

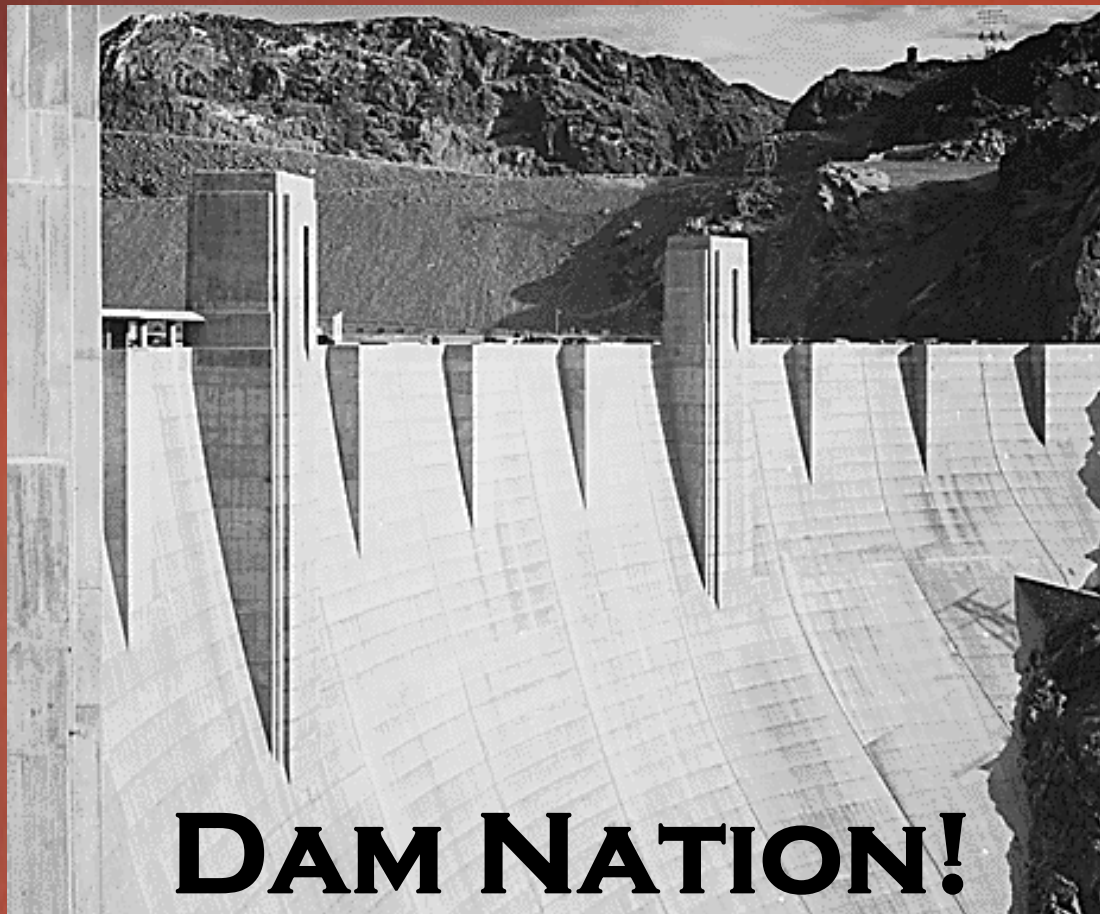
1 hr talk (11:45-12:45 get on bus at 1PM, box lunch) then bus tour to dams along river until 5:30PM the refreshments at Mill 6PM.

I will give the Keynote talk on Dam Removal and the implications of that (i.e. contaminants), tied back to this specific system.

Aging, safety, liability, sediments, contaminants, decision points, balancing issues, impacts of dams, impacts of removal, benefits of removal

They will be having a diversity of folks attending and speaking including hydro development folks who want to take older dams and convert them to hydro.

Audience: hydro converters, TU-fish, whitewater partnership, towns folk, landuse officials, regional planning agency, NRCS, DEP, public utilities, PFISER 55 people total so that they can fit in bus.



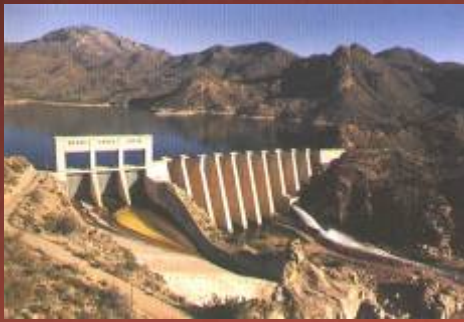
DAM NATION!

**An Introduction to Dam Impacts &
Dam Removal Efforts**

by

Laura Wildman, Professional Engineer - American Rivers





Bartlett Dam, Verde River, AZ

DAM NATION!

An Introduction to Dam Impacts & Dam Removal Efforts

Outline:

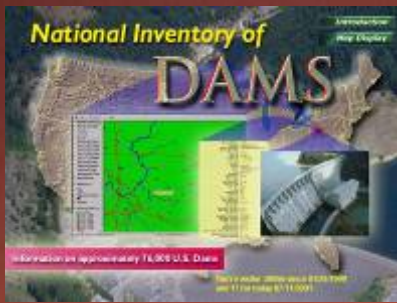
Dams & Their Impacts

Why Do We Remove Dams?

Issues to Consider

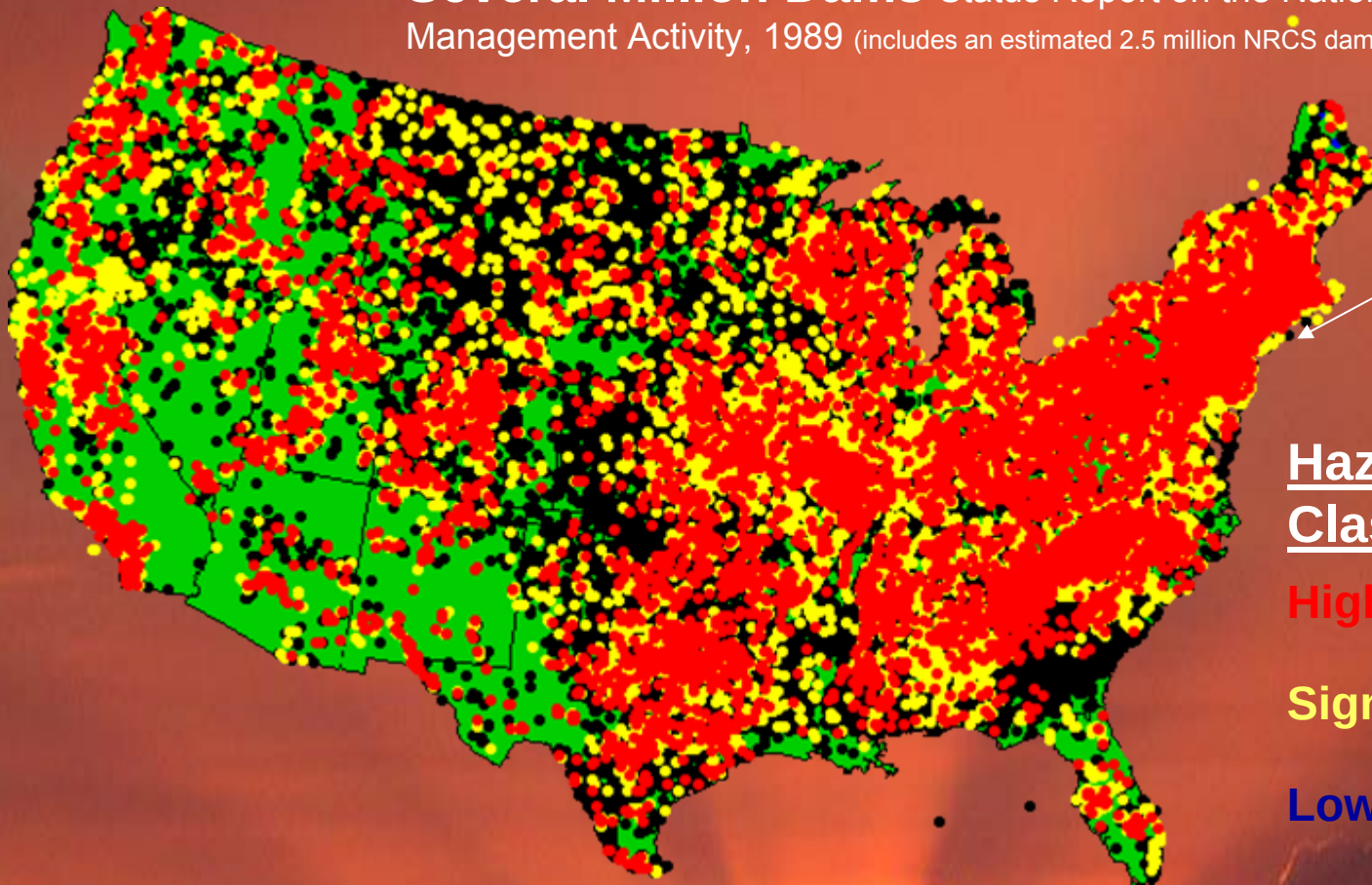
Dam Removal Projects





NATIONAL INVENTORY OF DAMS

- **78,747 Dams** >25 ft w/ 15ac-ft capacity or >6ft w/ 50ac-ft capacity
- **~99,000 Dams** regulated by states & in the USFWS Barrier Database
- **Several Million Dams** Status Report on the Nation's Floodplain Management Activity, 1989 (includes an estimated 2.5 million NRCS dams built as of 1977)



Oldest dam in NID
was built in 1677 in
Newington, CT

Hazard Classifications

High Hazard

Significant Hazard

Low Hazard

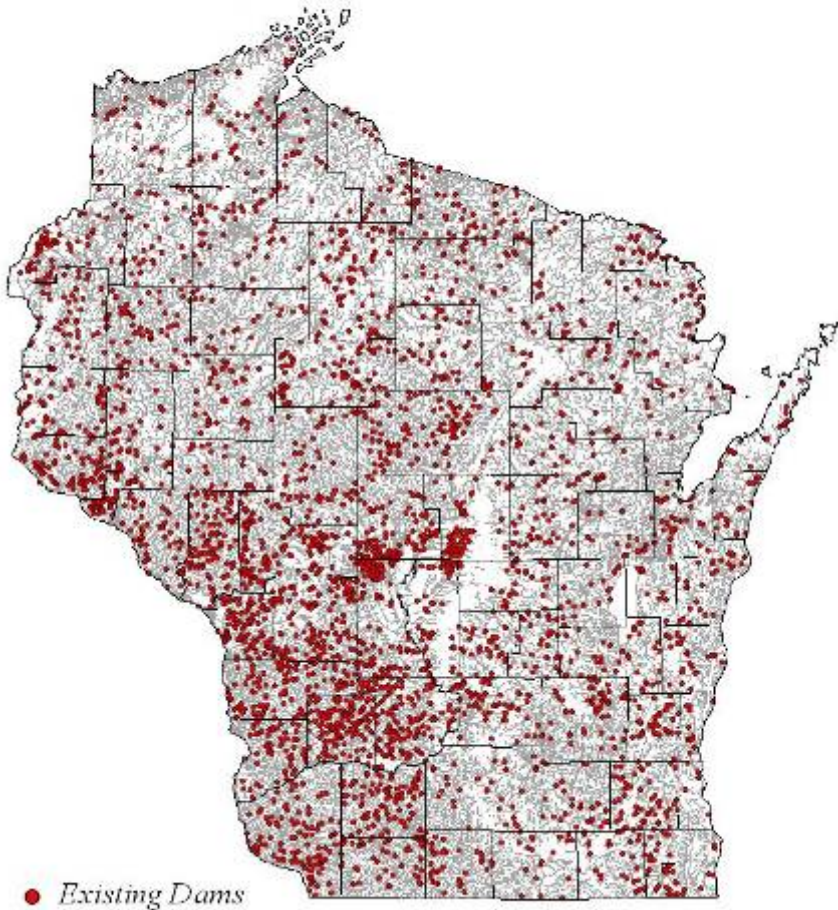


NUMBER OF DAMS: NID VS ACTUAL



WISCONSIN DAMS

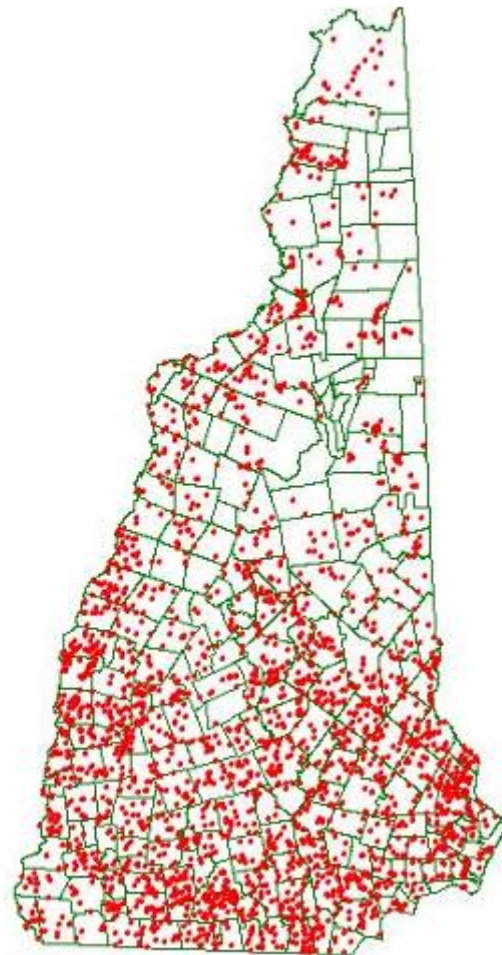
included in the state inventory



Created June 10, 2002

NEW HAMPSHIRE DAMS

Active dams that meet the NH dam definition



DAM & BARRIER TYPES

Dams Types:



