

The TVA Experience – Managing an Integrated, Multipurpose Reservoir System



TVA TODAY

Self-financing, wholly federal owned corporation and public power entity



Mission: improve the quality of life in the region

- Supply affordable, reliable power
- **Manage a thriving river system**
- Stimulate sustainable economic growth
- Partner with stakeholders
- Improve financial flexibility



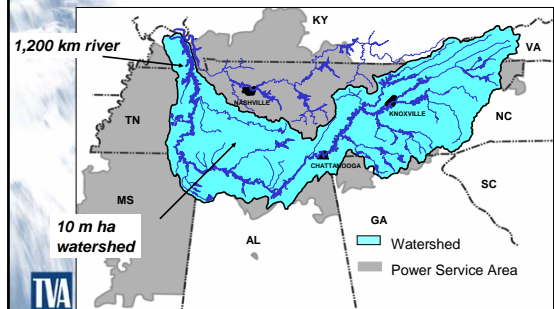
Many lessons from TVA, but important

Characteristic	Unit	Brahmaputra	Tennessee
Drainage Area	sq km	580,000	100,000
River Length	km	2,880	1,200
Rainfall	mm / yr	1,800 - 6,000	1,200 - 2,300
Max Discharge @ Assam/Chickamauga	cumecs	72,800	1,400
@ Outlet		120,000	2,800
Specific Flood Discharge	cmeq/sq km	0.14	0.03
Sediment Load	m tons/yr	74	-

River basin management must meet unique needs, circumstances and aspirations of each basin



TVA Water and 'Power' sheds



TVA AUTHORITY

- Legal authority derived from TVA Act (1933) and subsequent Congressional legislation
 - Manage reservoir system and manage river flow
 - Manage TVA owned lands and facilities
 - Produce and transmit power
 - Stimulate social & economic development
- TVA does not
 - Allocate water (riparian doctrine in Eastern US)
 - Control land use or pollution
 - Manage the watersheds
- But, public holds TVA accountable for water quality and environmental management

.....thus, TVA provides technical assistance and works closely with states & public



A Multipurpose Reservoir System

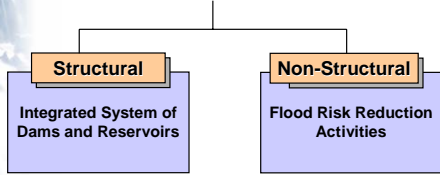
- **Flood damage reduction**
- Navigation
- Power generation
- Recreation
- Water supply
- Water quality



TVA Flood Management

The TVA ACT (1933):
 "...control the destructive flood waters in the Tennessee and Mississippi

Historic Dual Approach to Flood Management



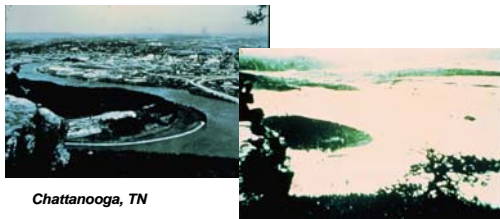
Keep water away from people

Keep people away from water

Highly Flood-Prone Area



- Flood producing storms once every year or two
- 350 flood prone communities
- 15 urban damage centers – Chattanooga largest
- Agricultural damages
- Contributes to Mississippi floods



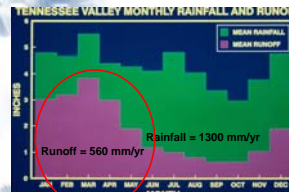
Chattanooga, TN



Gatlinburg, TN



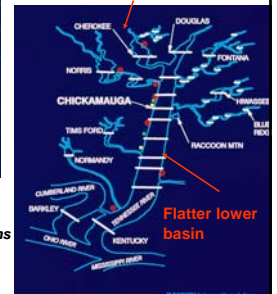
Designing a Multipurpose System: Hydrology & Geography



Streamflow:	Avg	Max
Chickamauga:	950	1,400 cms
Kentucky:	1,900	2,800



Mountainous upper basin



Flatter lower basin

TVA Reservoir System 49 dams



Tributary - Multipurpose



Main River - Multipurpose



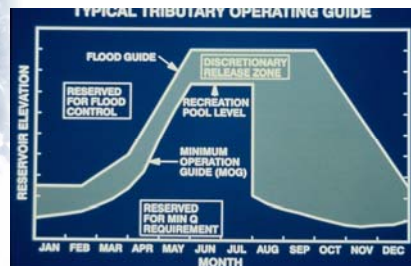
Tributary - Run-of-River Power



Tributary - Nonpower



Unique Reservoir Operating Strategy



Supported by extensive real-time monitoring & modeling system



A Systems Approach

Flood Control Operating Strategy



53 flood events reduced since 1936



- Damages averted:
 - \$4.5 billion at Chattanooga
 - \$5.2 billion Valley-wide
 - ~ \$224 million avg annual damages Valley-wide



