

# APPENDIX V.10

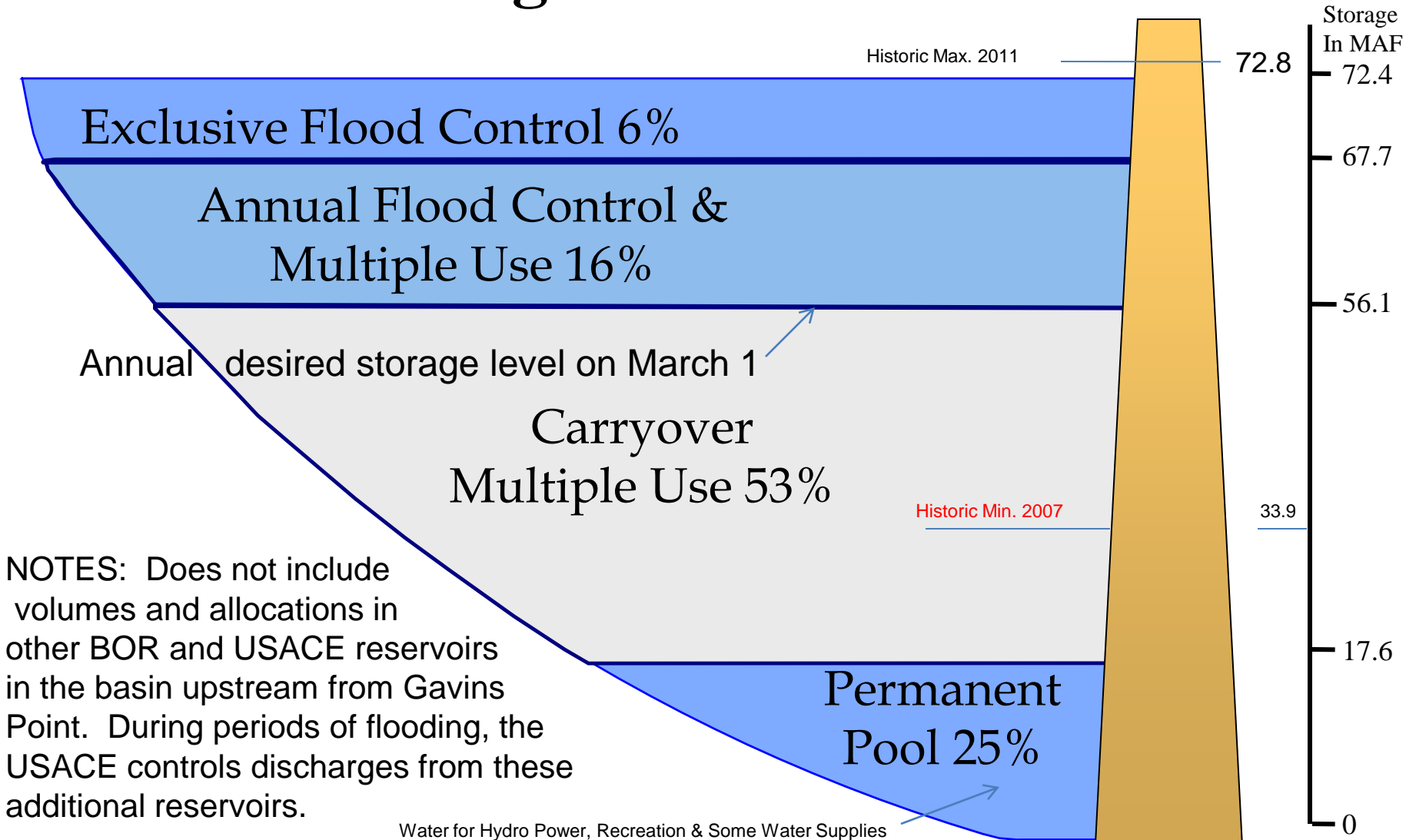
NOTE: This appendix contains revised slides obtained from various sources such as webinars, my personal files, handouts and agency personnel. Explanation and the definition of items are available in the UGLAA. Please send additions and corrections to [jbg6267@aol.com](mailto:jbg6267@aol.com).  
Thank you. *Joseph B. Gibbs*, PE Editor and Publisher 2013 to date.



PLATE 1

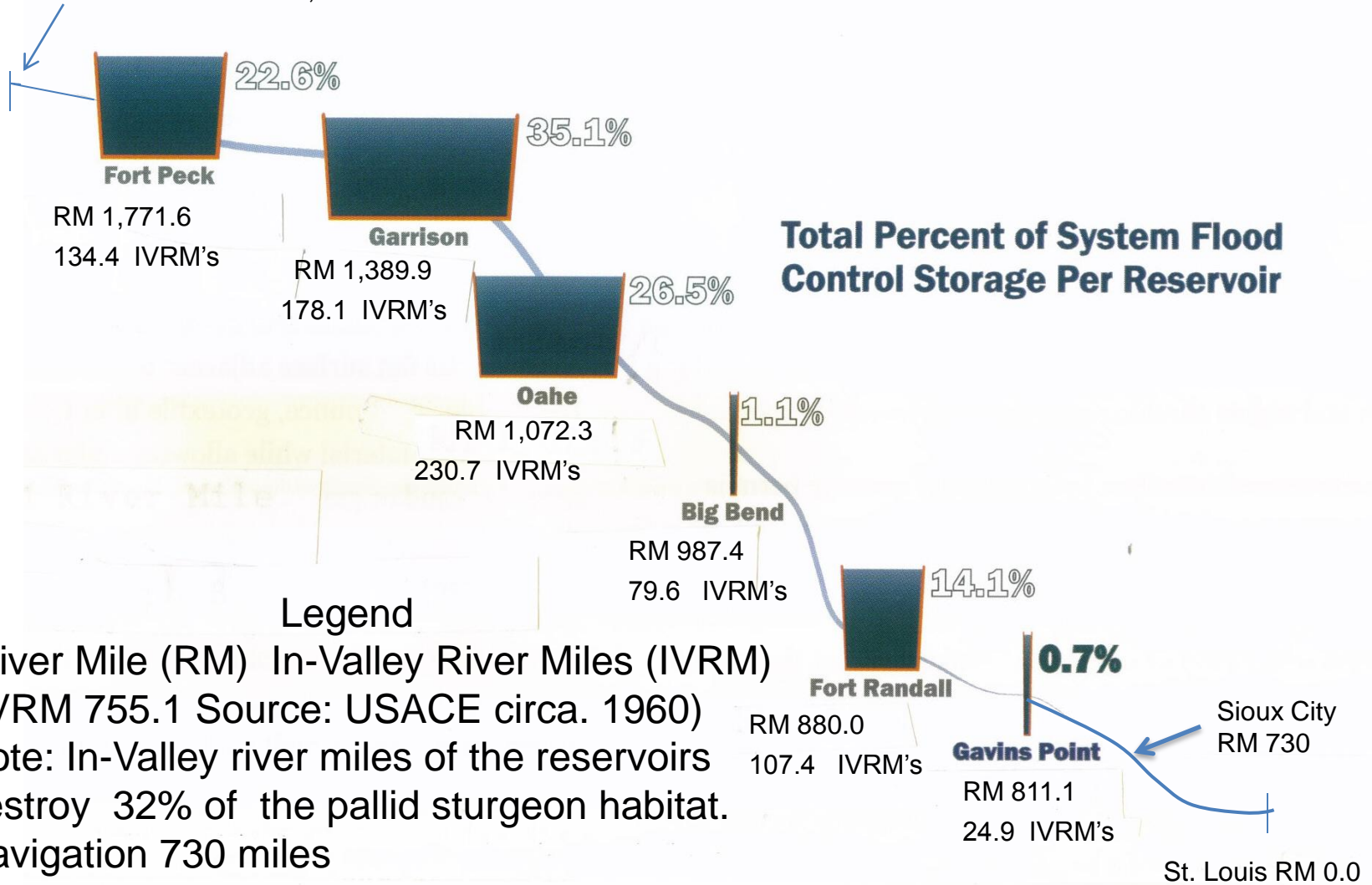
# Missouri River Mainstem System of 6 Dams

## Sum Total Storage Zones and Allocations



NOTES: Does not include volumes and allocations in other BOR and USACE reservoirs in the basin upstream from Gavins Point. During periods of flooding, the USACE controls discharges from these additional reservoirs.

Three Rivers Montana RM 2,341



### Legend

River Mile (RM) In-Valley River Miles (IVRM)  
(IVRM 755.1 Source: USACE circa. 1960)

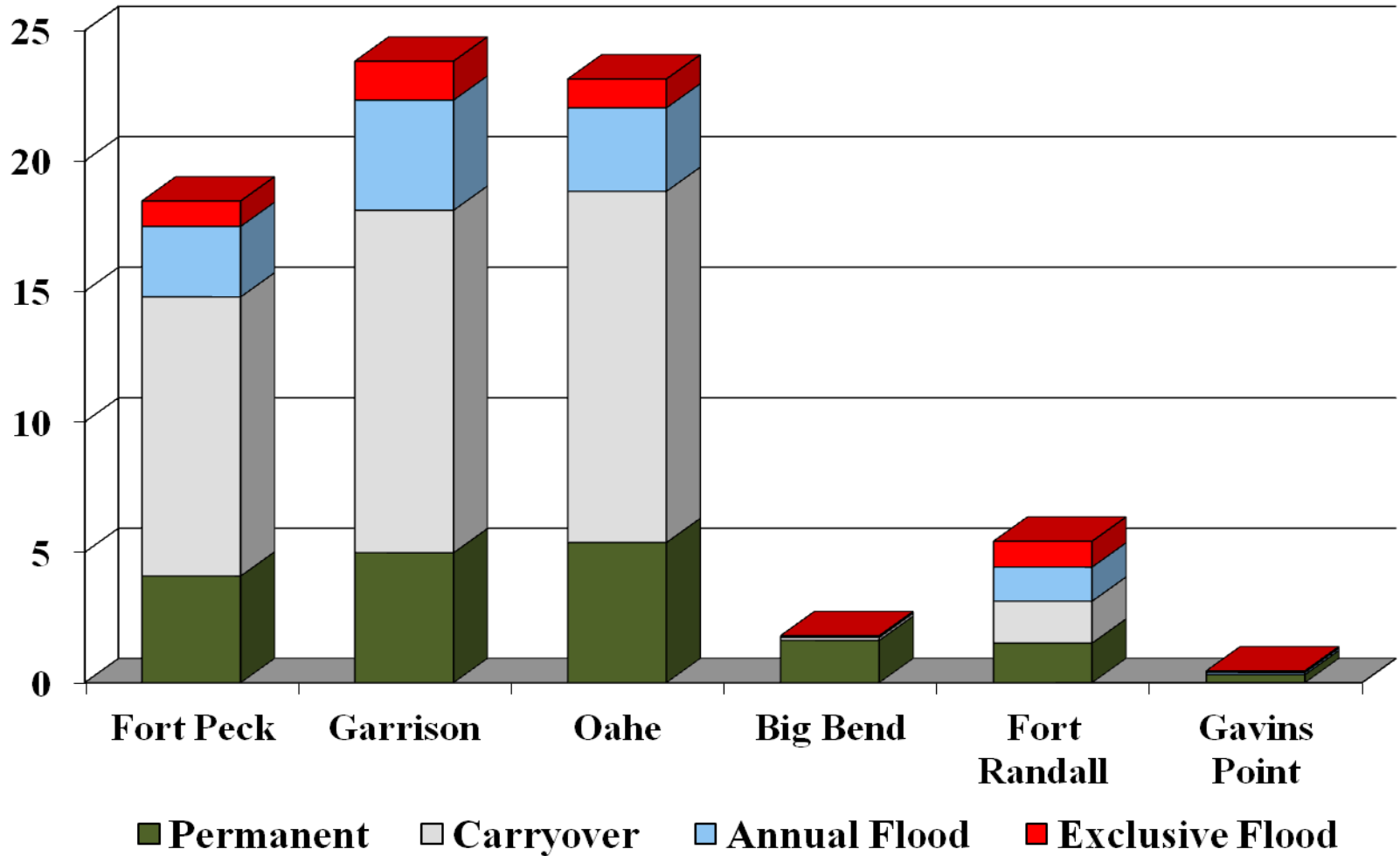
Note: In-Valley river miles of the reservoirs destroy 32% of the pallid sturgeon habitat.  
Navigation 730 miles