Earth

Gravity



Earth and Rock

Timber/Rock Fill



Variable Radius Arch

Hydraulic Fill

Constant Radius Arch

Flashboard & Buttress



Multiple Arch

Reinforced Concrete Tank

Slab and Buttress



Inflatable Rubber

Crib

Other (sheetpile, tailings, etc)

Other Barriers:

Culverts

Stream Paving

Levees / Floodwalls

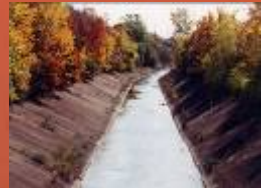
Hydraulic Barriers

Sediment Barriers

Tide Gates

Bridge Aprons

Over-allocation



DAM FACTS

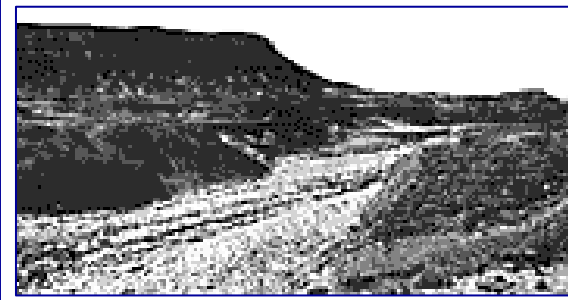
- Egyptians Started Building Dams 5,000 Years Ago. The earliest dams where remains have been found were built around 3000 b.c. for the town of Jawa in modern day Jordan. About 400 years later the Sadd Al-Kafara was built. It is estimated to have taken 10-15 years to build. The dam was built in ancient Egypt and was destroyed by heavy rainfall soon after its completion.

http://crunch.tec.army.mil/nid/webpages/USSD_Water_Dams/history.html

- Benefits Include:

- Cheap Electricity
- Water Supply
- Sediment Trapping
- Decreased Threat From Floods Or Drought
- Navigable Streams
- Irrigation
- Recreation

- Until Recently Engineers Were Unfamiliar With Many of the Impacts & Consequences of Dams
- “Virtually Every River In The Lower 48 Is Now Regulated By Dams, Locks, Or Diversions” Collier, Webb & Schmidt



Sadd Al-Kafara in Egypt:
The worlds oldest dam
(~ 2686 - 2498 BC) was
washed out before it was
ever used. ~36ft x 350ft



OUR DAM BUILDING HISTORY



Billington Street Dam



Cuddebackville Dam - Neversink

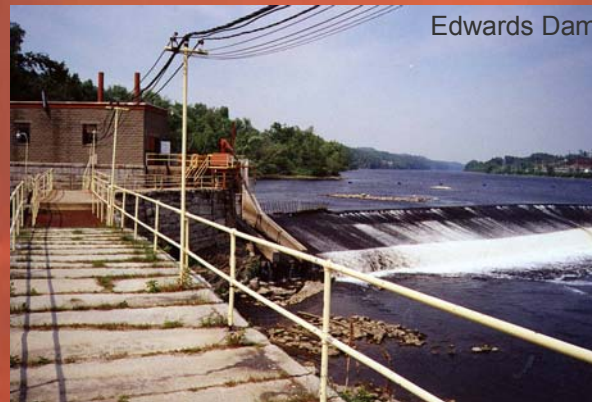
Billerica Dam
Middlesex Canal

Farm Pond Dams & Mill Dams (Mechanical Power)

Navigation Canal Dams



Tingue Dam



Edwards Dam



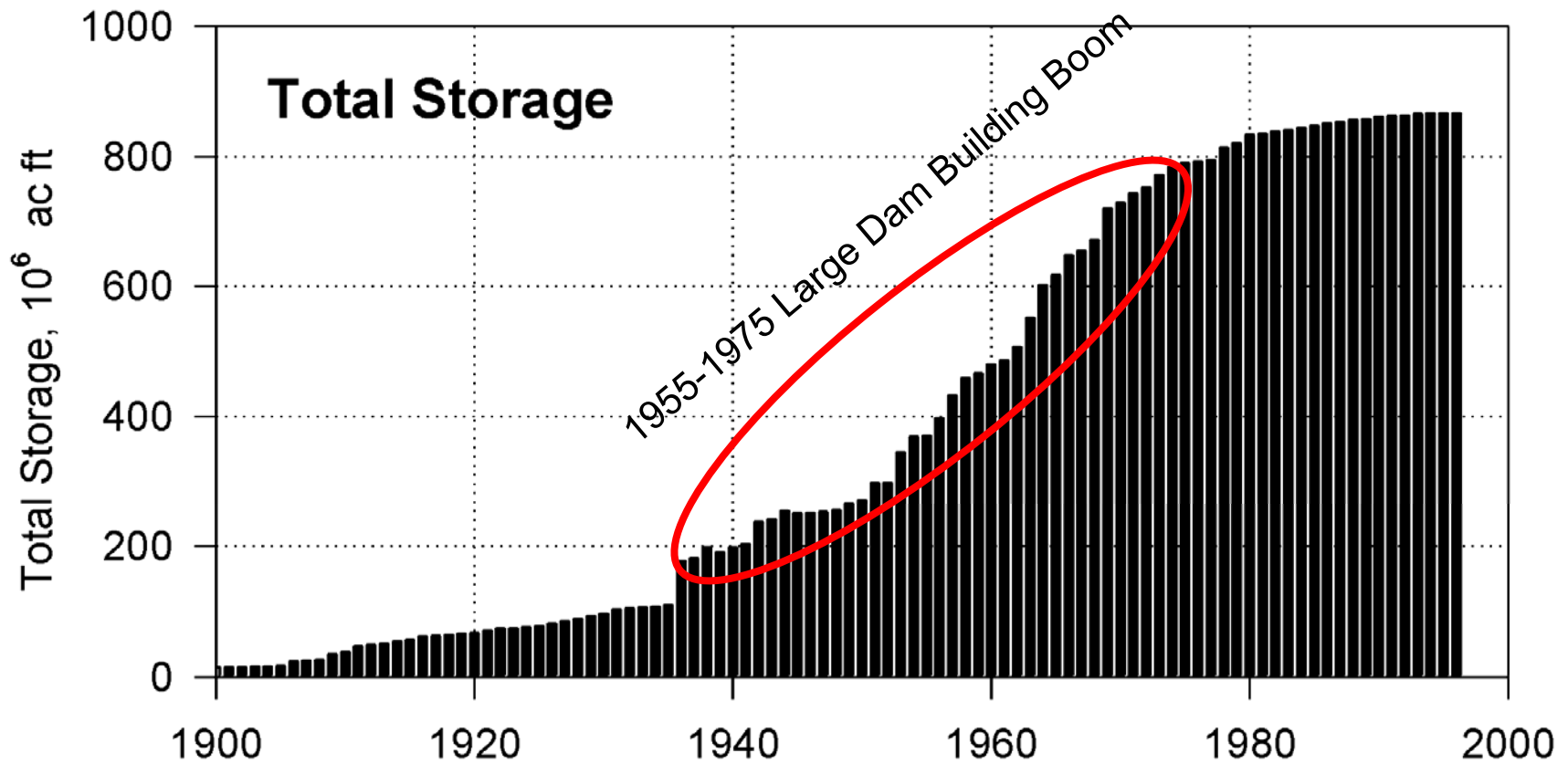
Thomaston Dam

Industrial Dams

Hydroelectric / Water Supply

Flood Control / Recreation

THE DAM BUILDING ERA



Slide Data Source: Will Graff

Dam building booms during industrial revolution & in the mid-century.
Now those dams are aging.



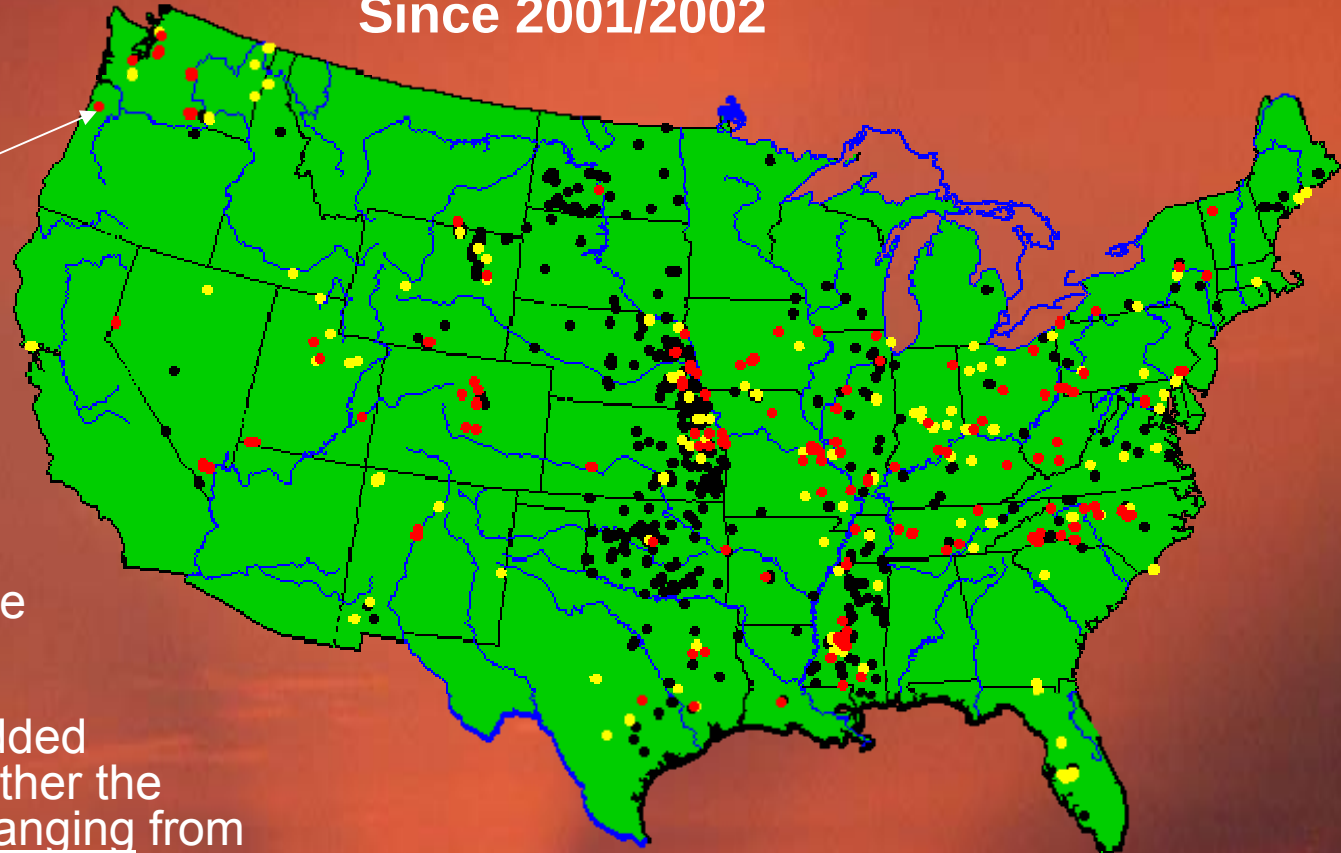


NEW DAM CONSTRUCTION

Since 2001/2002

Newly constructed, high hazard, Creekside Dam (2005) has a 5 min. warning time for hotel, RV park, Interstate highway & many private residences

Source: Elena Sossenkina, Kleinfelder, Inc.