*Still,
20% chance minor flood &
5% chance major flood*

TVA Flood Risk Reduction Program

Pioneering the concept of risk and floodplain management to reduce flood damage potential along the Tennessee River

• Non-structural Approaches

- Avoid damages – appropriate land use & siting
- Reduce potential for damage – flood warning, flood proofing, relocation, small structures
- Preserve the floodplain

• TVA's Strategy

- Reduce damage potential by controlling land use at the local level & incorporating flood risk considerations into overall community planning & development
- TVA provide the technical and engineering assistance

TVA Flood Risk Reduction

TVA activities - examples

- Flood risk mapping
- Assist state and local officials
- Public education
- Permitting & land use reviews
- Flood warning systems
- Relocation
- Small structures
- Preserve natural uses



Other Examples of Community-Based Flood Mitigation

Example Flood Marker
Flood Category Levels and Station of Flood Levels
Lower Melbourne River, Melbourne

Australia: flood poles



**Mekong:
Village flood
reference system**

Bangladesh:

- flood warning systems
- raised platforms
- cyclone shelters

TVA's Flood Risk Reduction Benefits

- Difficult to value
 - Value of inappropriate development that has not occurred
 - TVA's influence indirect
- At risk property & infrastructure = ~ \$ 10 b
- Without TVA presence
 - + 2 % risk /yr → additional \$ 10 billion

**Today, TVA's role in floodplain management is limited →
State's and local communities are responsible for
managing the floodplain**

A Multipurpose Reservoir System



- Flood damage reduction
- **Navigation**
- **Power generation**
- **Recreation**
- **Water supply**
- **Water quality**



Navigation is good for Valley economy



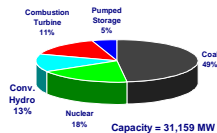
- 50 million tons moved annually
- Least cost transportation (\$10/ton or \$555 m/yr shipper savings)
- Railways must remain competitive (\$400 m reduced rail rates)
- Private investment = \$8 b
- Many commodities (60% coal, stone/gravel; minerals/ores)
- Joint maintenance by TVA & COE

**9 locks on the mainstem;
Connectivity to Mississippi River
~ 1,100km; 3.3 meters depth**

Hydropower generation & support to thermal power system



- Hydropower (4100 MW)
 - 29 hydro plants and 109 units (13%)
 - Raccoon Mountain Pumped Storage adds about 1600 megawatts (5%)
- Peaking power for least cost and maximum system flexibility
- Cooling water for fossil and nuclear plants



Recreation – providing summer pool levels & releases for recreation



- Boating
- Swimming
- Fishing
- Whitewater rafting
- Sailing
- Camping



**- TVA manages public lands, recreation facilities & shoreline
- Recreation generates \$25 m/year**

Clean and reliable water supply

- Reliable water supply for downstream use during low flow periods
- Minimum depths maintained for municipalities and utility intakes and minimum discharges for waste assimilation
- Process water and cooling water for TVA thermal and nuclear plants

**Consumptive use is low (approx 5 - 10 %),
But demand is growing**



TVA reservoirs are operated to provide water quality & health benefits



- Minimum flows for aquatic habitat and waste assimilation
- Aeration improves DO in tailwaters
- Environmental health monitoring
- Stabilized reservoir levels to improve spawning success
- Mainstem reservoir fluctuations for mosquito control

\$3- 4 million/yr in O&M to provide aeration and minimum flow

Keeping the public informed

www.tva.gov



-public report card

- real time infor

In Closing

- TVA system designed and operated – from regional, system perspective - to maximize benefits and multiple uses
- Reservoir operations have changed over time in response to new and changing public demands (major: 1990, 2005)
- Flood Management
 - Structural and non-structural approaches critical
 - Some flood risk always remains
- Operating an integrated reservoir system is a balancing act
 - Maintaining flood storage availability
 - Producing power
 - Recreation (high lake levels vs river discharges)
 - Minimum flows for water quality and intakes
 - Maintaining navigable depths on the Tennessee

TVA