Not to Scale. Slide Revised by Joseph B. Gibbs , PE

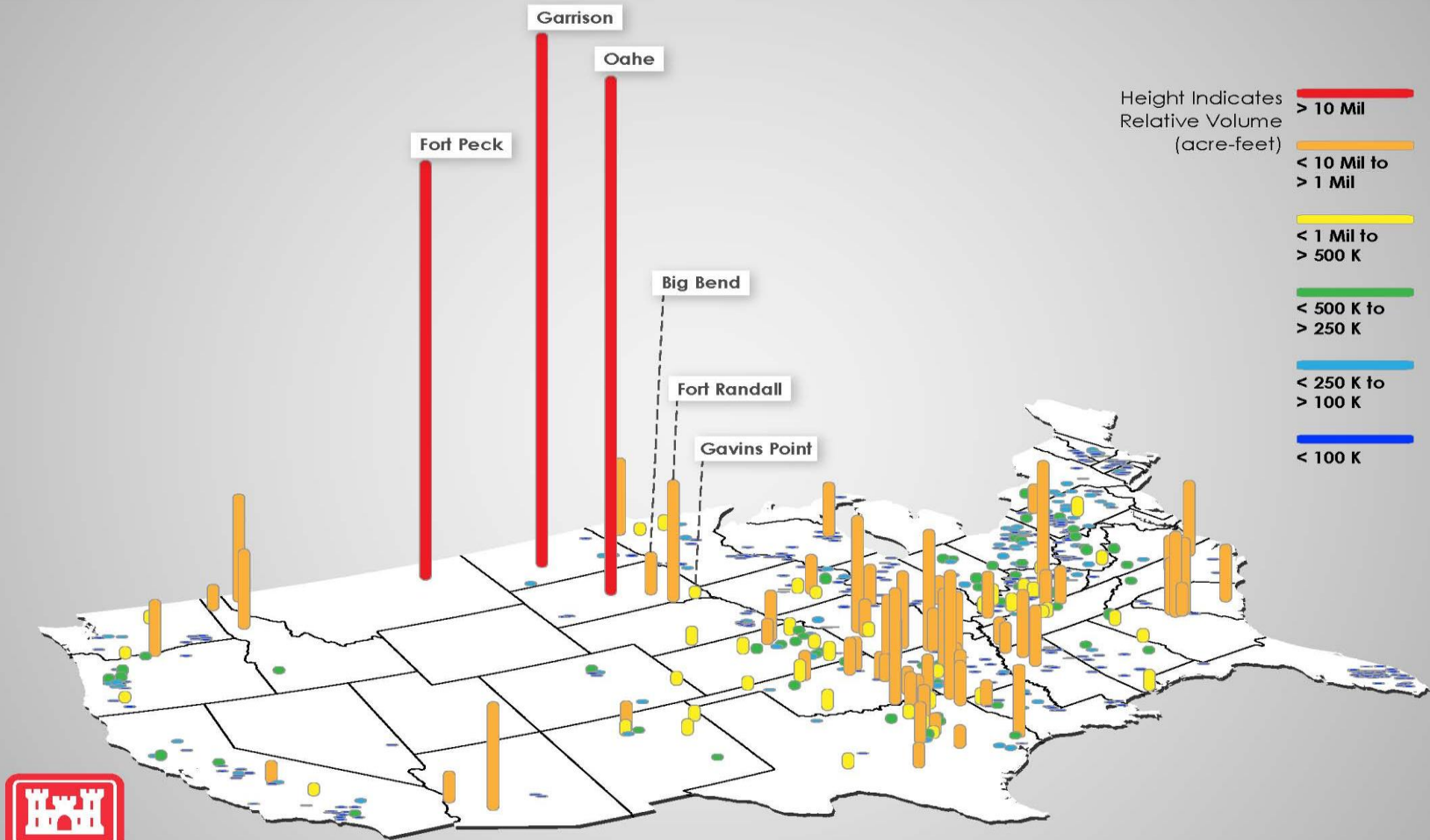
U.S. Army Illustration/ Jennnyann Noack, Omaha District