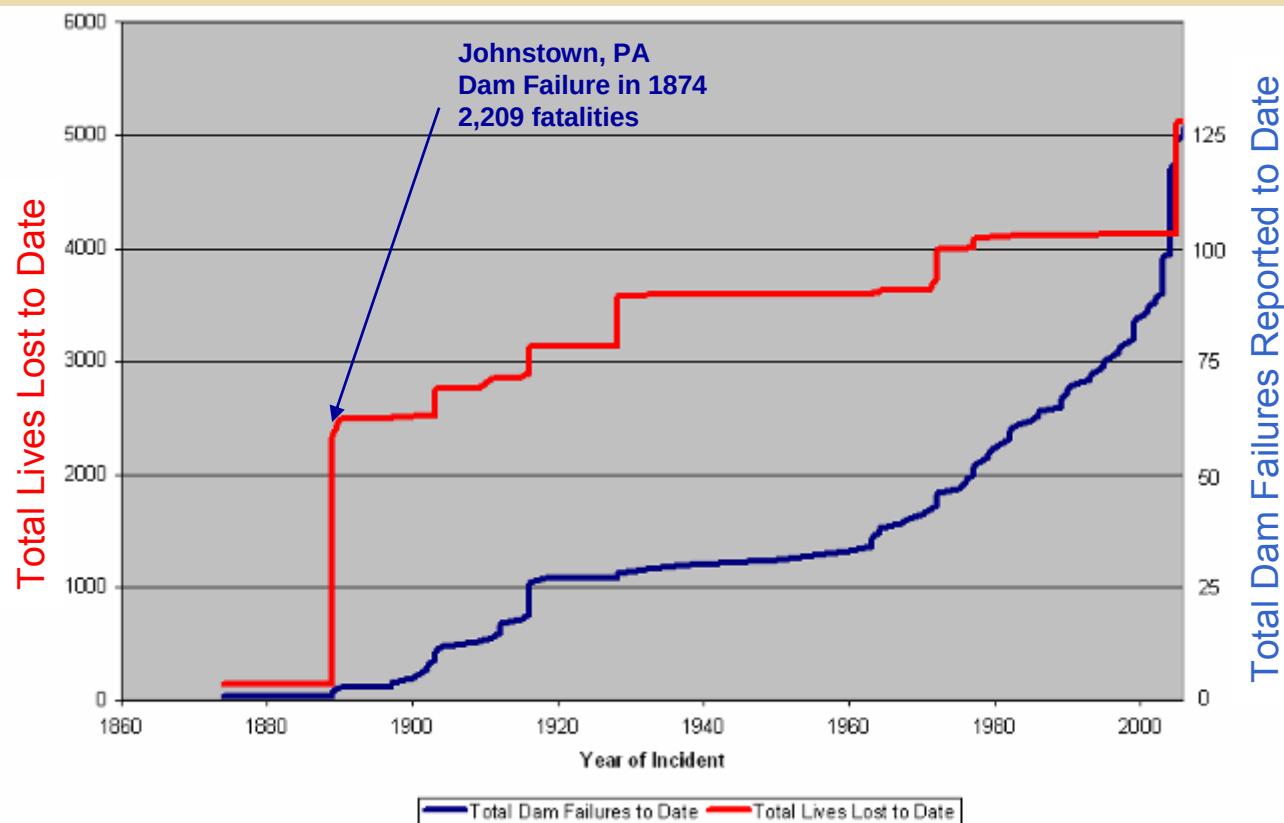
- 746 new NID eligible dams constructed
- 4519 dams were added to the NID due to either the hazard potential changing from Low to Sig/High or remaining Low but the dam Height/Storage now meets NID Inclusion Criteria, or newly identified





ASDSO REPORTED DAM FAILURES & FATALITIES

1874-2006



“Even though the potential for flood damage may be greatly reduced by reservoir storage, the damage potential remains if a flood of greater than design capacity occurs or if the dam should fail.” Johnston Report 1989

5128 known deaths due to dam failure from 1874 to 2006



REPORTED OVER-TOPPINGS, BREACHES OR DAMAGED DAMS

<i>State</i>	<i>October 2005</i>	<i>May 2006</i>
New Hampshire	13, plus 2 breaches	~100
Massachusetts	~40	~200
Connecticut	53 total =16 breached; 34 overtopped or damaged; 3 nearly overtopped	No record as of 6/06
Vermont	No record as of 6/06	No record as of 6/06
Rhode Island (staffed by 1)	No record	No record
Maine (staffed by 1)	No record	No record
Total* =	108 recorded	300 recorded

* Does NOT include unreported or undetected dam incidents



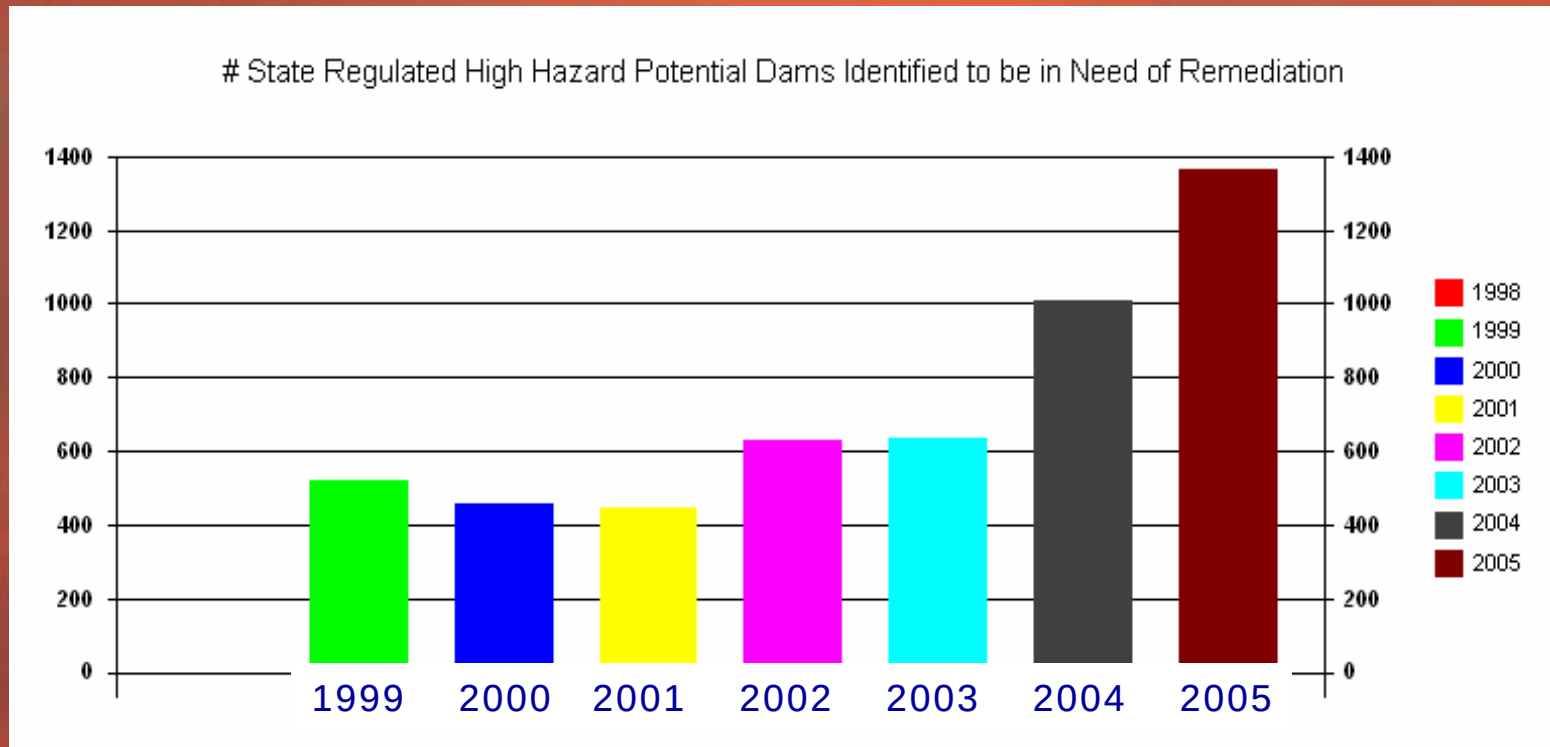


Rindge Dam, CA

AGING DAMS

The number of high hazard dams in need of remediation continues to increase significantly (due to aging, more dams, better inspections)

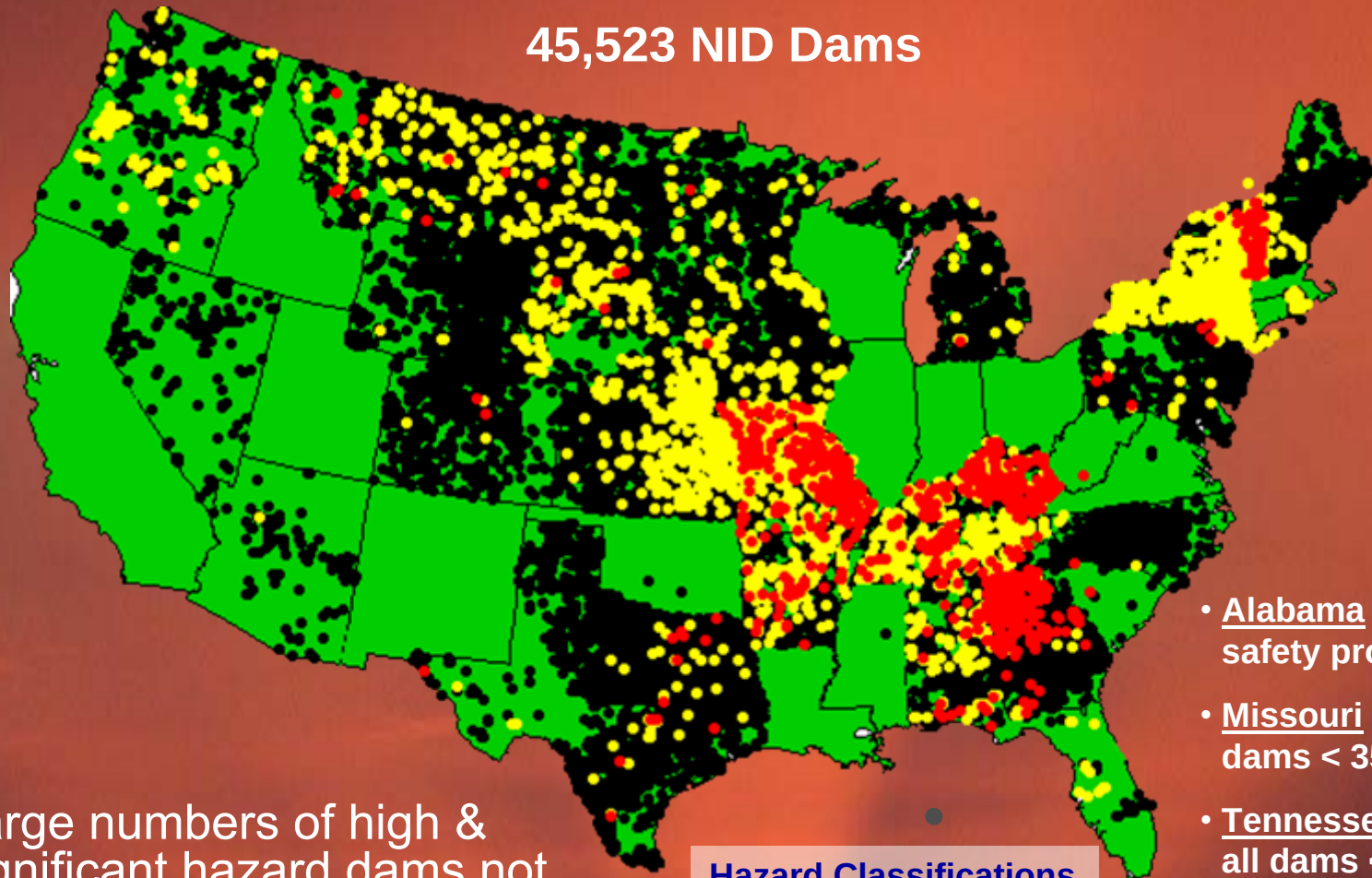
Only around 50% of the nations high hazard dams currently having Emergency Action Plans



Slide source: modified from Michael Grounds ASDOS 2006 presentation on Dams Safety Performance Measures and NID

HAZARDOUS DAMS THAT DO NOT REQUIRE EMERGENCY ACTION PLANS

45,523 NID Dams



- Large numbers of high & significant hazard dams not requiring EAP's.

Hazard Classifications

High Hazard

Significant Hazard

Low Hazard

- Alabama has no dam safety program
- Missouri exempts all dams < 35 ft
- Tennessee exempts all dams < 20' tall & < 30 Acre-Feet Storage





LARGE SCALE HYDROLOGIC IMPACTS OF DAMS

Current Research Supports that U.S. dams:

- Dam Reservoirs cover ~ 3% on the nations land surface (Stallard 1994)
- In a give year 60% of the US' entire flow can be stored behind dams (Hirsch 1990)
- Fragment the fluvial system of the nation
- Impact on river discharge is several times greater than likely impact of global climate change on river discharge
- Greatest impact on flow occurs in the Great Plains, Rocky Mountains, and Southwest (Storage $\approx 3.8 \times$ Mean Annual Runoff)
- Store 4 acre-feet of water per person
- Cumulative increase in storage = cumulative increase in D/S impacts

Source: *Dam Nation: A geographic census of American dams and their large-scale hydrologic impacts* William Graf





IMPACTS OF DAMS

Ecological

Roosevelt Dam, Salt River, AZ

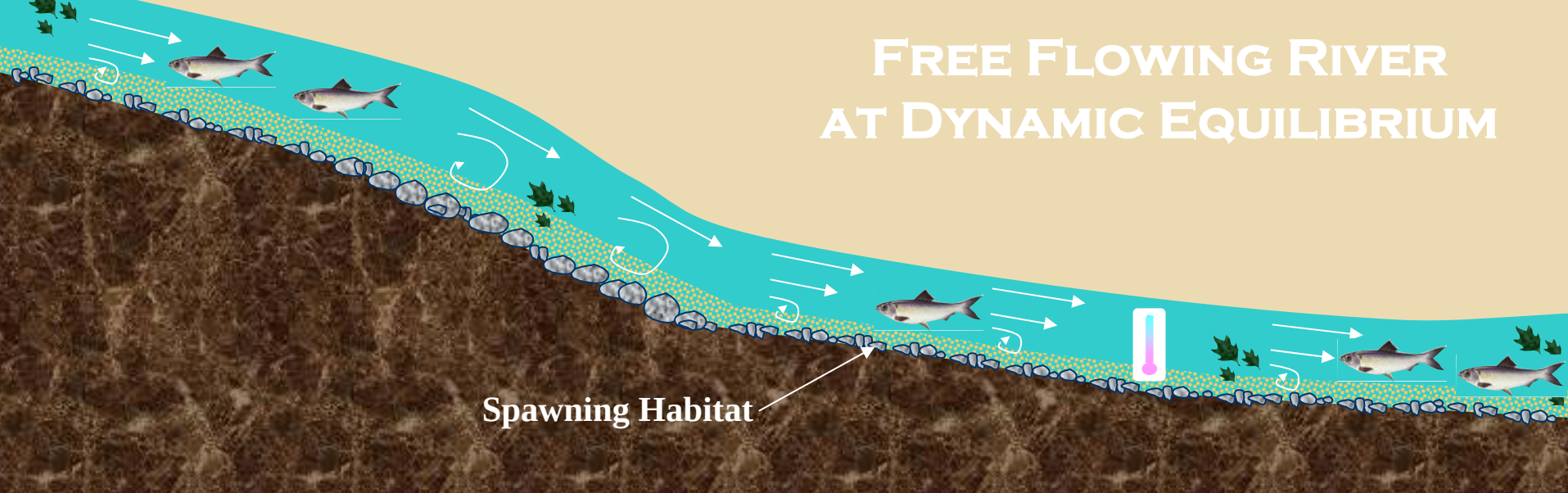
DAMS CAN:

