation system would instantaneously increase national wealth……would untie people in every part of the nation…. (Gallatin report of 1808)

Economic Historians on Erie Canal

"…provided the spark, the flashpoint and the inspiration for a burst of progress in America that would eventually coin the buzzword of the early twenty-first century: economic growth, urbanization, national unity, globalization, networking and technological innovation…"

"…canal provided a fantastic wealth – creation machine for the powerful forces of economic change at work in the U.S., motivated by the …passion of Americans for *money and impatience to get ahead…..*

…"opening of the Erie canal was the dividing point between the periods of the "frontier without the factory" and the "frontier with the factory.