# Mainstem Reservoir Storage Capacity

Million Acre-Feet



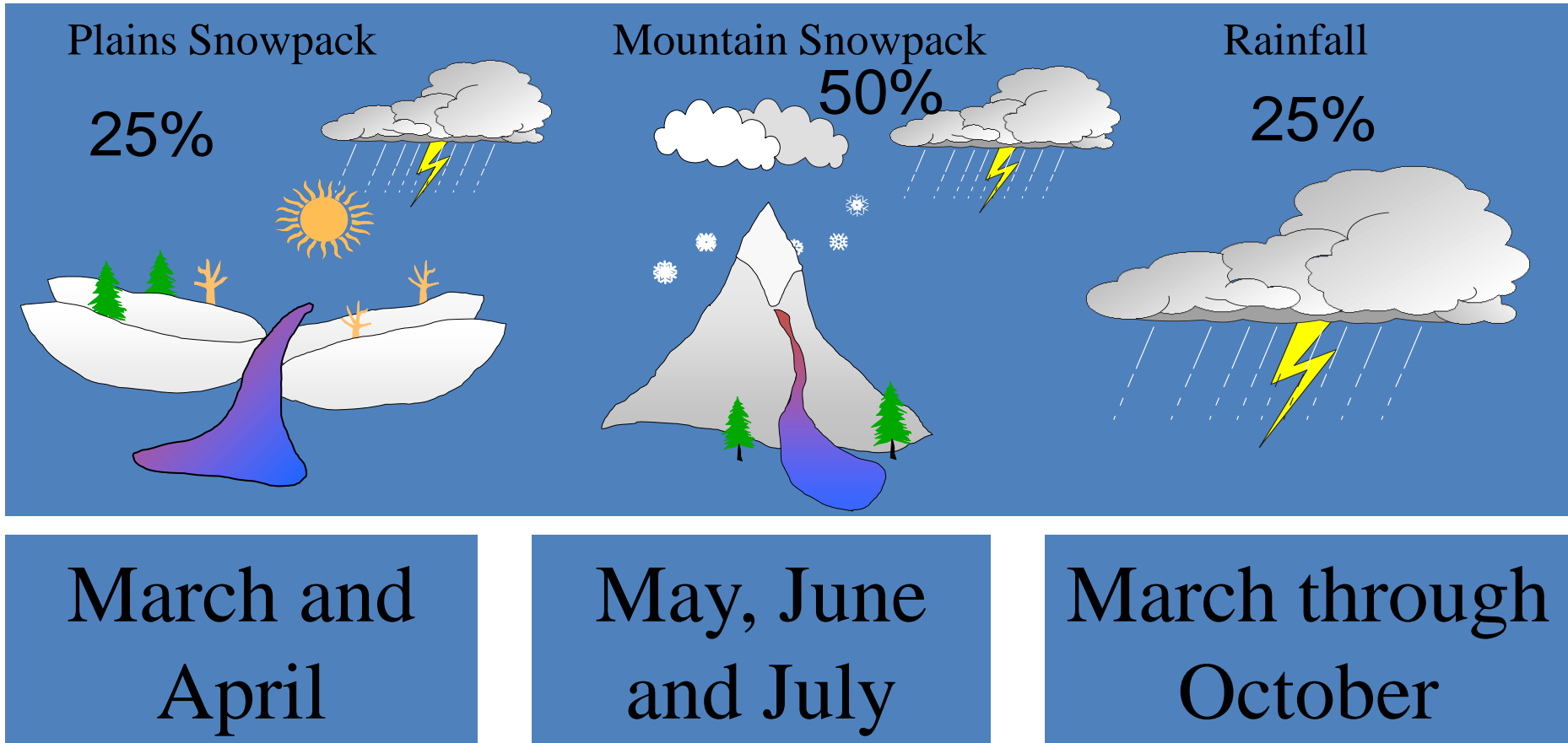
# Storage Capacity of Corps Reservoirs



Prepared and Produced by the U.S. Army Corps of Engineers Omaha District 2010

# Runoff Components

Annual average runoff is 25.3 MAF upstream from Sioux City, Iowa

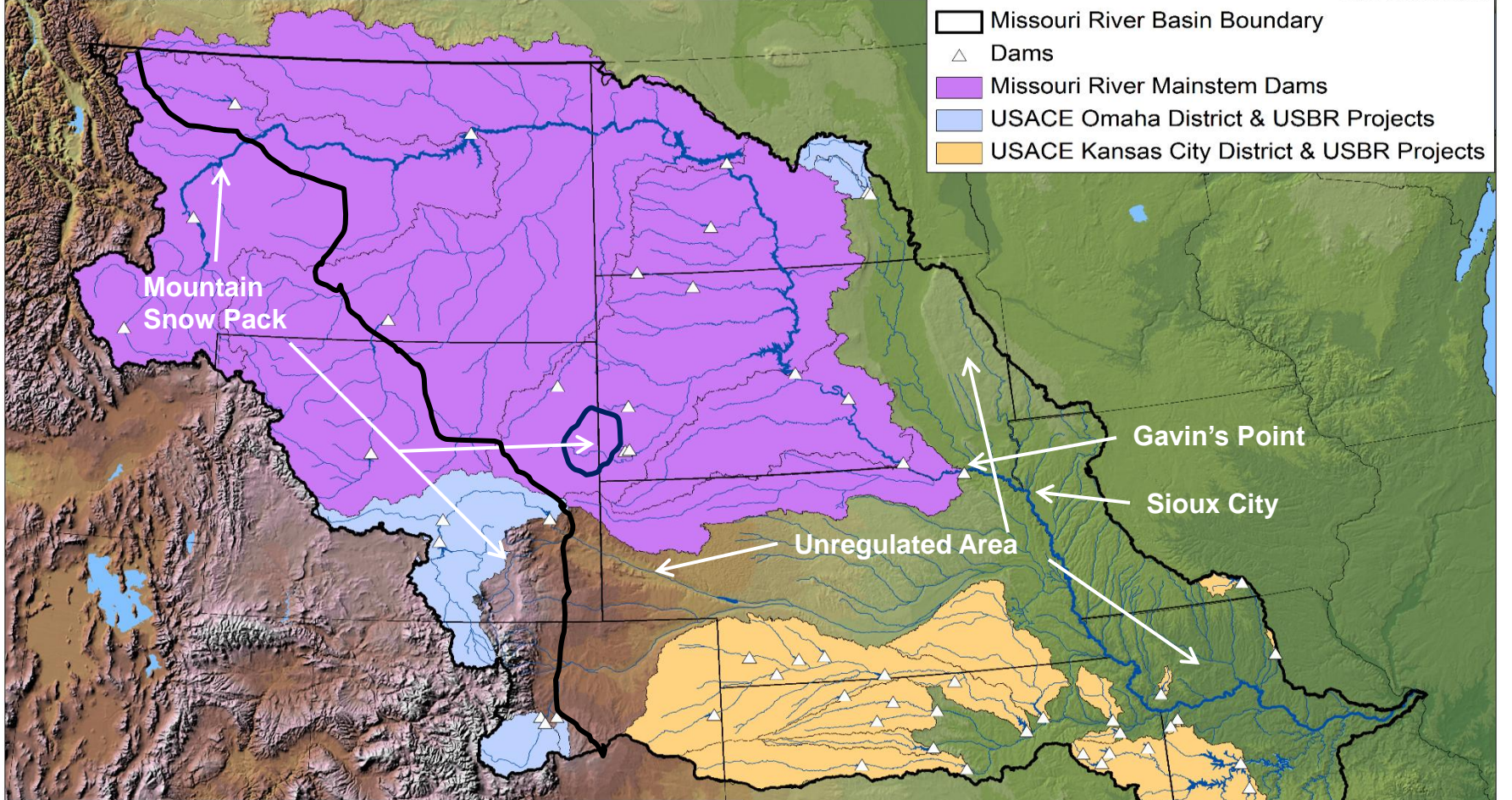


Runoff from approximately 10.7% of the basin area above Sioux City does not flow through any of the mainstem reservoirs. 75% of the runoff into the mainstem reservoirs occurs from March 1 to July 31.

# Missouri River Basin Regulated Watersheds

Background: North America Relief Map

USACE NWO March 2016

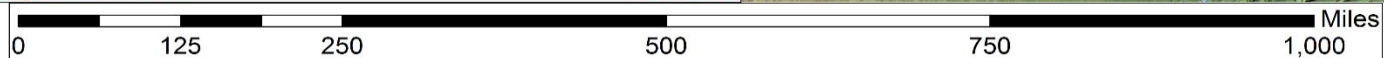


- Missouri River Basin Boundary
- Dams
- Missouri River Mainstem Dams
- USACE Omaha District & USBR Projects
- USACE Kansas City District & USBR Projects

## Summary of Missouri River Basin Regulated Areas

	square miles
Total Missouri River Basin Drainage Area	529,350
Missouri River Mainstem Dams	-279,480
All Other USACE Omaha District and USBR Projects	-21,500
USACE Kansas City District and USBR Projects	-63,300
<b>Total Unregulated Area</b>	<b>31% 165,070</b>

Approx. **44%** Mean Annual Runoff is Unregulated







## *Service Assessment*

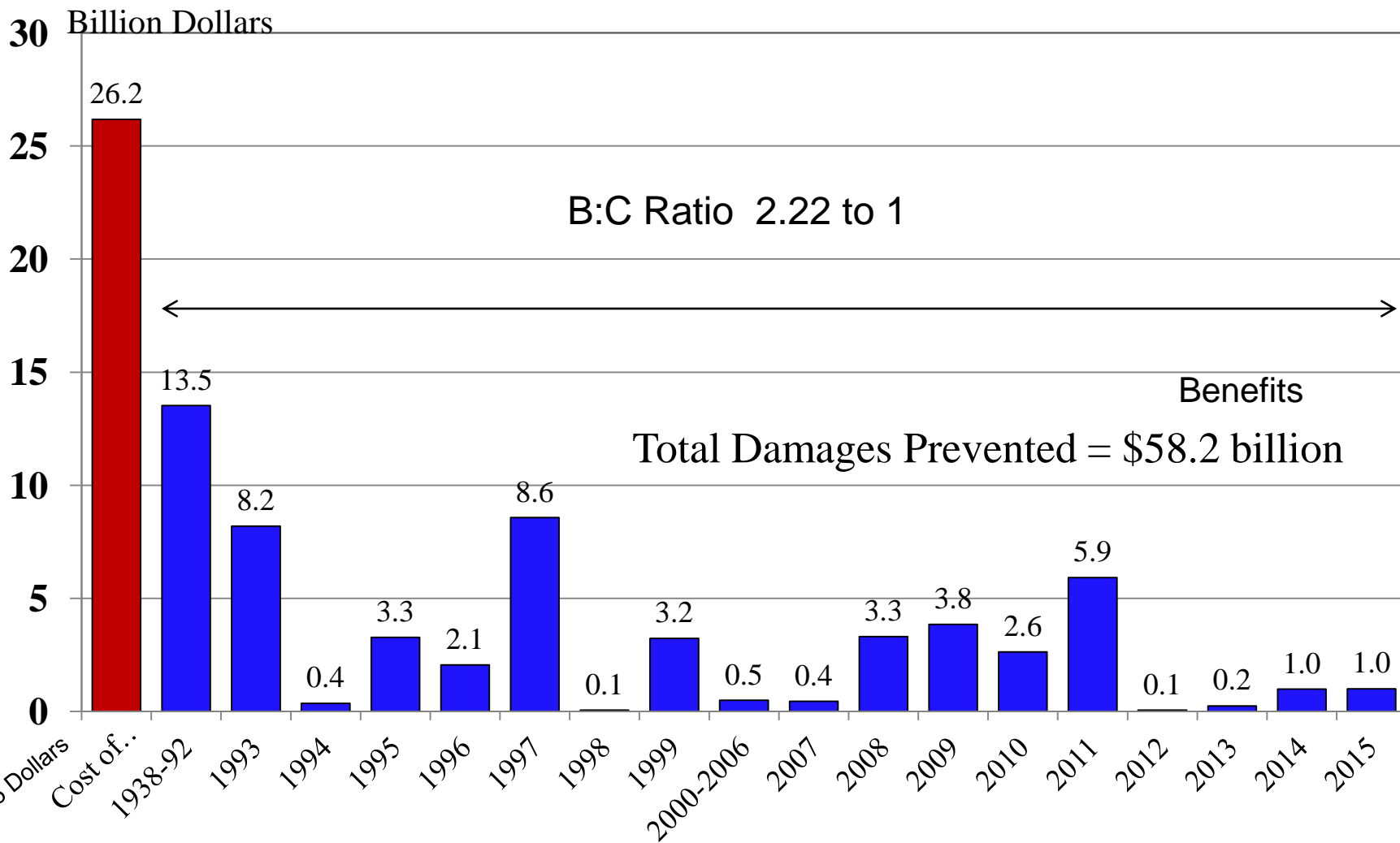
# The Missouri/Souris River Floods of May – August 2011



Typical flood damage to concrete road surface when flood waters pass over the road surface and embankment.

**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
National Weather Service  
Kansas City, Missouri and Salt Lake City, Utah