- Significantly Disrupt Sediment Processes & Fill w/ Large Amt. of Sediment (Complicating Inevitable Removal)
- Changes Temperature Regime & Transition Habitats
- Lead to Significant and Irreversible Loss of Native Species and Ecosystems (Decrease Aquatic Biodiversity)
- Decrease Natural Function of D/S Floodplains, Wetlands, and Riverine, Estuarine and Adjacent Marine Ecosystems
- Have Cumulative Impacts on Water Quality, Flow Modification and Species Composition where a Series of Dams Exist on a River
- NOT Often Successfully Mitigate Fish Passage Impacts by Constructing Fish Passes

Source: Majority of List Above is Modified & Summarized from The World Commission on Dams Report, 2000



FREE FLOWING RIVER AT DYNAMIC EQUILIBRIUM



Spawning Habitat

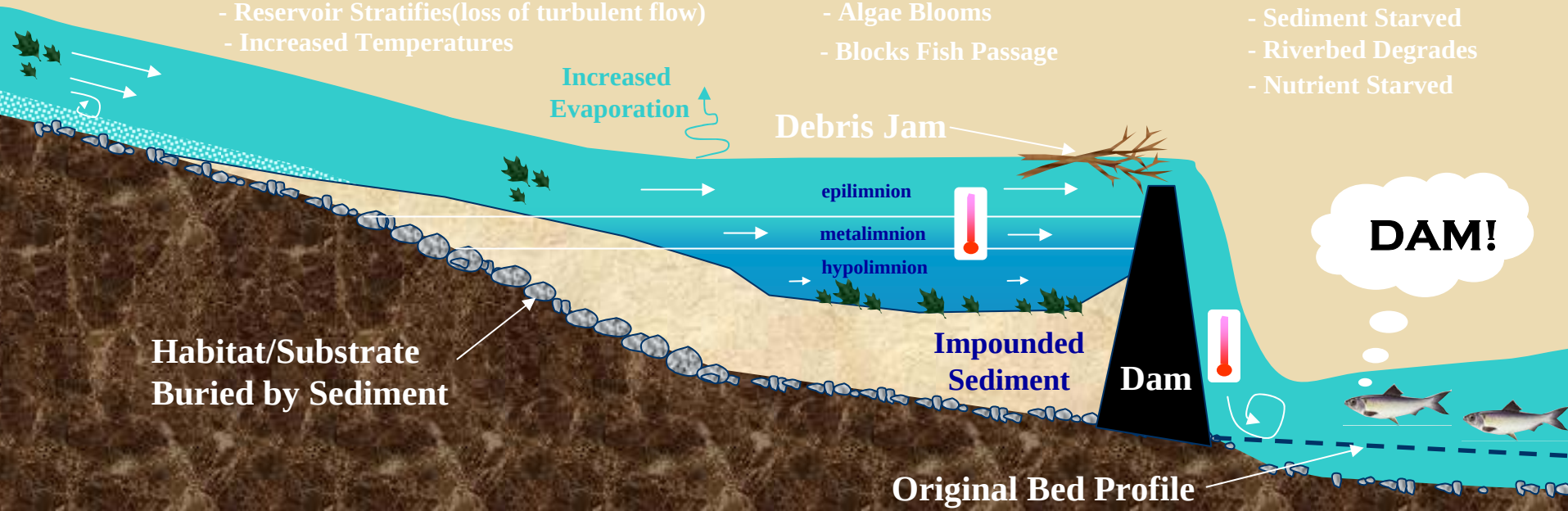
Reservoir

- Decreased Water Quality (decreased circulation)
- Pollutants Accumulate (concentrate)
- Oxygen Depletion (may become anoxic)
- Reservoir Stratifies (loss of turbulent flow)
- Increased Temperatures

- Traps Sediment
- Traps Debris
- Blocks Nutrient Transport
- Algae Blooms
- Blocks Fish Passage

Downstream

- Water Quality is Reduced
- Altered Flow Regime
- Temperatures modified
- Sediment Starved
- Riverbed Degrades
- Nutrient Starved



Increased
Evaporation

Debris Jam

epilimnion

metalimnion

hypolimnion

Impounded
Sediment

Dam

DAM!