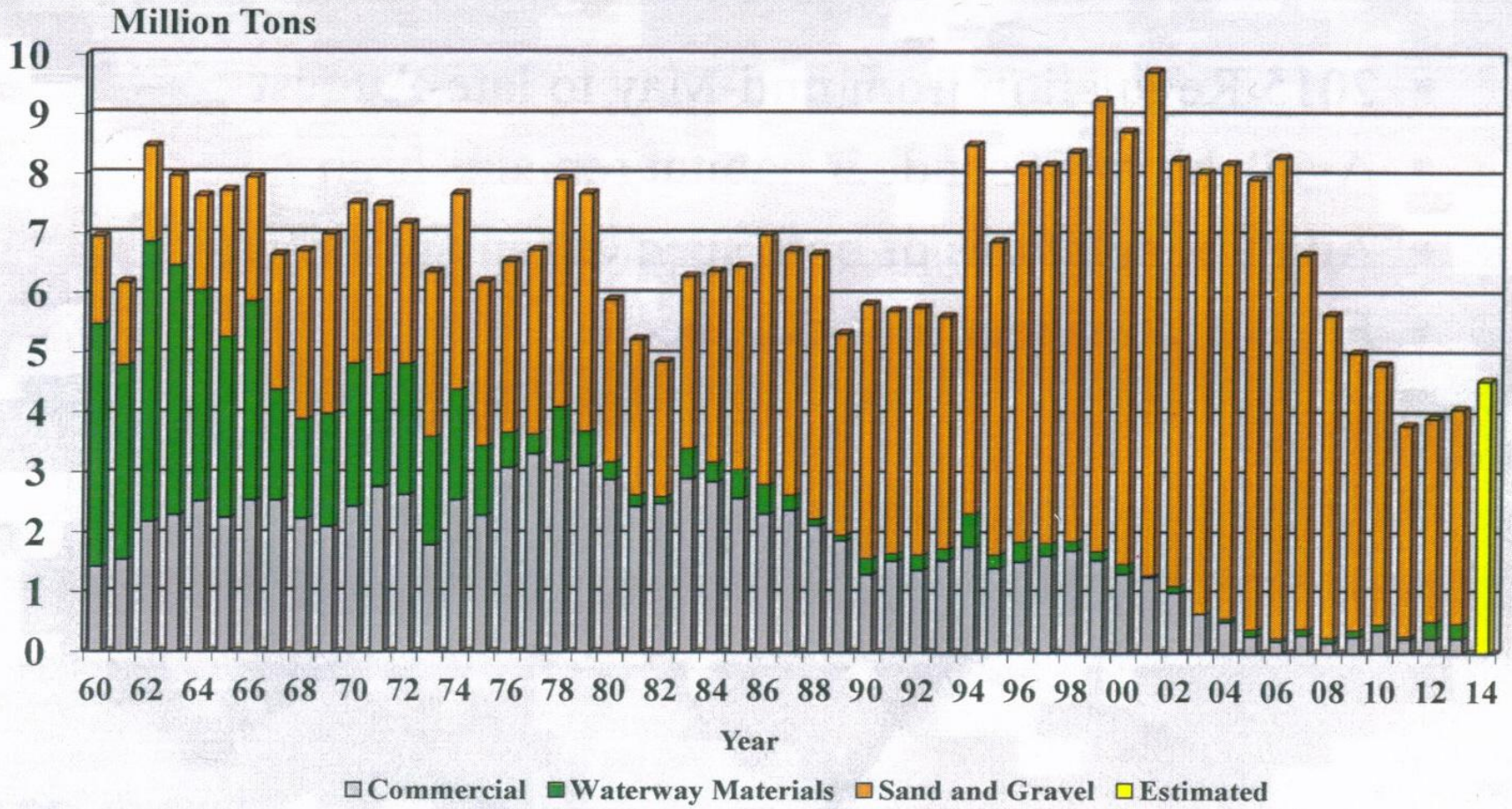
# Flood Damages Prevented by Mainstem Dams Indexed to 2015 Levels



# Missouri River

## Total Navigation Tonnage

Missouri River Navigation Channel St. Louis to Sioux City 735 Miles



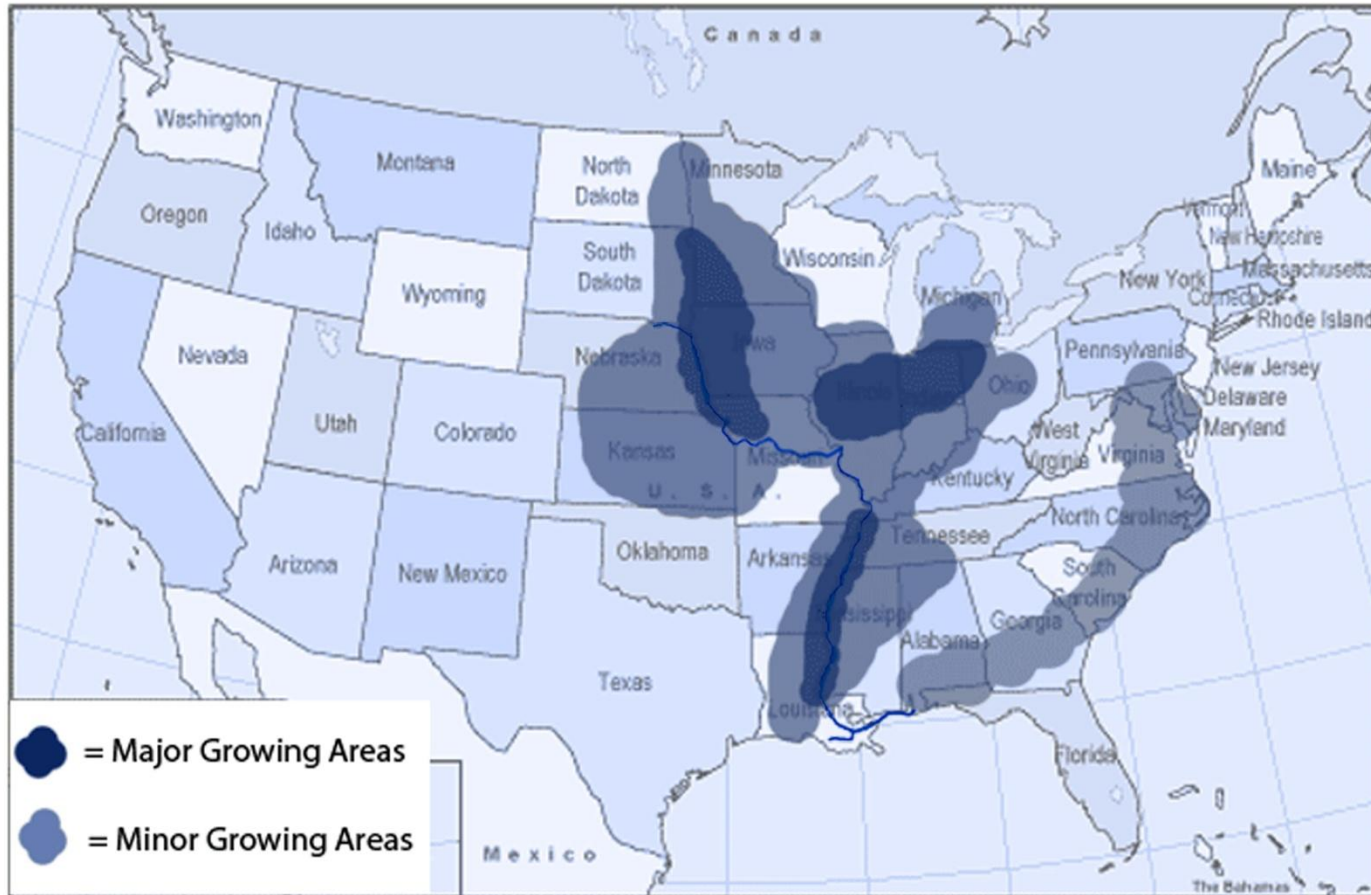
# U.S. Inland & Intracoastal Waterways



Missouri River Navigation Channel St. Louis to Sioux City 735 Miles

## Inland and Intracoastal Waterways

## Areas of Soybean Production in the United States




Source: NOAA/USDA

20 % of the Soybeans produced in Missouri are transported by barge.  
44 % of the United States Soybean production is transported by barge.

Source: soytransportation.org

# TYPICAL CHANNEL CONFIGURATION

Red / Nun Buoy-Left Edge Channel  
 "Red Right Return from the Ocean"

 Crossing Daymarker

Source USACE

Nebraska

Shore Guides


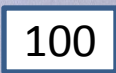
Revetment

Shore Guides  
 Single Flashing Light  
 Every 4 Seconds (typ)

Dikes

Rock Chevrons

Shoreline Mile Markers  
 Provided by USACE

 or 

Green / Can Buoy-Right Edge Channel

Dikes

Rock Chevrons

Iowa

Shore Guides  
 Double Flashing Light  
 Every 5 Seconds (typ)

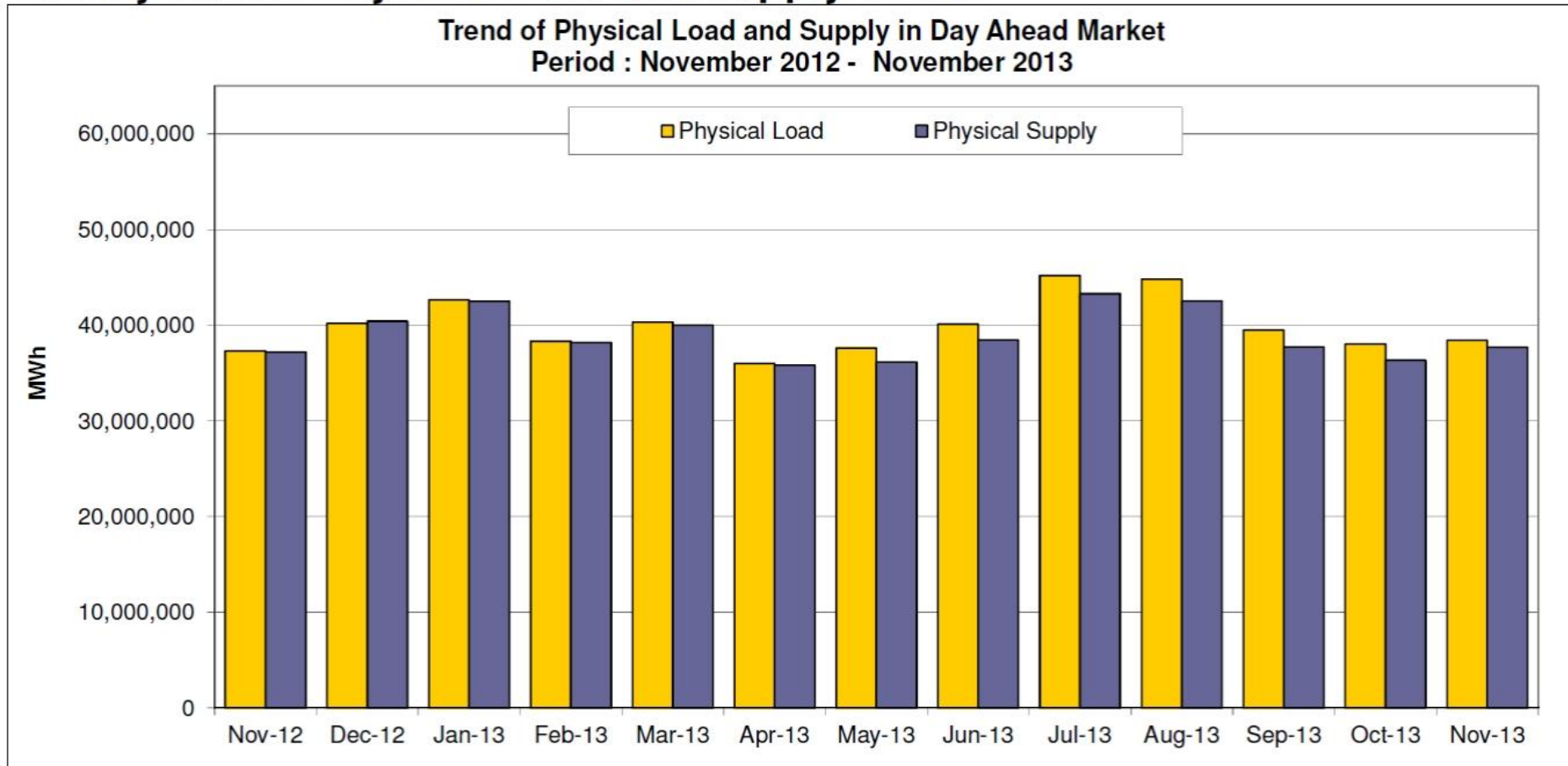
Revetment

Buoys & Shore Guides  
 Provided by USCG

Shore Guides

# 4.1 Day-Ahead Physical Load and Supply Trend

Midwest Independent System Operator (MISO)