Habitat/Substrate
Buried by Sediment

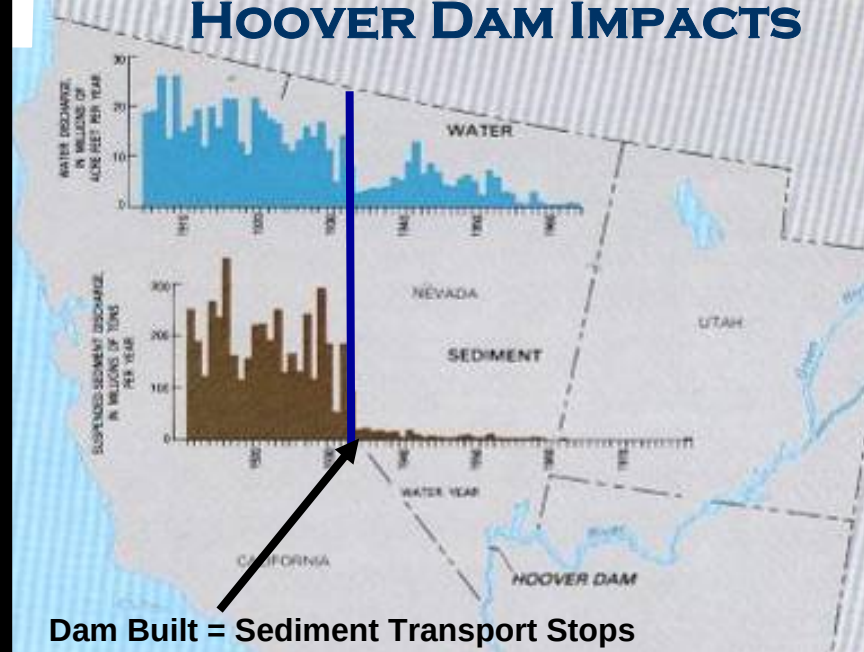
Original Bed Profile

DAVIS DAM IMPACTS

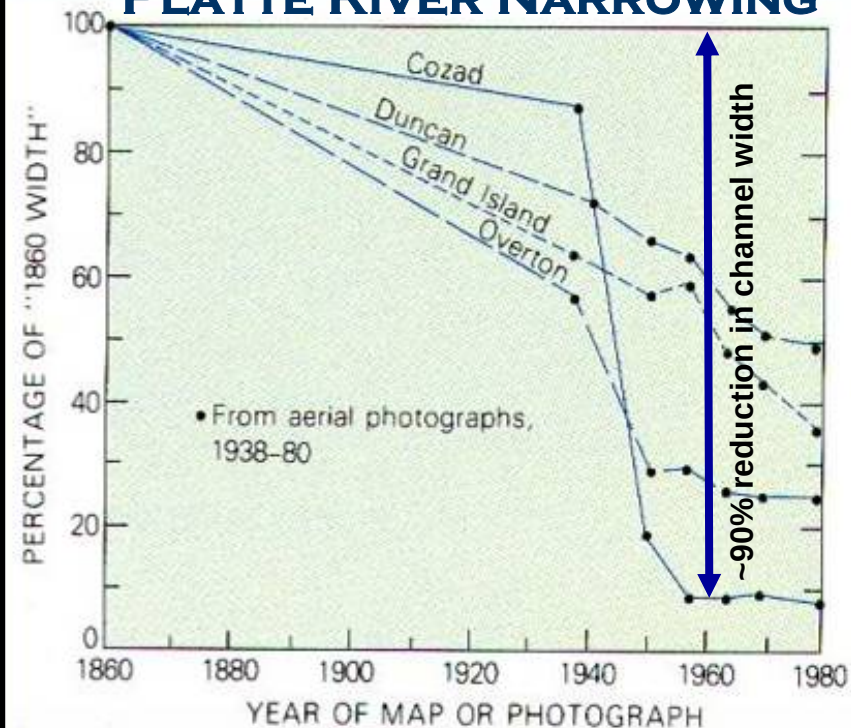


**IMPACT OF DAMS AT
LANDSCAPE LEVEL**
(irreversible impacts at times)

HOOVER DAM IMPACTS

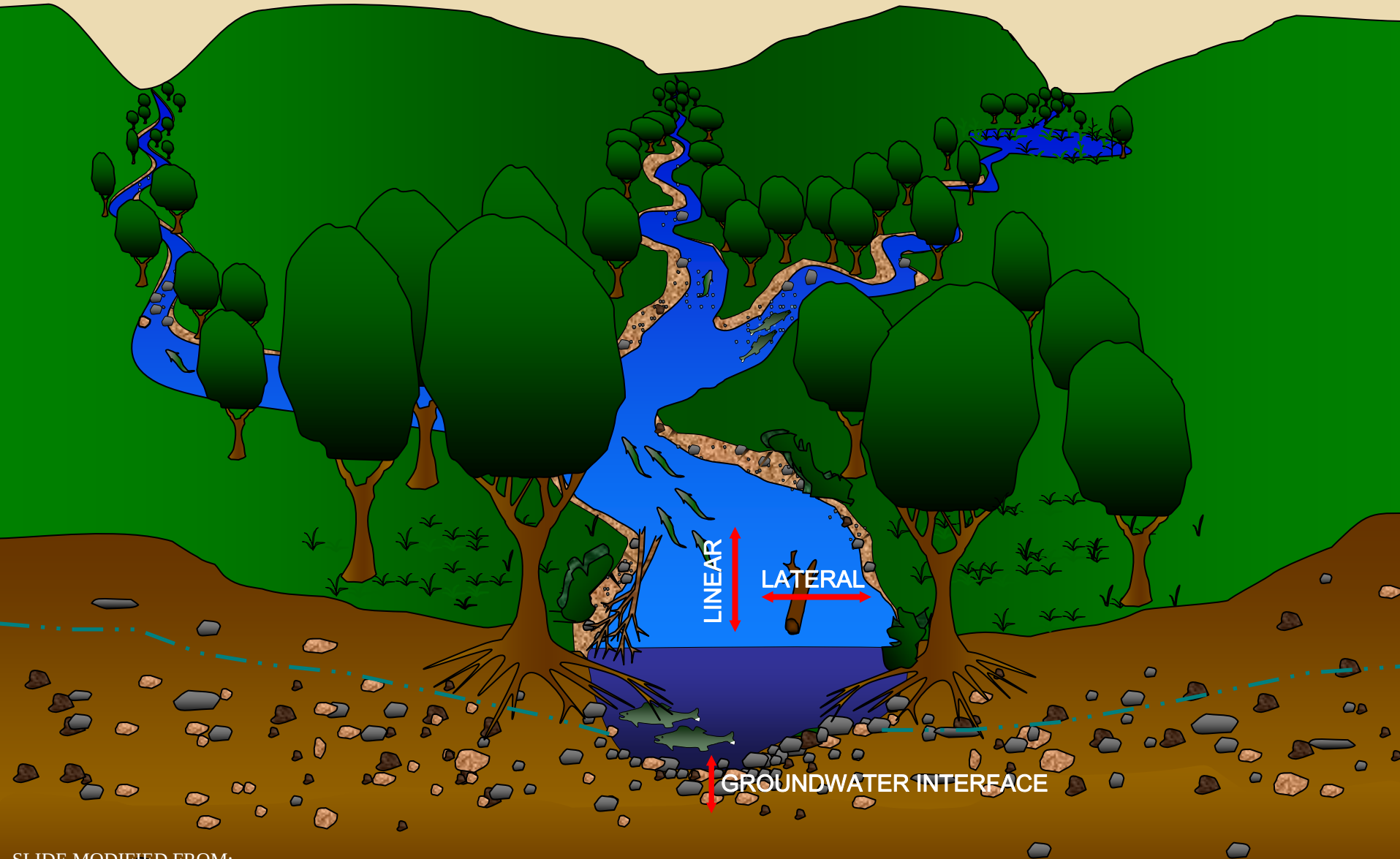


PLATTE RIVER NARROWING



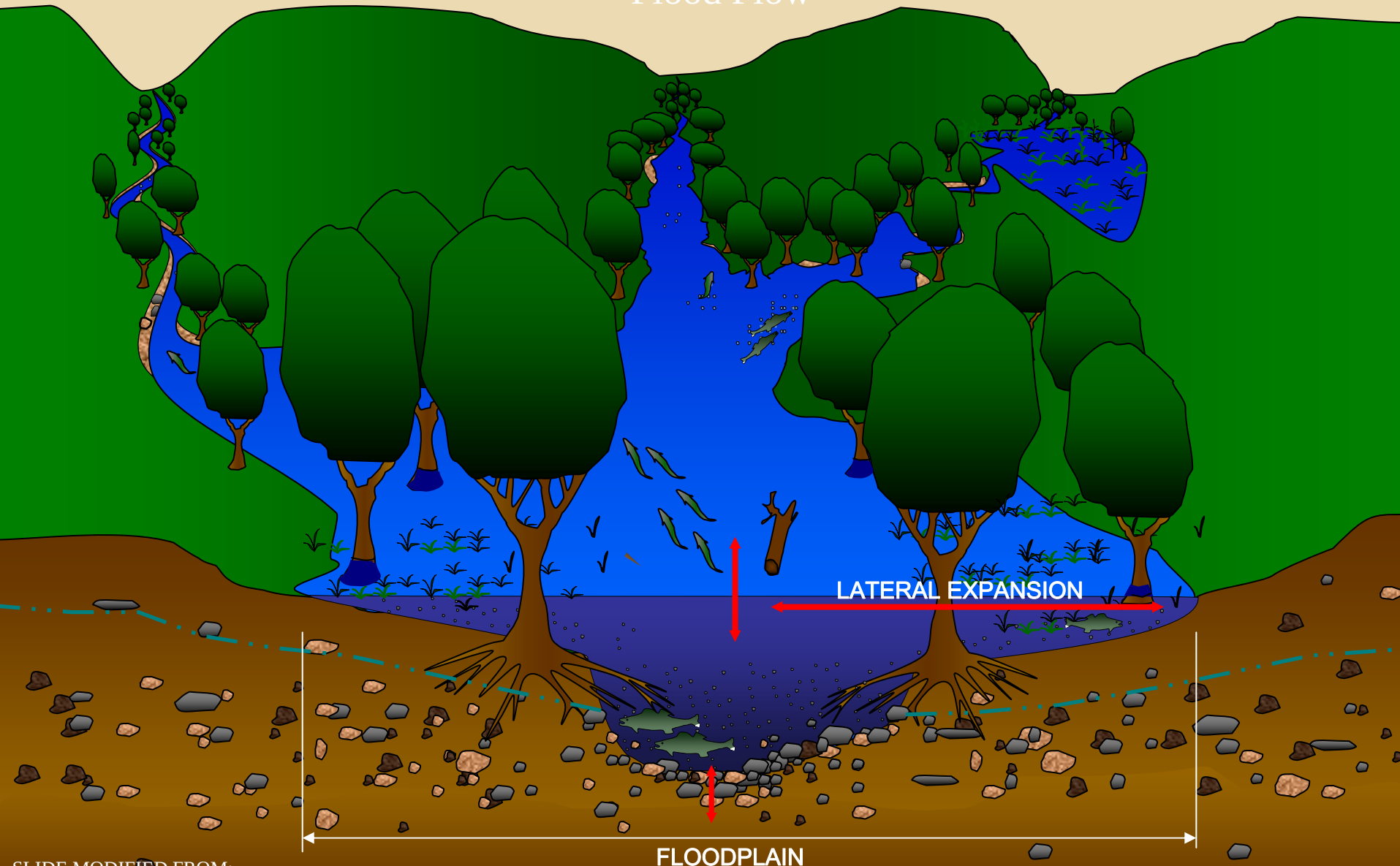
CONNECTIVITY OF A RIVER

Normal Flow

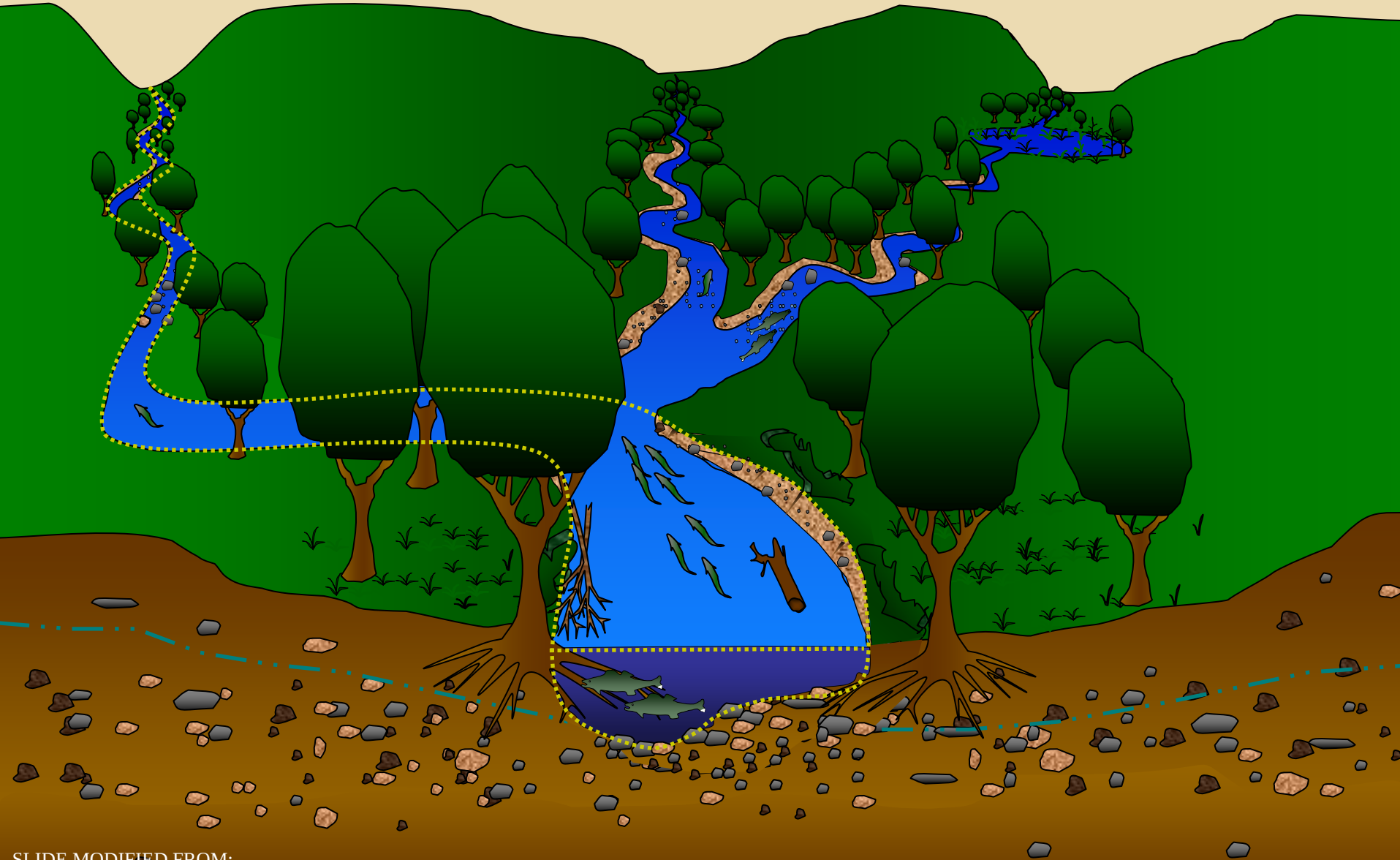


CONNECTIVITY OF A RIVER

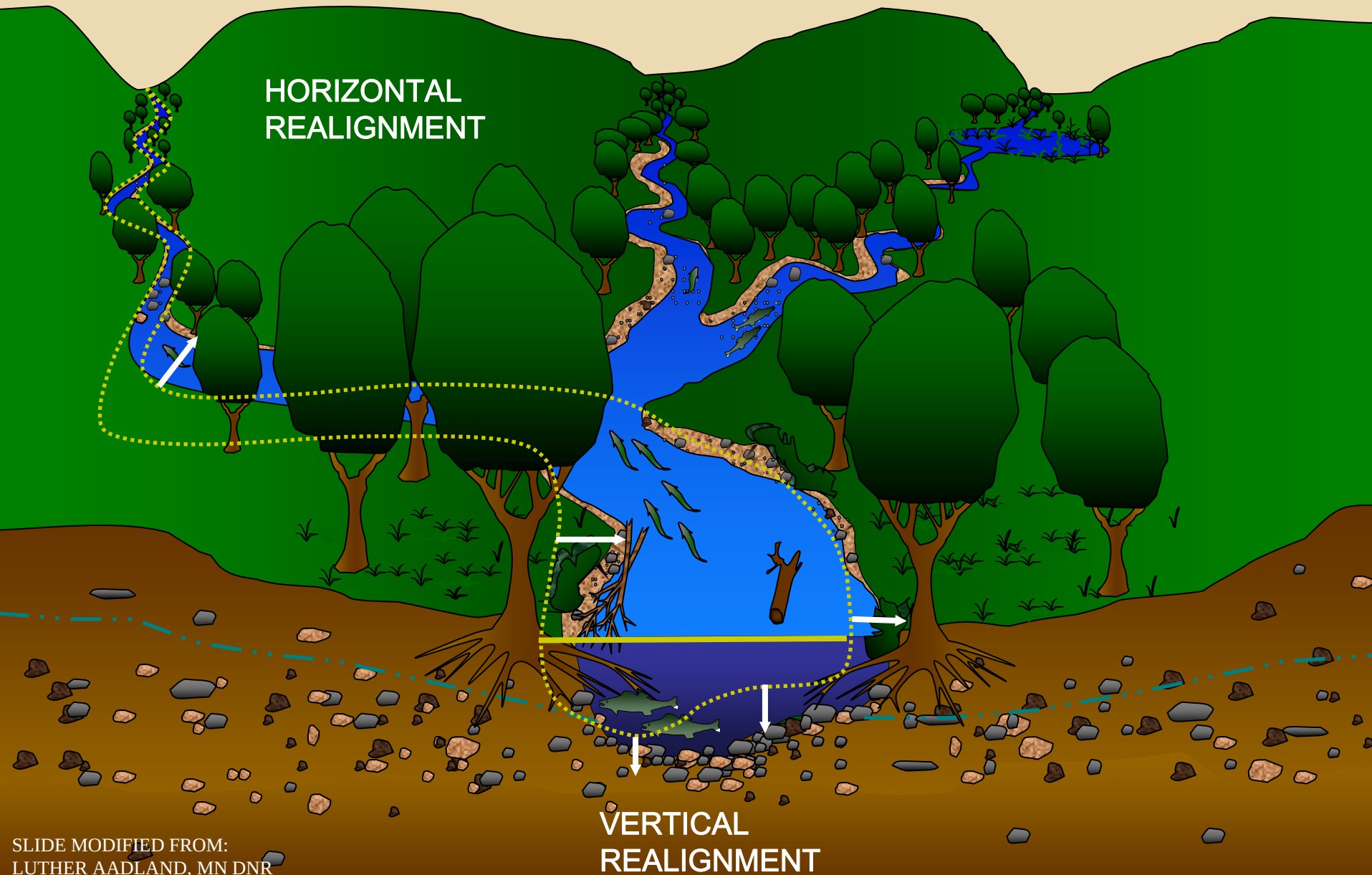
Flood Flow



DYNAMIC NATURE OF A RIVER



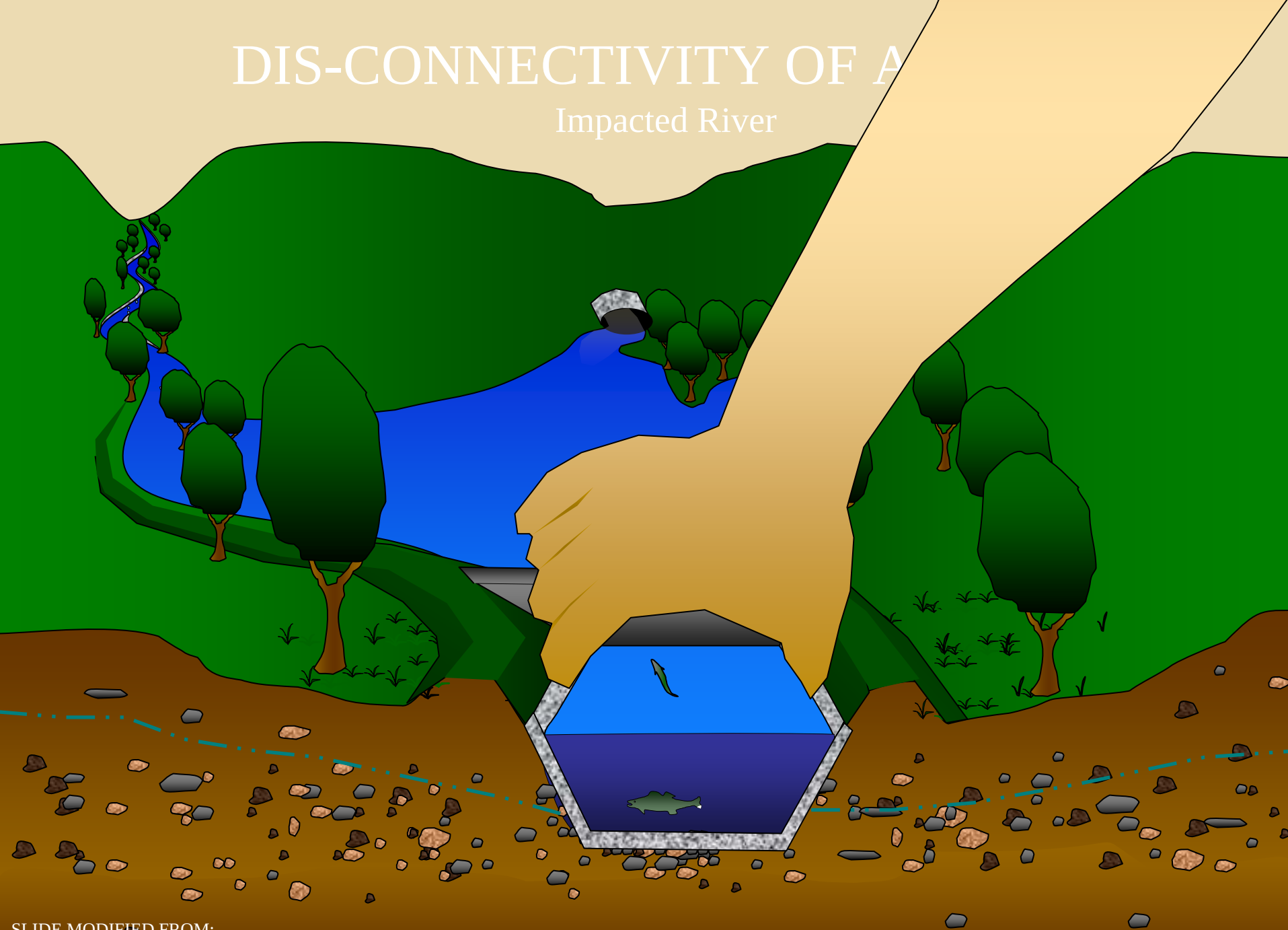
DYNAMIC NATURE OF A RIVER





DIS-CONNECTIVITY OF A

Impacted River



IMPACTS OF DAMS

Socioeconomic

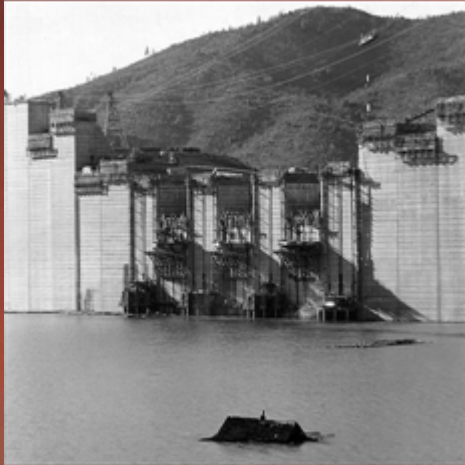
LARGE DAMS CAN:

- Uproot Ex. Communities & Submerge Land, Habitats, Communities, and Cultural Artifacts
- Disrupt the Culture
- Require Extensive Maintenance & Updates
- Vulnerable Groups Bear Disproportionate Share Of Social & Env. Cost

Source: Modified & Summarized from The World Commission on Dams Report, 2000

SMALL DAMS ARE:

- Remnants of an Industrial Past & Have Significant Sentimental Value
- Hidden Liabilities
- Not Waterfalls - Require Regular Maintenance to keep safe
- Numerous



Shasta Dam Rises
House Submerges



WHY REMOVE A DAM?

“Environmental harms have little to do with whether dams are built or removed” *Science and Environmental Health Network*

Aging

- dam structure
- reservoir sedimentation

Safety

- breaching
- drowning
- liability

Economics

- loss of original purpose or economic value
- maintenance
- no longer economically justifiable

Environment

- environmental impact too great
- proactive restoration



Remnants of the Austin, Pennsylvania, dam after its failure on September 30, 1911.



Attractive Nuisance



Fish Passage



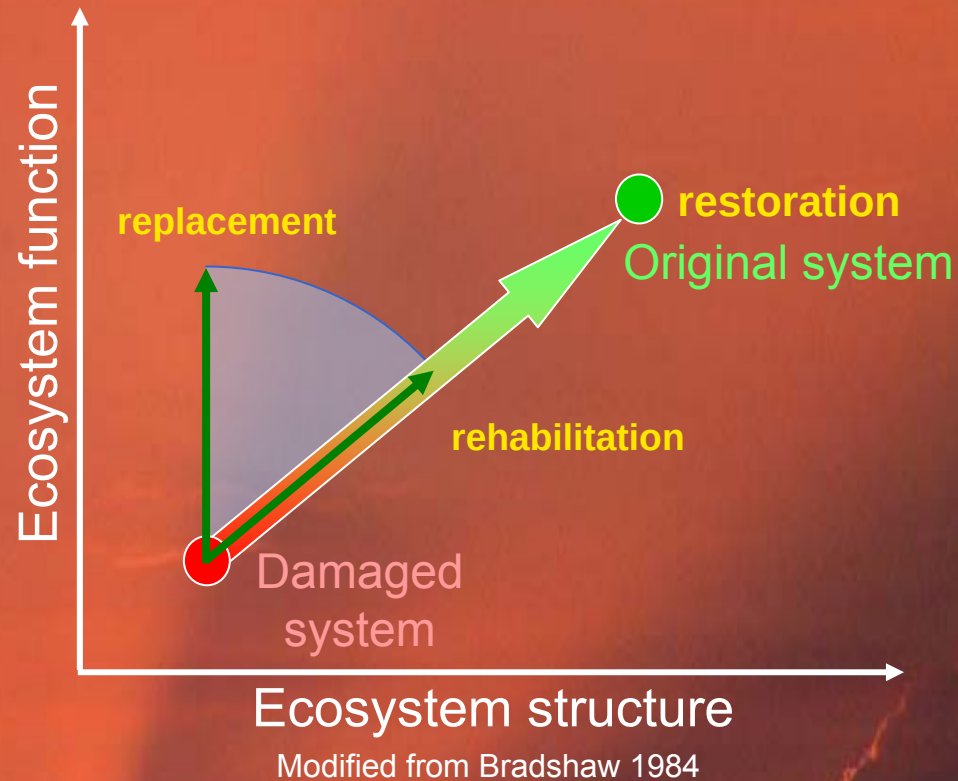
Underestimating the power of a dam





CAN WE REALLY RESTORE A RIVER?

- Flows have Changed
- Sediment Regimes have Changed
- Species & Unique Genetic Strains have been Eradicated
- Infrastructure Remains In Way & Must be Accommodated for
- Restoring Toward an Ideal, but May Never Obtain It
- Restore as Much Natural Function as Possible
- Improved Ecological Condition
- Goal: Self Sustaining System
- Change the Way People Perceive & Utilize Rivers



DAM REMOVAL ISSUES TO CONSIDER

ENGINEERING

DATA COLLECTION