\* Excluding imports and exports



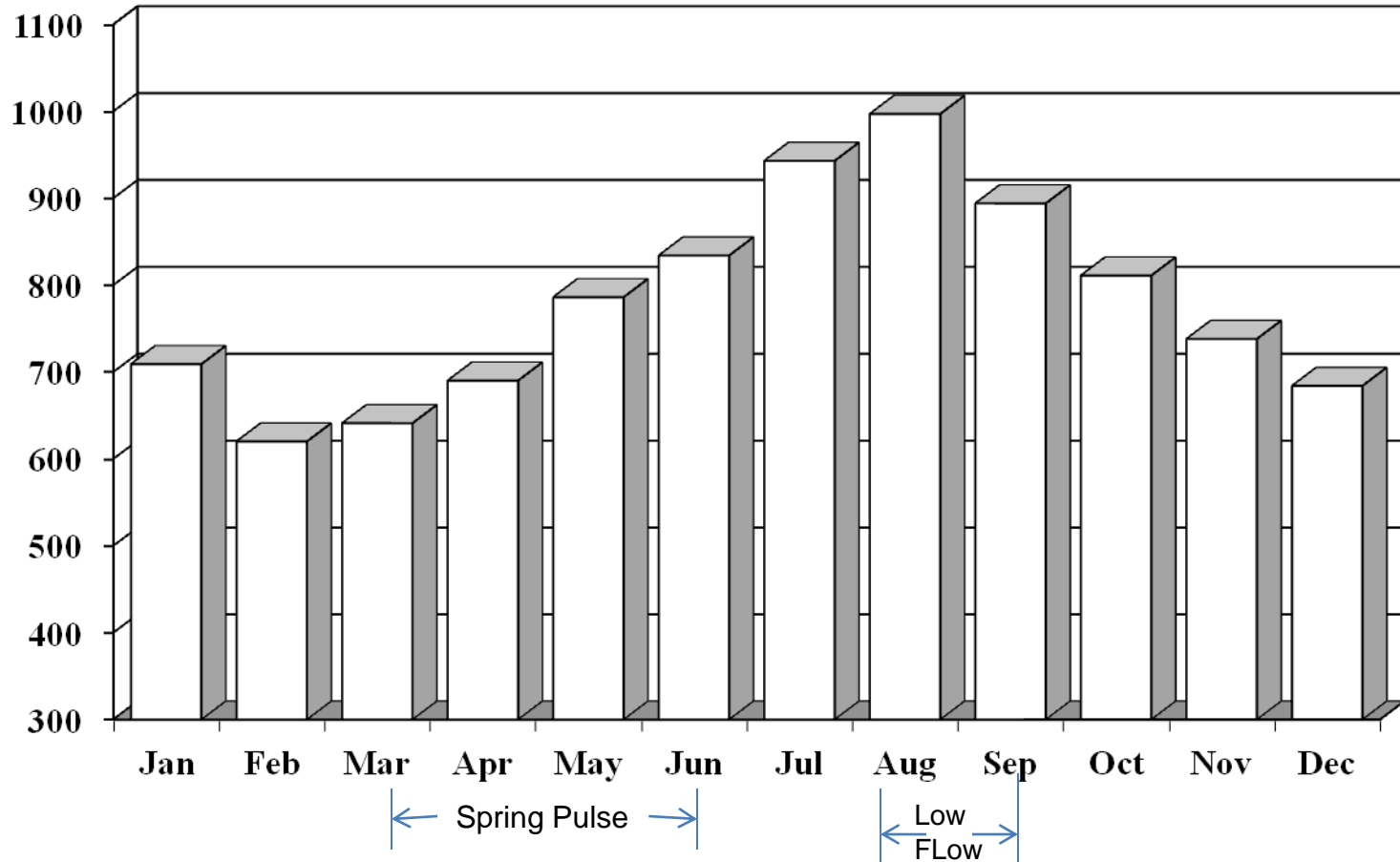
The graph bars represent typical annual average load and supply. MISO controls generation and transmission of electric power in non WAPA areas in portions of Montana, North and South Dakota, Illinois, Missouri, Indiana, Arkansas, Mississippi, Louisiana, Texas and Kentucky; and, all of Michigan, Wisconsin, Iowa and Minnesota. The power comes from all types of sources: coal, nuclear, hydro and wind. The power generated does not include that from municipal power plants. Note the low power usage during the Spring Pulse period where some discharges from mainstem dams for the Pulse would not be used for power generation and the Low Flow period where water would be unavailable for peak loads in August and September.

# Mainstem Dams Average Monthly Energy Generation

Energy in 1000 MWh

Average 1967-2015

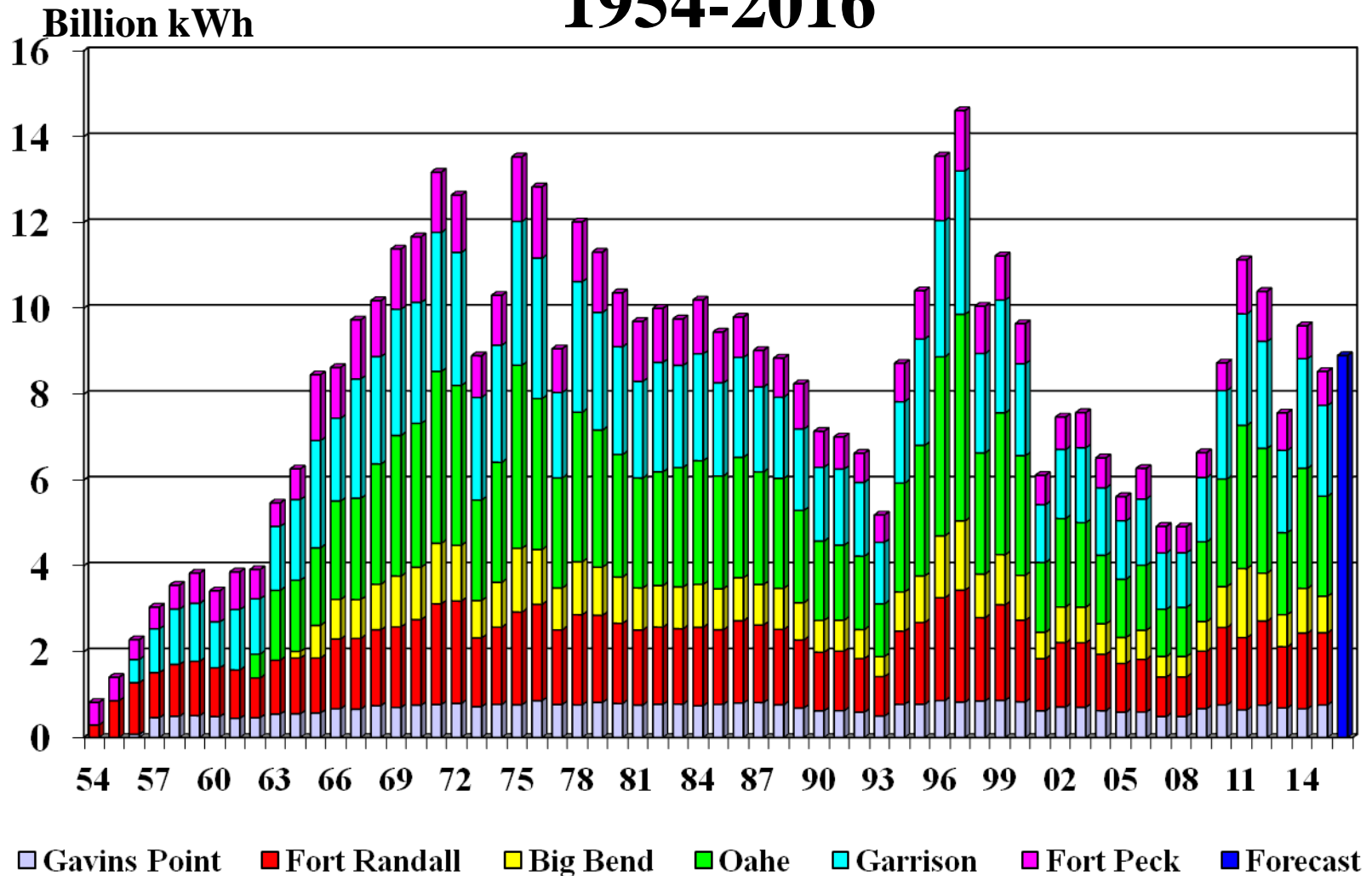
Source: USACE



The graph bars represent typical monthly average power generation. USACE controls generation of this hydro electric power. WAPA controls distribution of this electric power. Note the low power generation during the Spring Pulse period where some discharges from mainstem dams for the Pulse would not be used for power generation and the Low Flow period where water would be unavailable for peak loads in August and September.