TYPE & CONDITION OF DAM
SITE LIMITATIONS (Utilities, Topo)
UPSTREAM & DOWNSTREAM ISSUES
(bridges/structures, tributaries)
PROJECT PERMITTING
ALTERNATIVES ANALYSIS

WATER QUALITY

CHEMICAL PROPERTIES
PHYSICAL PROPERTIES
(i.e. temperature, turbidity)
PUBLIC HEALTH

SOCIOECONOMIC

OWNERSHIP (Water Rights; Easements)
CURRENT USES
RECREATION
PUBLIC SAFETY
ECONOMIC ANALYSIS
ARCHEOLOGICAL/HISTORICAL
SENTIMENTAL VALUE
AESTHETICS
LEGAL ASPECTS

HYDROLOGY

WATERSHED HYDROLOGY
FLOODWATER STORAGE
IMPOUNDMENT DRAWDOWN
WELL IMPACTS

ECOLOGY

ANADROMOUS / RESIDENT FISH
AQUATIC HABITAT
HABITAT FRAGMENTATION
ECOLOGICAL INTERCONNECTIONS
VEGETATION
WILDLIFE
SPECIES OF SPECIAL CONCERN

HYDRAULICS

CHANNEL HYDRAULICS (&safety)
FLOODPLAIN HYDRAULICS
ICE JAMS

FLUVIAL GEOMORPHIC

TESTING (quality & quantity)
SEDIMENT STABILITY/TRANSPORT
SEDIMENT MANAGEMENT
SEDIMENT DISPOSAL
CHANNEL MORPHOLOGY/DESIGN (form, function,
process, materials)
SITE RESTORATION

CONSTRUCTION

SEASONAL CONSTRUCTION LIMITS
CONSTRUCTION ACCESS
CONSTRUCTION SEQUENCE
WATER CONTROL



LEGAL ASPECTS OF DAM OWNERSHIP

- State statute (if listed with the Office of Dam Safety): the owner must maintain and operate the dam and other equipment
- Dam owners are ultimately responsible for any damages caused by the improper operation and maintenance of their dam structure
- Each dam should have: operation/maintenance/emergency plans; periodic inspections; warning signs & controlled access (according to the Association of State Dams Safety Officials)
- Many dams have a Dam Safety Classification: Low, Moderate or High Hazard Dams
- Dam safety classification can change over time
- Dam owners should have, and may be required to have liability insurance



LEGAL ASPECTS OF DAM OWNERSHIP

A Dam Safety Repair Order is Often the Accidental Dam Owners First Reality Check

- A decision to repair or remove a dam often occurs or is forced after a dam inspection
- Once an order has been issued by the state Office of Dam Safety, a decision must be made to repair or remove the structure within the timelines established in the order. These timelines vary on the basis of the severity of the dam's disrepair.



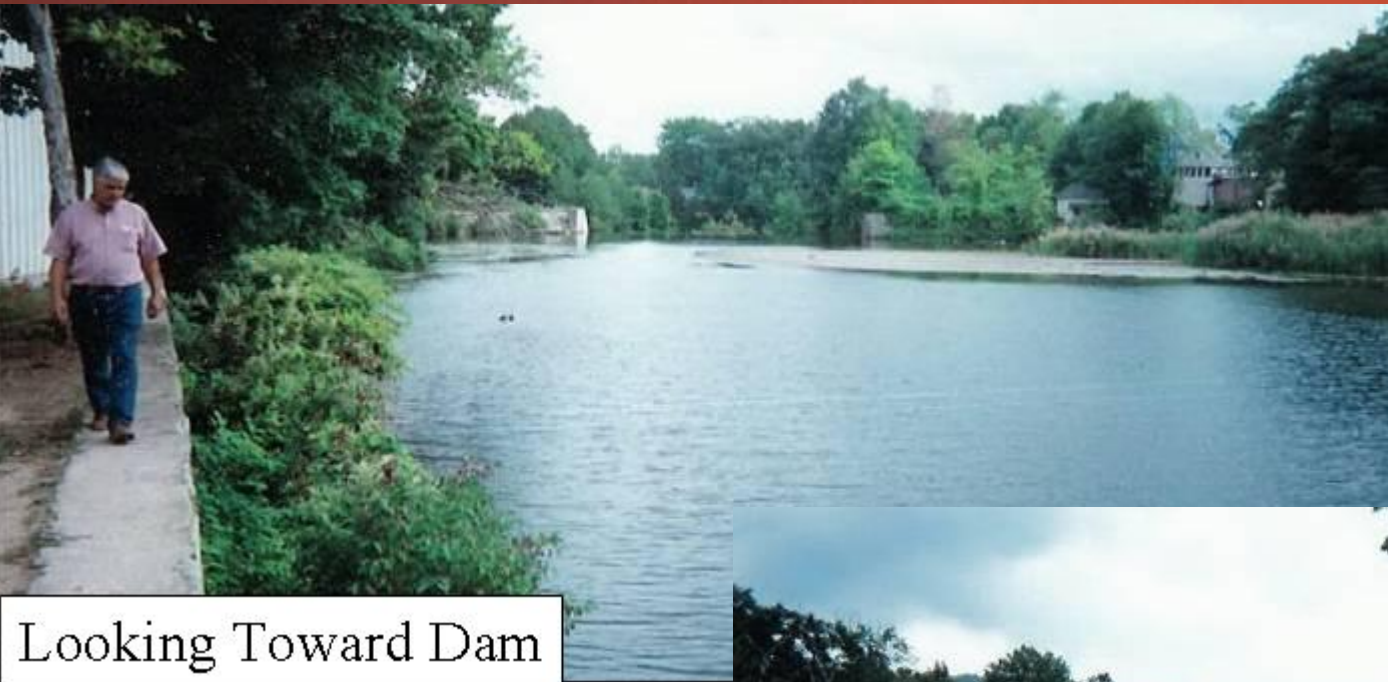
THE \$1 BARGAIN!



Brass Company Dam – West Branch Naugatuck River – Torrington, CT

The Unsuspecting Owner: The Heritage Land Trust

BEAUTIFUL LAKE OR CONTAMINATED SEDIMENT TRAP?



Looking Toward Dam



Looking Upstream



Coe Brass Dam

1800's - Dam Built

1960 - Brass
Company Shut
Down

1980 - Heritage
Land Preservation
Trust, Inc.
Received 12.1
Acres Donation,
Including the Dam,
Pond, Buffer, and
Gatehouse

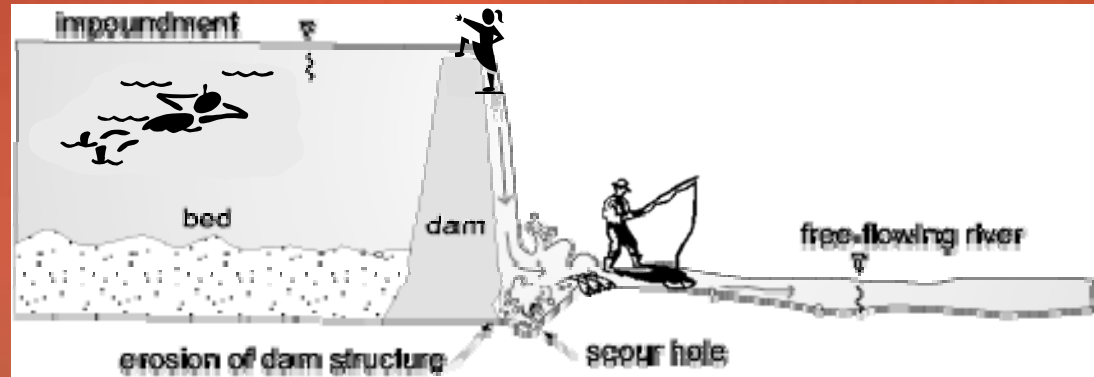
1991 - Dam Safety
Maintenance
Request

2006 - Land Trust
is Assessing Their
Alternatives

ECONOMIC CONSIDERATIONS

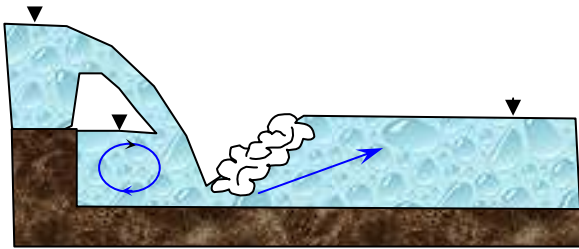
SAFETY & LIABILITY — ATTRACTIVE NUISANCE

- Dam owners are liable for personal injury to visitors or trespassers
- swimming, fishing, falling, drinking
- Need Signage: upstream as well as at dam
- Even with signage and fencing dam owner is still liable

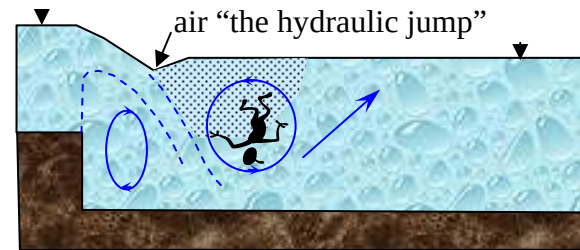


ECONOMIC CONSIDERATIONS

SAFETY & LIABILITY — BOAT SAFETY



**Passable
for boaters**



**Plunging nappe:
The drowning machine**



Small PA dam killed 2 boaters



**Dam was removed & state required
that all small dams be posted**

“Compliance with government or professional standards does not absolve an owner from liability”

ASDSO

ECONOMIC CONSIDERATIONS

SAFETY & LIABILITY – DAM BREACH



Connecticut Dam Failure - Source: Jim MacBroom



Rockfish Creek dam failure, NC, 2003

- **Downstream:** threat to life, property & environment; may required relocation of buildings; potential for contaminated sediment transport
- **Upstream:** increased flooding issues
- Repair reduces safety hazard but never eliminates liability

WHITTENTON POND DAM — NEAR FAILURE

TOWN OF TAUNTON, MA EVACUATED



173-year-old, 12-foot-tall wooden dam

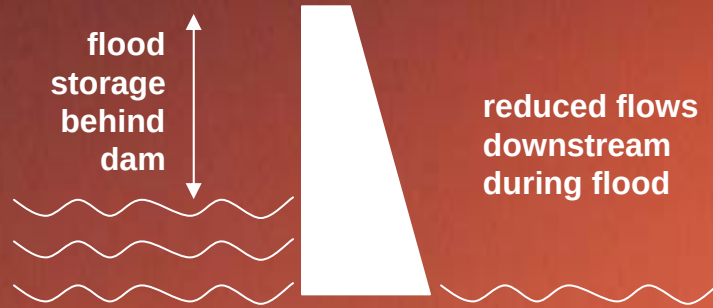


WHITTENTON POND DAM – QUICK FIX

NOT A LONG TERM SOLUTION



DEBUNKING THE “ALL DAMS ARE FLOOD CONTROL” MYTH

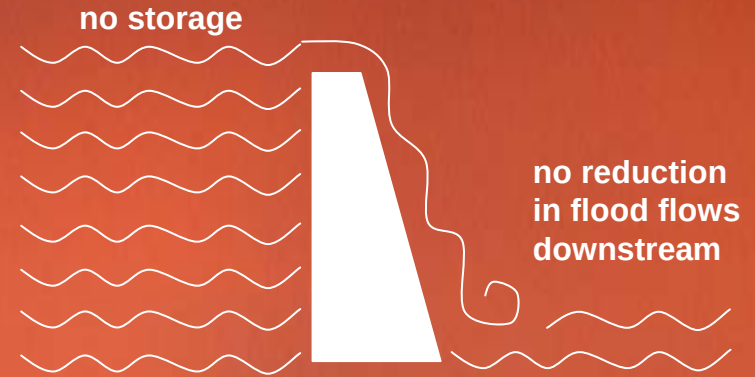


Typical Flood Control Dam

Has a dry spillway and the reservoir has room to fill up during a storm, therefore flood flows are reduce downstream. The Assoc. of State Dam Safety Officials conservatively estimates that less than 15% of all dams are flood control dams.



Example: Thomaston Flood Control Dam, CT



Typical Mill Dam

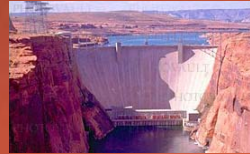
Water constantly flows over the spillway, the impoundment is full (increasing upstream flooding during a storm) and the flow into the impoundment equals the flow out, therefore there is no flood reduction downstream.



Example: Willow Mill Dam, MA

Consensus vs Controversial

Big vs Small



Flood Control vs None

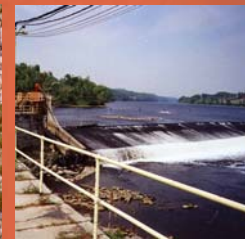


Good Condition vs Bad



Impoundment vs Run-of-River

Lots of Sediment vs Little



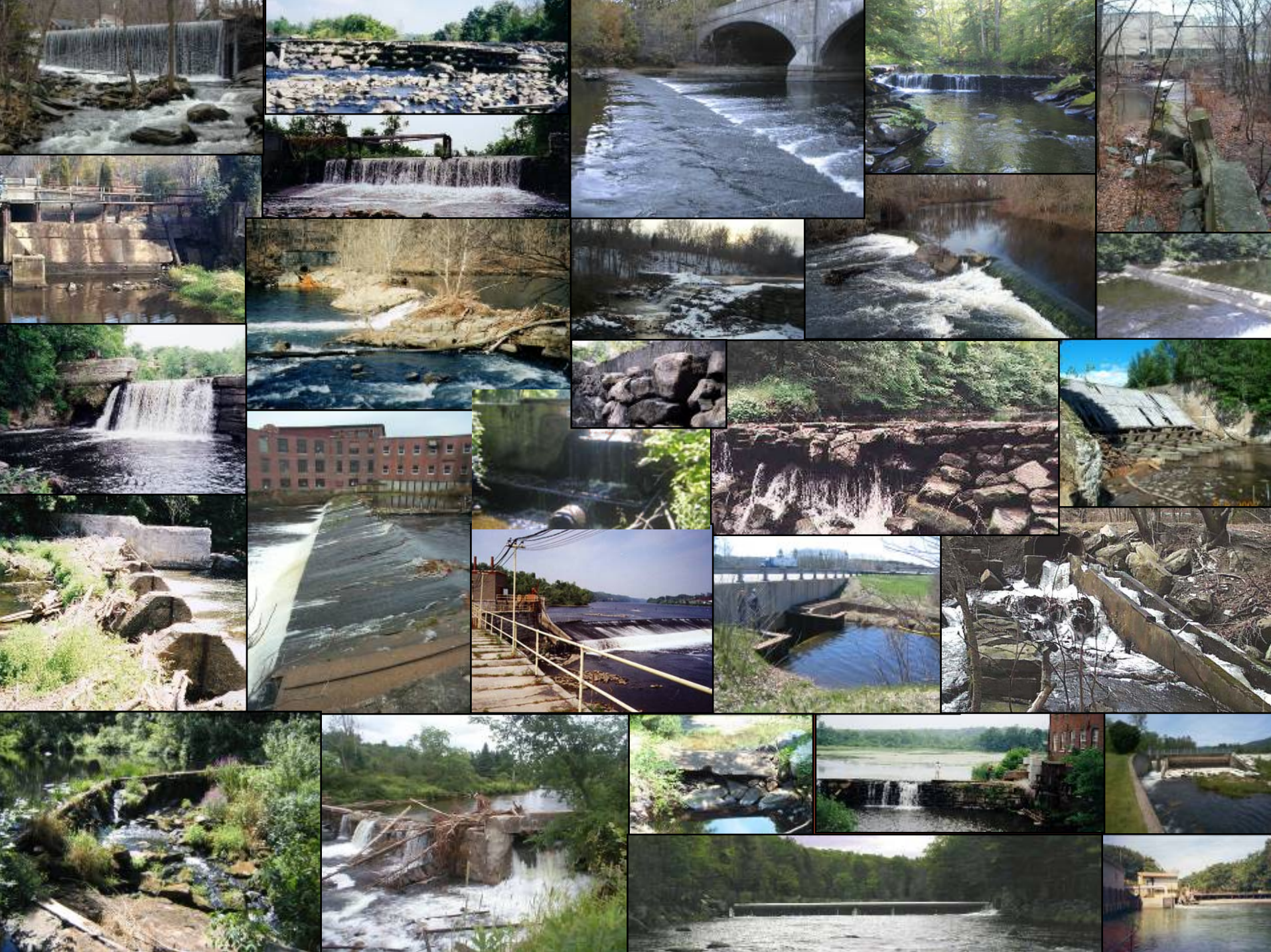
Contamination vs Clean

Course Grained vs Fine

High Impact vs Low



Alluvial vs Non-Alluvial



DAMS REMOVED (LAST 25YRS)

Connecticut

Anaconda Dam (1999), Naugatuck River
Muddy Pond Dam (1992), Muddy Brook
Freight St. Dam (1999), Naugatuck River
Lower Pond Dam (1991), Cedar Swamp Brook
Platts Mill Dam (1999), Naugatuck River
Paradise Lake Dam (1991), Blackwell Brook
Union City Dam (1999), Naugatuck River
John Dee's Dam (N/A), Mad River
Simpson's Pond Dam (1995), Wharton River
Frost Road Pond Dam (1983), Mad River trib.
Indian Lake Dam (1994), Indian River
Sprucedale Water Dam (1980), Mill Brook.
Little Pond Dam (1994), Bigelow Creek.
Woodings Pond Dam (1971), Quinnipiac River
Unnamed dam, (1993), Bradley Brook
Baltic Mills Dam (1938), Shetucket River
Chase Brass Dam (2004) Naugatuck River
Pizzini Dam (2005) Eightmile River

Maine

Gilford Dam (2002), Sebasticook River
Souadabscook Falls Dam (1999), Souadabscook River
Sennebec Dam (2002), St. George River
Brownville Dam (1999), Pleasant River
Smelt Hill Dam (2002), Presumpscot River
Hampden Rec. Area Dam (1999), Souadabscook River
Mill Pond Dam (2001), Sebasticook River
Archer's Sawmill Dam (1999), Stetson River
Union Gas Dam (2001), Messalonskee River
Grist Mill Dam (1998), Souadabscook River
East Machias Dam (2000) East Machias River
Bangor Dam (1995), East Machias River
Canaan Lake Outlet Dam (1999), Machias River
Columbia Falls Dam (1989), Pleasant River
Edwards Dam (1999), Keenebec River

Massachusetts

Billington St. Dam (2002), Town Brook
Silk Mill Dam (2003), Yokum Brook
Old Berkshire Mill Dam (2000), Housatonic River

Rhode Island

Jackson Pond Dam (1979), Pawtuxet River

New Hampshire

Bearcamp River Dam (2003), Bearcamp River
Winchester Dam (2002), Ashuelot River
Bellamy River Dam V. (2003), Bellamy River
McGoldrick Dam (2001), Ashuelot River
Fitch Reservoir Dam (1996), Grandy Brook
West Henniker (2003), Contoocook River
Mast Point Dam (1996), Salmon Falls River
Badger Pond Dam (2003) Tioga River
Champlin Pond Dams (2005)
Winnicut Dam (2005)
2 Dams on the Newfound River (2006)

Vermont

Johnson State College Dam (2003), LaMoille R. trib.
Eddy Pond Dam (1981), Mussey Brook
Groton Dam (1998), Wells River
Red Mill Dam (N/A), Batten Kill River
Newport No. 11 Dam (1996), Clyde River
Lyndon State College Dam (N/A), Passumpsic trib.
Youngs Brook Dam (1995), Youngs Brook
Norwich Reservoir Dam (N/A), Charles Brown Brk
Winooski Water Supply Upper Dam (1983),
Winooski trib.
Cold River Dam (2003) Cold River
Hillside Farm Dam (2003) Ompompanoosuc R. trib.