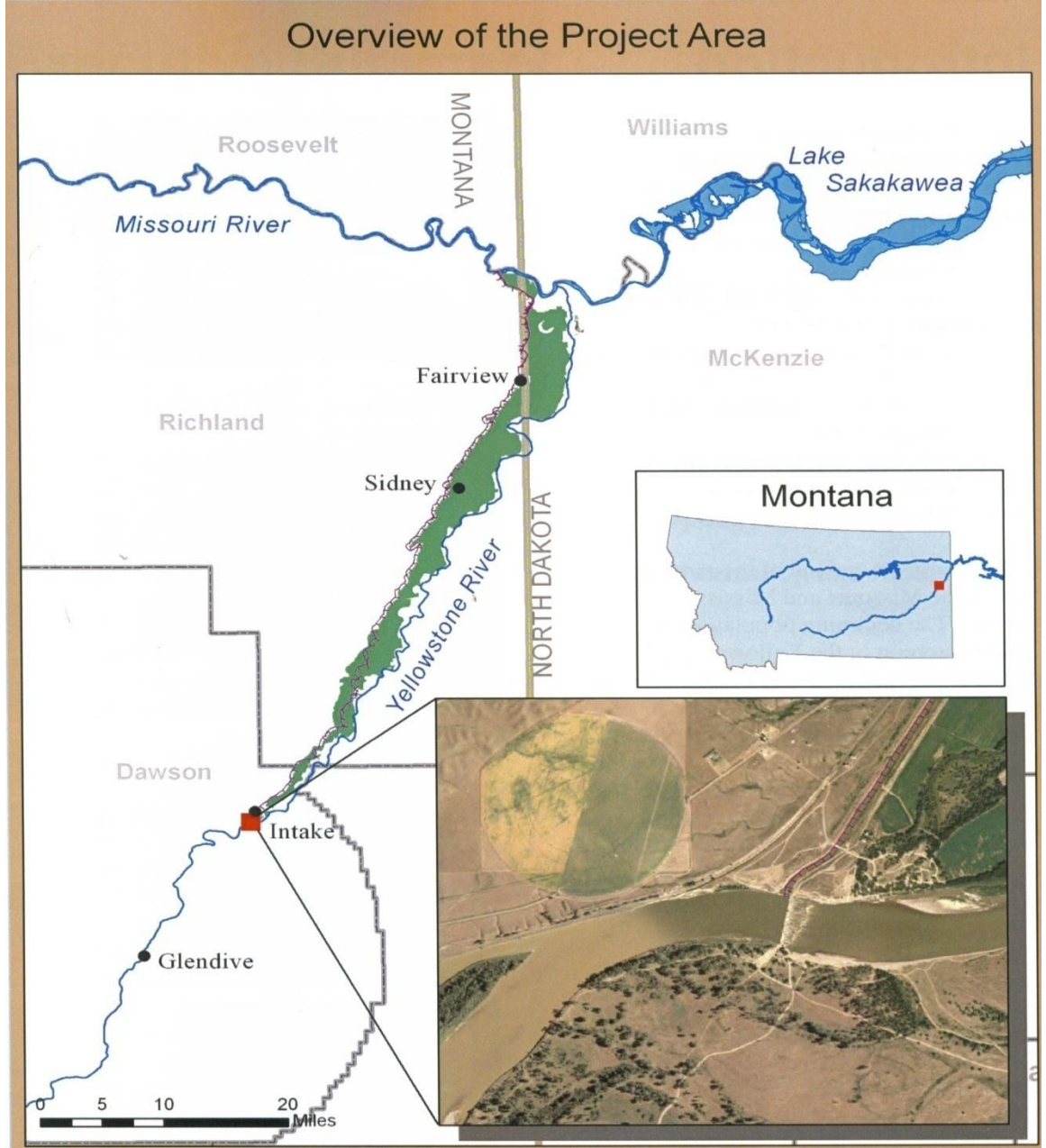


# Mainstem Hydropower Generation 1954-2016



## Intake, Montana Project

Note: Water in the diversion canal provides recharge of aquifers for wells in Fairview, Sidney and other cities.





Intake, Montana water intake diversion structure on the Yellowstone River

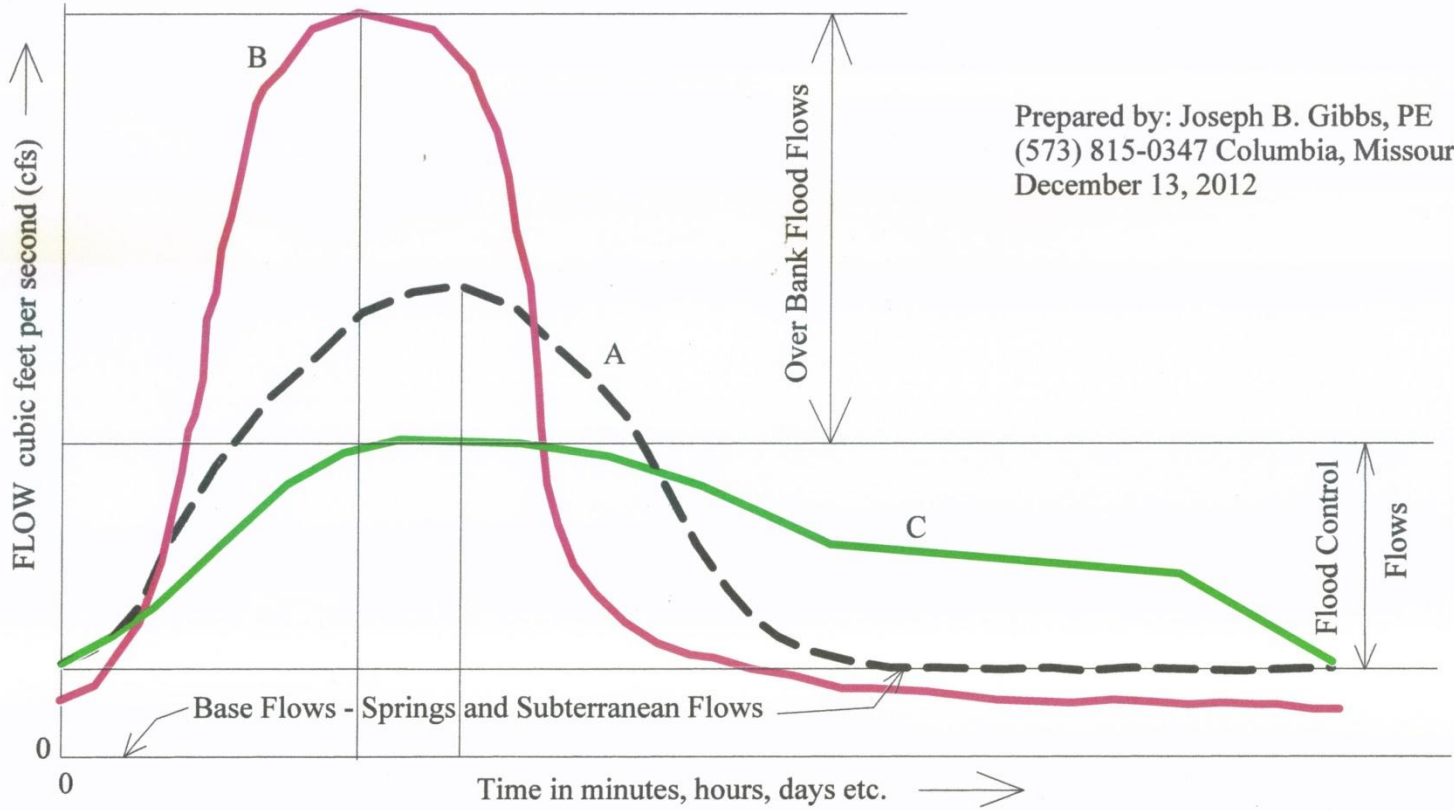


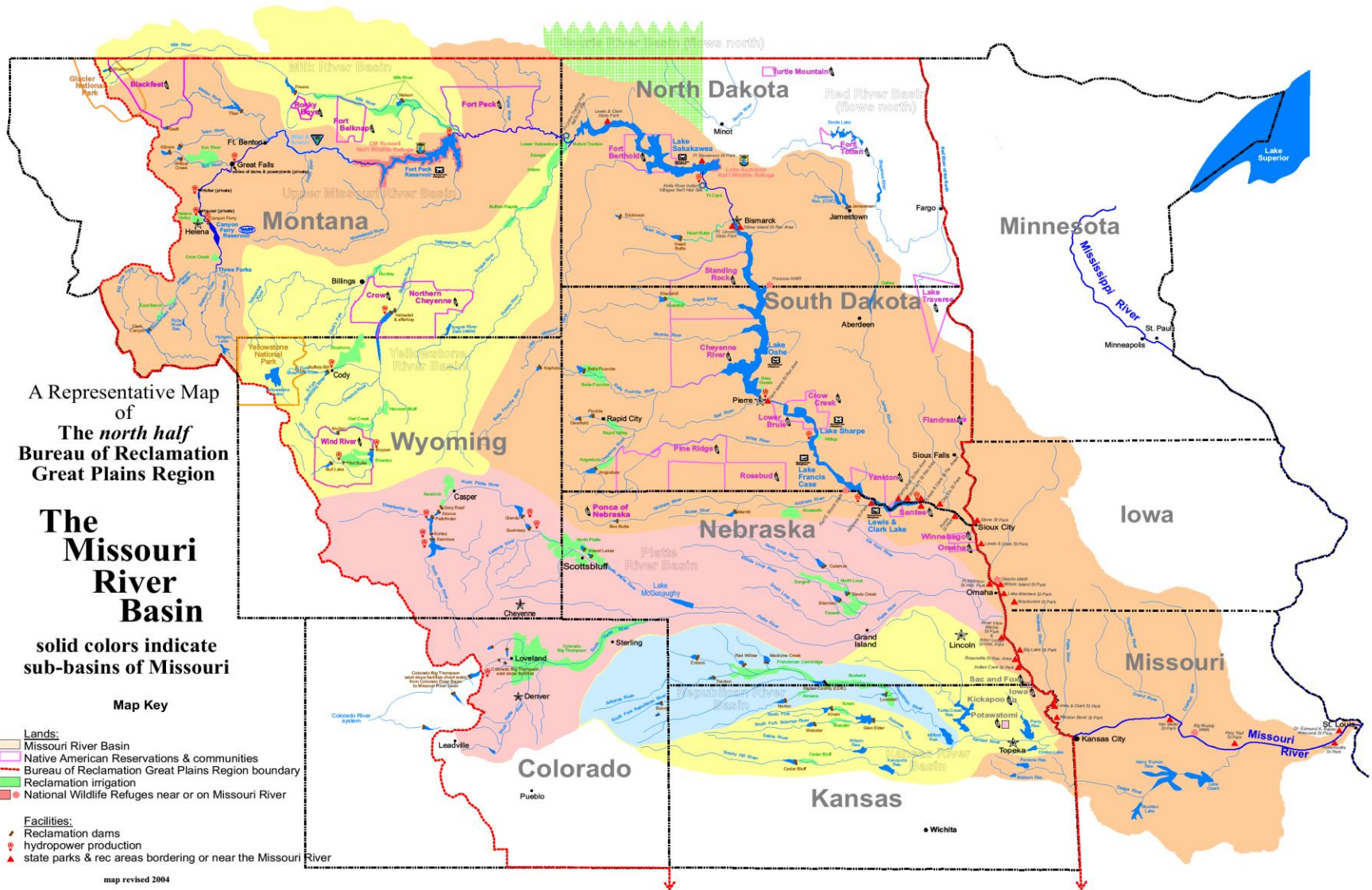
Water level and diversion control structure to divert irrigation waters from one drainage to another. July 10, 2010 transbasin diversion on north dam of Lake DeSmet, Wyoming



Water level and diversion control structure to divert irrigation waters from one drainage to another. July 10, 2010 transbasin diversion on north dam of Lake DeSmet, Wyoming

These are hydrograph curves for a sample watershed or drainage. Graph 'A' is the 'reference hydrograph' for an undeveloped watershed, Graph 'B' is for ground that is frozen or where development has taken place like land clearing, paving and/or urban development and Graph 'C' is where runoff is stored in reservoirs and released at lower rates over a prolonged period to reduce flooding. These curves are for the same 'storm' or rainfall event (typically 5, 10, 25, 100 year event etc.). The values along the vertical axis are flow amounts usually in cubic-feet-per-second (cfs). The flows are measured at a selected discharge point in the water shed. It is the 'outlet in common' that receives all of the runoff from the water shed. The values along the horizontal axis are segments of time that can be in minutes, hours, days, etc. Measurements of flow are taken at some convenient time interval to make the graph. By solving for the areas under the curves, the total volume of runoff can be computed. These curves are schematic, not drawn to scale and are for illustration purposes. The areas under the curves are assumed to be identical.