New York

Fort Edward (1973) Hudson River
Cuddebackville Dam (2004)
Neversink River
Grey Reservoir (2002) Black Cr1k
Curry Pond Dam
Luxton Lake Dam

**Majority of dams
removed have
been under
15ft. in height &
no longer served
a purpose**



ONGOING DAM REMOVAL EFFORTS

Connecticut

Bristol Brass Dam
Norwalk River Dams
Steele Brook Dams
Raymond Brook Pond Dam
Salmon Brook Dam
(Parke Pond Dam)
Stamford Dam
4 Willimantic Dams
Zemko Dam
(2 Coginchaug Dams)
(Plume & Atwood Dam)
Poliak Pond Dam

Maine

Cobbosseecontee Dam
Fort Halifax
2 Penobscot Dams
Presumpscot Dams

New Hampshire

Merrimack Village Dam
W. Swanzee Dam
Taylor River Dam
Homestead Mill Dam

Massachusetts

Hatfield Dam
Ballou Dam
Third Herring Brook Dams
2 Neponset Dams
Plymco Dam
4 Red Brook Dams
Willowdale Dam
Bronson Brook Culvert Removal

Rhode Island

Pawtuxet River Dam
Potter Hill Dam
Shannock Lower Dam

Vermont

Dufresne Dam, Battenkill
East Burke Dam
Swanton Dam
Cox Brook Dam

New York

Eddyville Dam
Fort Covington

AR Fish Passage

Completed:

Guilford Lakes Bypass Channel, CT
Sennebec Rock Ramp, ME

Ongoing:

Ipswich Fish Passage Plan, MA
West Winterport Rock Ramp, ME
Wiswall Bypass Channel, ME
Bronx River Dams, NY
Peconic River Rock Ramp, NY
Pequonnock River, CT
Tingue Dam Bypass Channel, CT
Johns River Dam Rock Ramp, NH
Shannock Upper Dam, RI
Woonsquatuck River, RI
Howland Dam Bypass Channel, ME



LARGE DAM REMOVAL - 2005

Birch Run Dam, PA – 65ft high, 700ft long
Former Water Supply, Earthen Dam

#1 Unsafe Dam in PA. 11,00 people at risk w/ 3 schools in dams inundation zone.

The city of Chambersburg decided to remove the 72 yr old dam due to the dam's failure to meet dam safety standards.

Removed in 2005.

\$20-30 million to Repair vs. \$1.35-2.1 million to Remove





Bluebird Dam Removal, CO

LARGE DAMS REMOVED



Edwards Dam Removal, ME

Occidental Chem Pond Dam A, TN 1995 (120')
 Occidental Chem Pond Dam D, TN 1995 (160')
 Monsanto Dam #4, TN 1990 (53')
 Monsanto Dam #5A TN 1990 (52')
 Rhone Poulenc Dam #19, TN 1995 (60')
 Monsanto Dam #12 TN 1990 (125')
 Occidental Chem Dam #6, TN 1991 (53')
 Alamo Arroyo Dam, TX 1979 (48')
 Atlas Mineral Dam, UT 1994 (93')
 Box Elder Creek Dam, UT 1995 (50')
 Brush Dam, UT 1983 (49')
 Hunters Dam, WA (65')
 Prairie Dells Dam, WI 1991 (60')
 Mounds Dam, WI 1998 (58')

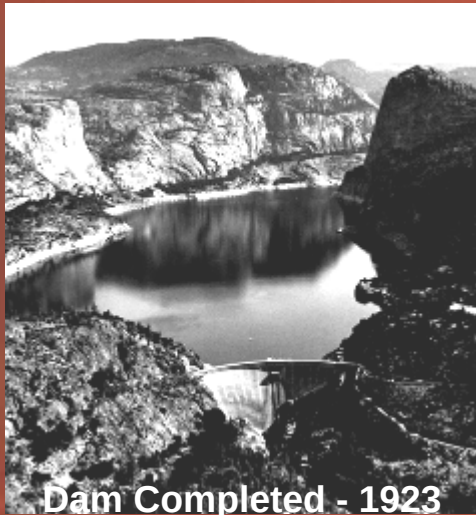
Willow Falls Dam, WI 1992 (60')
 Lake St. Francis Dam, AR 1989 (45')
 C-Line Dam #1, CA 1993(56')
 Sweasey Dam, CA 1970 (55')
 Bluebird Dam, CO 1990 (56')
 Grangeville Dam, ID 1963 (56')
 Lewiston Dam, ID 1973 (45')
 Mississippi River Lock & Dam #26, IL (98')
 Lake Bluestem Dam, KS (68')
 Goose Creek Lake Dam, MO 1987 (52')
 Indian Rock Lake Dam, MO 1986 (57')
 Vaux #2 Dam, MT 1995 (56')
 Epping Dam, ND 1979 (47')
 McMillan Dam, NM 1989 (65')
 Two Mile Dam, NM 1994 (85')

LARGE DAM REMOVAL PRECEDENT — SMALLER DAM

Edwards Dam Removal, ME 1999 (24' high x917' long)

CURRENT LARGE DAM REMOVAL PROJECTS & CAMPAIGNS

1908 Hetch Hetchy Valley



Dam Completed - 1923

Elwha Dam (110ft), WA
Glines Canyon Dam (185 ft), WA
Matilija Dam, CA
Snake River Dams, WA
Klamath Dams, CA
Milltown Dam, MT
Condit Dam, WA
San Clemente, CA
Englebright Dam, CA
Savage Rapids Dam, OR
Marmot & Little Sandy Dam, OR
Rodman Dam, FL
Hetch Hetchy Dam, CA



A fish contemplates the removal of the Condit Dam, WA

LARGE DAM REMOVAL CAMPAIGN — SMALL DAMS

Penobscot — large effort, large project, but small dams

HISTORY OF DECISION POINTS

*In the late 1600's "Massachusetts Supreme Judicial Court ruled that **if a dam was seen as a nuisance "any individual ... might tear it down"** Source: Linda Rigali*

"...who knows what may avail a crow-bar against that Billerica dam?"

Henry David Thoreau 1839



Billerica Dam Concord River, MA

1710 – Constructed

1711 – 1st Law Suit

1722 – Dam Removed – Rebuilt –
Removed by Force - Rebuilt

1798 – Law Suit

1860 – Law Suit

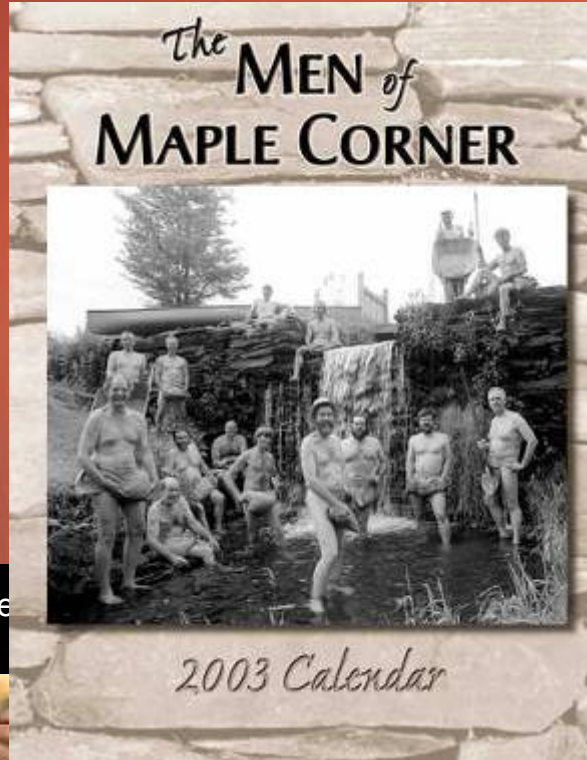
2003 – Still Discussing the dam's fate.

"For generations, a painful and expensive controversy has existed in relation to [the Billerica Dam], and if [not removed now], the children and children's children of these parties will be cursed with strife and contention".

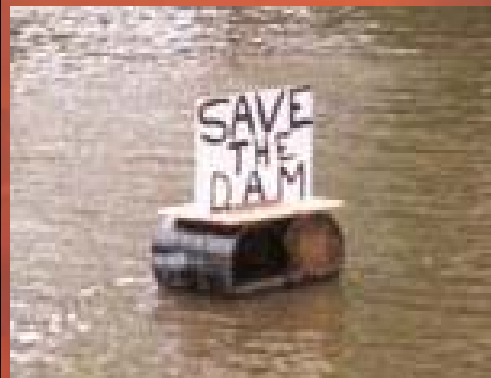
Henry French pleads with the Massachusetts Legislature, 1861

CHILDREN'S CHILDREN

Cursed with Strife and Contention



Winnemem Wintu Tribe
dance to protest Shasta



ORGANIZATIONS INVOLVED IN DAM REMOVAL EFFORTS NATIONWIDE



Palmer River Association
Parker River Clean Water Association
Parker River Clean Water Association
Pascommuck Conservation Trust

Pemigewasset River Council
Piscataquog Watershed Association
Piscataquog Watershed Association
Public Service of New Hampshire

- **American Rivers**
- **Trout Unlimited**
- **The Nature Conservancy**
- **Rivers Alliance of Wisconsin**
- **Professional Societies (ASCE, AFS, ASDSO, COLD, etc)**
- **NOAA Open River Initiatives & NRCS Open River Initiatives**
- **Other Federal Agencies (USFWS, NPS, ACOE, etc)**
- **State Agencies & State Task Forces**
- **Regional Task Forces (i.e. Northeast Stream Barrier Task Force)**



Somers Land Trust
St. Lawrence University
St. Lawrence Valley Paddlers
St. Regis Mohawk Tribe
SUNY Student
The Catskill Center
The Moore Charitable Foundation
the town of East Meadow
Thousand Islands Land Trust
Tompkins Co. Planning Dept.

- River Watch Network
- Save Everyone's Wells River
- Seventh Generation - Black River
- Sierra Club - Vermont Chapter
- Sterling Falls Gorge Natural Area Trust
- Vermont Agency of Natural Resources
- Vermont Bass Chapter Federation
- Vermont Land Trust
- Vermont Law School
- Vermont League of Conservation Voters
- Vermont Natural Resources Council

DAM REMOVAL INFORMATION

American Rivers publications / toolkit

- *Exploring Dam Removal: A Decision-making Guide*
- *Beyond Dams: Options and Alternatives*
- *Dam Removal Success Stories Report*
- *The Ecology of Dam Removal*
- *Paying for Dam Removal: a Guide to Selected Funding Sources*
- *Taking a Second Look – video*

Partner publications

- *Aspen Dialogue: Dam Removal: a New Option for a New Century*
- *Heinz Center: Dam Removal: Science and Decision Making*
- *NOAA – Relics & Rivers: Dismantling Dams in New England – video*
- *ASCE/EWRI Sediment Transport Post Dam Removal Monograph*
- *POWR Fact Pack: Small Dam Removal in Pennsylvania: Free-Flowing Watershed Restoration*
- *Guidelines to Regulatory Requirements for Dam Removal Projects in New Hampshire*
- *Small Dam Removal: A Review of Potential Economic Benefits* (Trout Unlimited)
- *Dam Removal: A Citizen's Guide to Restoring Rivers* (River Alliance of Wisconsin & Trout Unlimited)
- *Guidelines for Retirement of Dams and Hydroelectric Facilities*. American Society of Engineers (1997).

Other Resources

- *Dam Removal Clearinghouse* <http://www.lib.berkeley.edu/WRCA/damremoval/>
- *University of Wisconsin – Madison's Repair or Removal Decision Making Guide*
- *USFWS Fish Passage Decisions Support System* <http://fpdss.fws.gov/index.jsp>
- *List Servers: AFS Fishpass & Oregon State Dam Removal list servers*
- Many Groups (nationally) listed on the AR web site.
- State Examples – WI (many removed & good resources), PA (many removed), NH (good program), CA (property disclosure)
- University of Wisconsin short course

PAYING FOR DAM REMOVAL

Federal Sources

- NOAA - Community Based Restoration Partnership (AR, TNC, GOM, TU, Fish America) & Open Rivers Initiative (tied to migratory fish)
- USFWS - National Fish Habitat Initiative; National Fish Passage Program; Partners for Fish & Wildlife Grant Program; & Regional Offices or Ecological Services Offices can establish cooperative agreements w/ state agencies on restoration projects
- NRCS – WHIP & Future Potential: Open Rivers Initiative (not tied to migratory fish)
- USGS – Technical services for a fee
- EPA – Section 319 Grants & in-kind services such as sediment testing
- ACOE – H&H, 206 & 1135 (for restoration of corps-built flood control projects)
- Armed Forces - Innovative Readiness Initiative



PAYING FOR DAM REMOVAL

Non-Federal Sources

- **Supplemental Environmental Projects (SEP)**
- **NGO's (American Rivers, TNC, TU, CT River Alliance, etc.)** – In-Kind Match, Technical Assistance, Project Management, Grant Writing
- **National Fish & Wildlife Foundation** (multiple grants)
- **Long Island Sound Futures Fund** (NFWF LISFF)
- **LISS Enhancement Grants** - New England Interstate Water Pollution Control Commission (NEIWPC) and the Long Island Sound Study (LISS)
- **Fish America, American Sportfishing Assoc.** (multiple grants)
- **State Hazard Mitigation Grants**
- **Disaster Assistance Funding** (state)
- **Future Potential: Dam Rehabilitation & Repair Act of 2006**
- **Corp. Wetland Rest. Partnership**
- **Dam Owner**
- **Mitigation Money**
- **State River Restoration Funds**
- **CT DEP In-House Services**
- **Volunteers** – In-Kind Match
- **Universities** – student labor



BILLINGTON ST. DAM REMOVAL — PLYMOUTH, MA

View Looking Upstream

WITH DAM



WITHOUT DAM



View Looking Downstream

WITH DAM



WITHOUT DAM



PIZZINI DAM



9:00AM



9:15AM



9:30AM



10:00AM



Lamprey & mussel relocation post removal

**3 Years to
Permit**

**1 Hour to
Remove!**



Partners: AR; CT DEP; NOAZA, CRWC

WEST HENNIKER DAM - NH



West Henniker Dam



Restored Contoocook River



Brownfield site



Removal of dam in June 2004



Anxious Whitewater Boaters



Historic Canal

MILWAUKEE RIVER DAM REMOVAL - WI



With Dam



1 Week After Removal



12 Years After Removal



Condit Dam
1913-2008

Long May

You Run!

Source: Art for the Sky - Daniel Dancer



THANK YOU!

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