Shows Tribal Reservations , USACE mainstem dams, BOR dams and irrigation projects, etc.

# Endangered Species Act of 1973

Each Federal agency shall... ensure that any action authorized, funded, or carried out by such agency... is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat...



**Interior Least Tern**  
Listed "Endangered" 1986

The process to delist the tern as endangered, threatened or a species of concern began in January, 2015



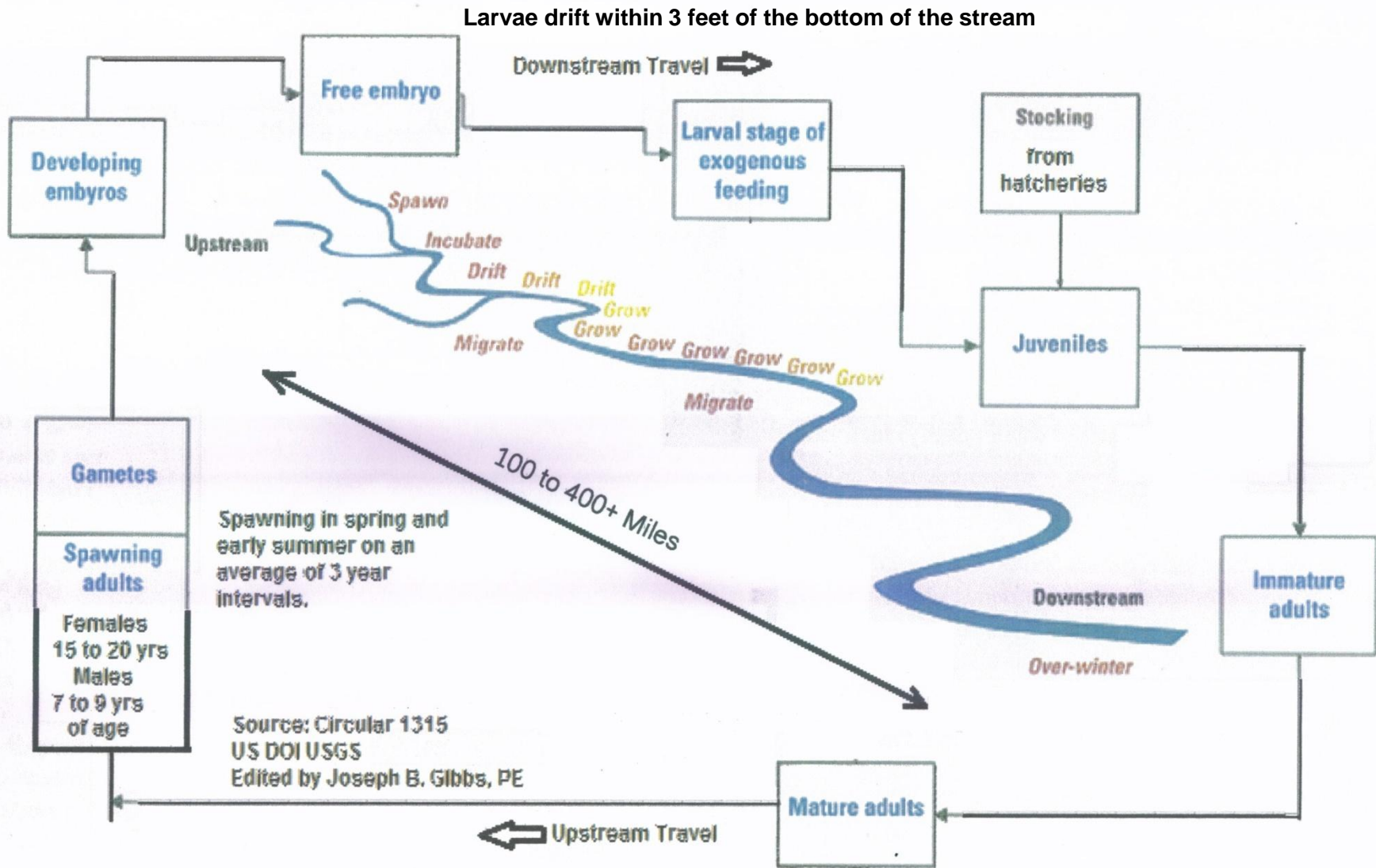
**Piping Plover**  
Listed "Threatened" 1986



**Pallid Sturgeon**  
Listed "Endangered" 1990

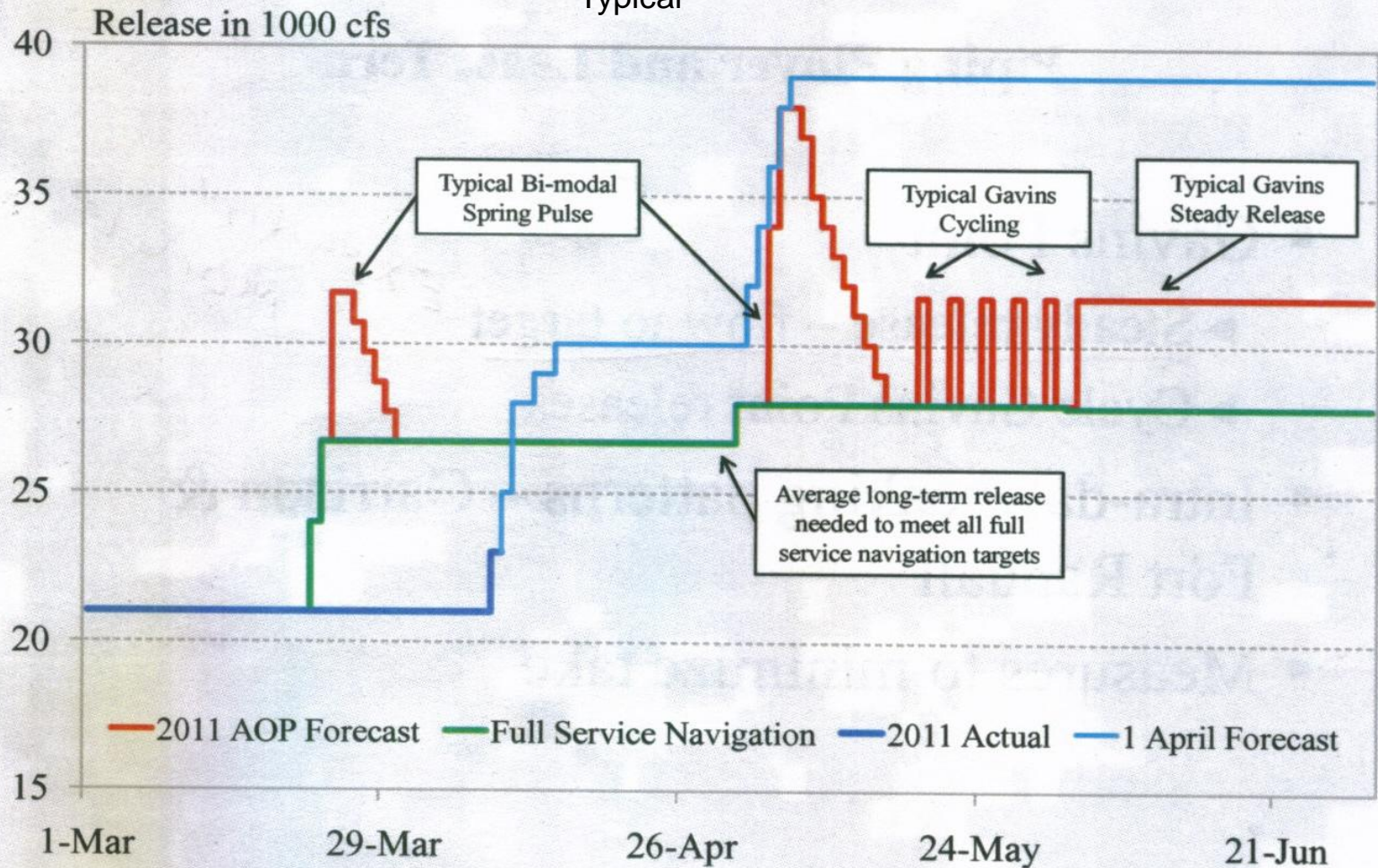


# A Conceptual Life-History Model for Pallid and Shovelnose Sturgeon



# Gavins Point Releases

Typical



Releases for 2011. Shows typical spring pulses for pallid and navigation support releases.

# Focal Natural Resources / Study Segments

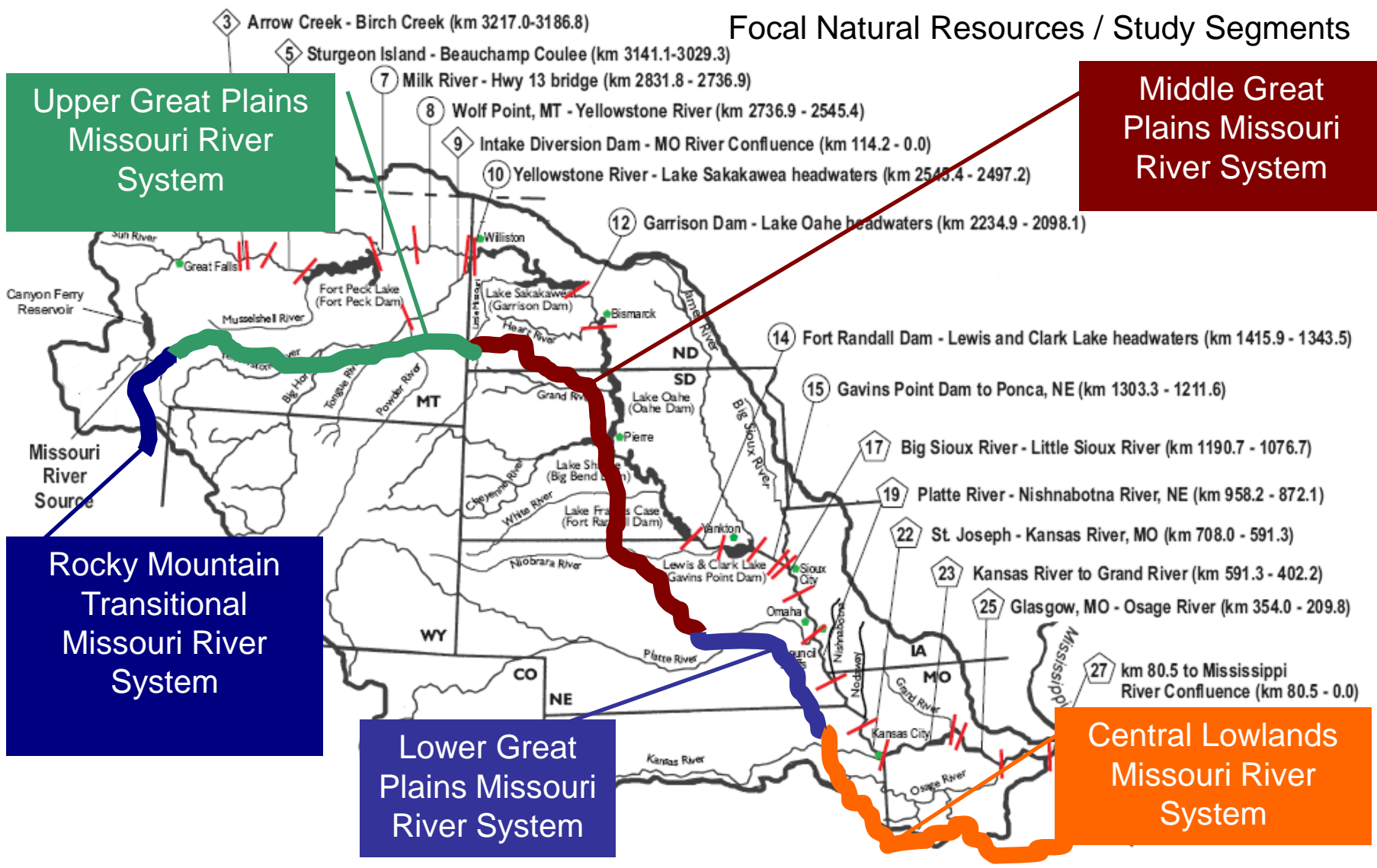
Upper Great Plains Missouri River System

Middle Great Plains Missouri River System

Rocky Mountain Transitional Missouri River System

Lower Great Plains Missouri River System

Central Lowlands Missouri River System



See in the UGLAA: "Ecosystems for FNR in the MRERP, Study of;"

# Civil Works - Value to the Nation

Recreation Areas  
370 M Visitors/yr  
Generating \$18 B in  
Economic Activity,  
500,000 Jobs



450 Major Lakes &  
Reservoirs

299 Deep Draft  
Harbors

1/4 of Nation's  
Hydropower:  
\$800 M + Sales

12,000 miles of  
Inland Navigation  
1/2 cost of Rail  
or 1/10 of Trucking



400 miles of  
Shore protection  
Destination for  
75% of U.S.  
Vacations



692 Dams  
11,750 mi. of  
Levees

627 Shallow Draft  
Harbors

153 Lakes  
With Water  
Supply Storage



Environmental  
Infrastructure

Emergency  
Operations



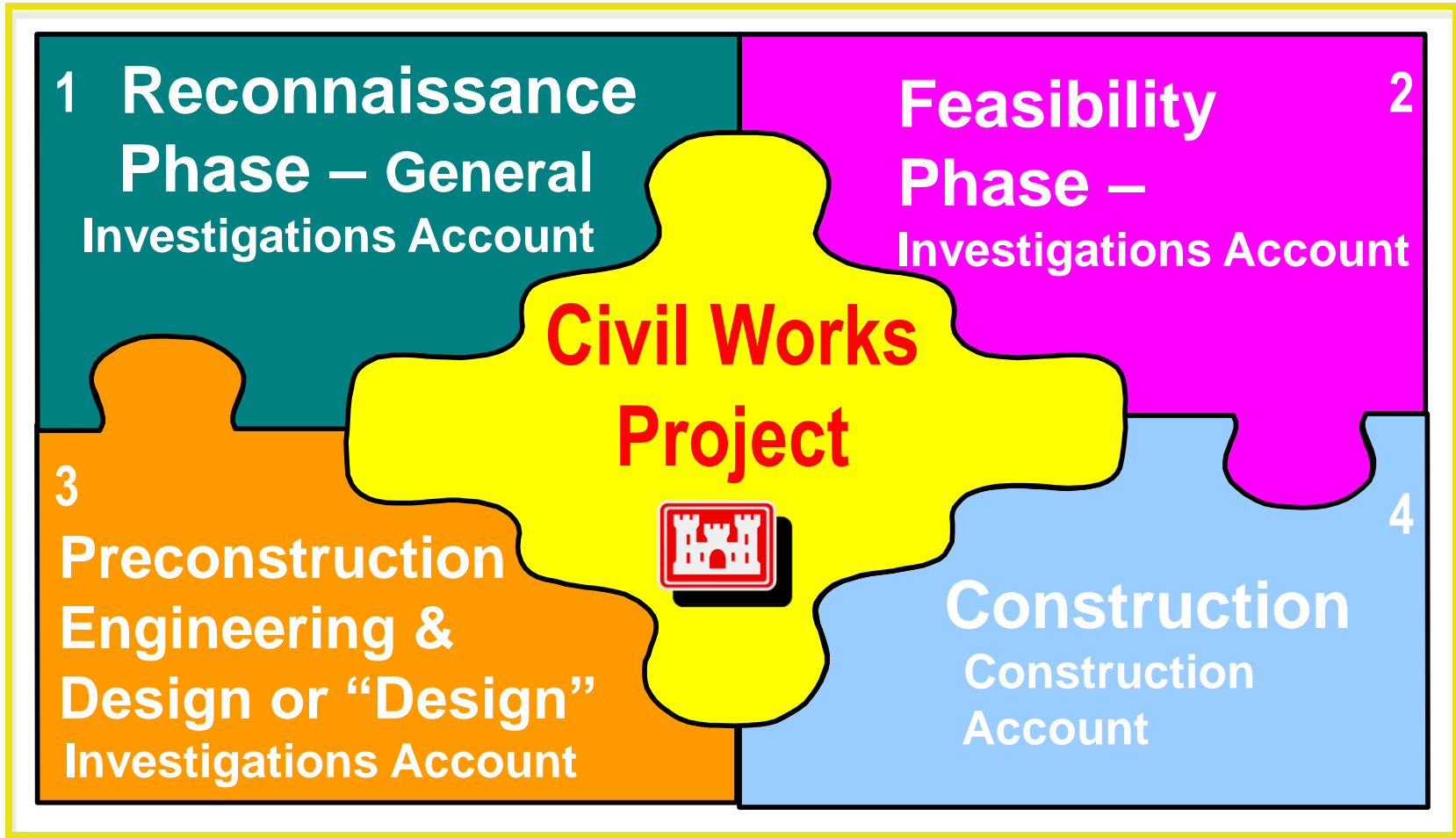
Stewardship of  
11.7 Million Acres  
Public Lands

Environmental  
Restoration



- US Ports & Waterways convey > 2.2B Tons Commerce
- Foreign Trade alone creates > \$160 B Tax Revenues
- Cumulative Flood Damages Prevented >\$821B

# Project Development Process – The Phases



# Civil Works Programs / Funding Accounts

- **Investigations (GI) Studies** – Specifically Authorized or “Large Projects”
- **Construction (CG)** – Specifically Authorized or “Large Projects”
- **Continuing Authorities Programs (CAP)** – small projects - funded by program annually in all phases – **under the Construction Account**
- **Planning Assistance to States (PAS)** – Study only, technical planning support, funded by program annually – **under the Investigations Account**
- **Operations & Maintenance** – annual O&M of all Corps owned projects



# Budget Process – 2 Year Cycle

US Army Corps  
of Engineers

OMB BUDGET GUIDANCE

( Jan )



All Offices Develop  
Program Requirements  
( Feb - May )



Budget Reviewed &  
Presented to SecArmy  
( Jun - Aug )

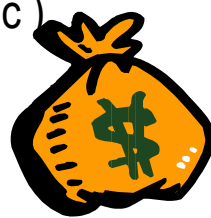
Budget Submitted to  
OMB ( Sep )



OMB Passback  
( Nov )

President's Budget  
to Congress ( Feb )

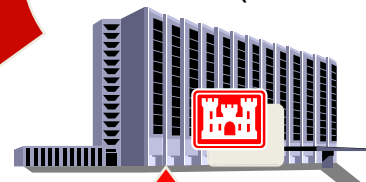
Earmarks or Mark Ups



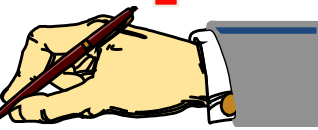
**Budget Cycle**

Cong. Hearings ( Mar - Apr )

Appropriations Bills  
( Jul - Sep )



Funding Alloc.  
To Field Offices  
( Oct - Dec )



President Signs  
Approp. Bill  
( Sep - Oct )



# *Budget Process – 2 Year Cycle*

- May – June: District/Division Budget Data Development
- Jun/Aug: HQ President's Budget Review
- Aug/Sep: ASA(CW) President's Budget Review
- Oct/Nov: OMB President's Budget Review
- Nov: OMB Passback President's Budget Comments to Agencies
- Feb: President's Budget release on first Monday
- Mar-Apr: Congressional Budget Hearings and Bill Mark-up
- Sep-???: Final Bill passes and Act signed by the President
- In recent years, budgets late or not passed, Continuing Resolutions part or all of the year are the norm