

AHPS Long-Term Water-Resource Probabilistic Forecasting for the St. Mary and Milk Rivers

NOAA's Missouri Basin River Forecasting Center
(MBRFC, <http://www.weather.gov/mbrfc>)

Presented at the Montana Hydrology Conference/Workshop

Great Falls, MT - May 27-28, 2008

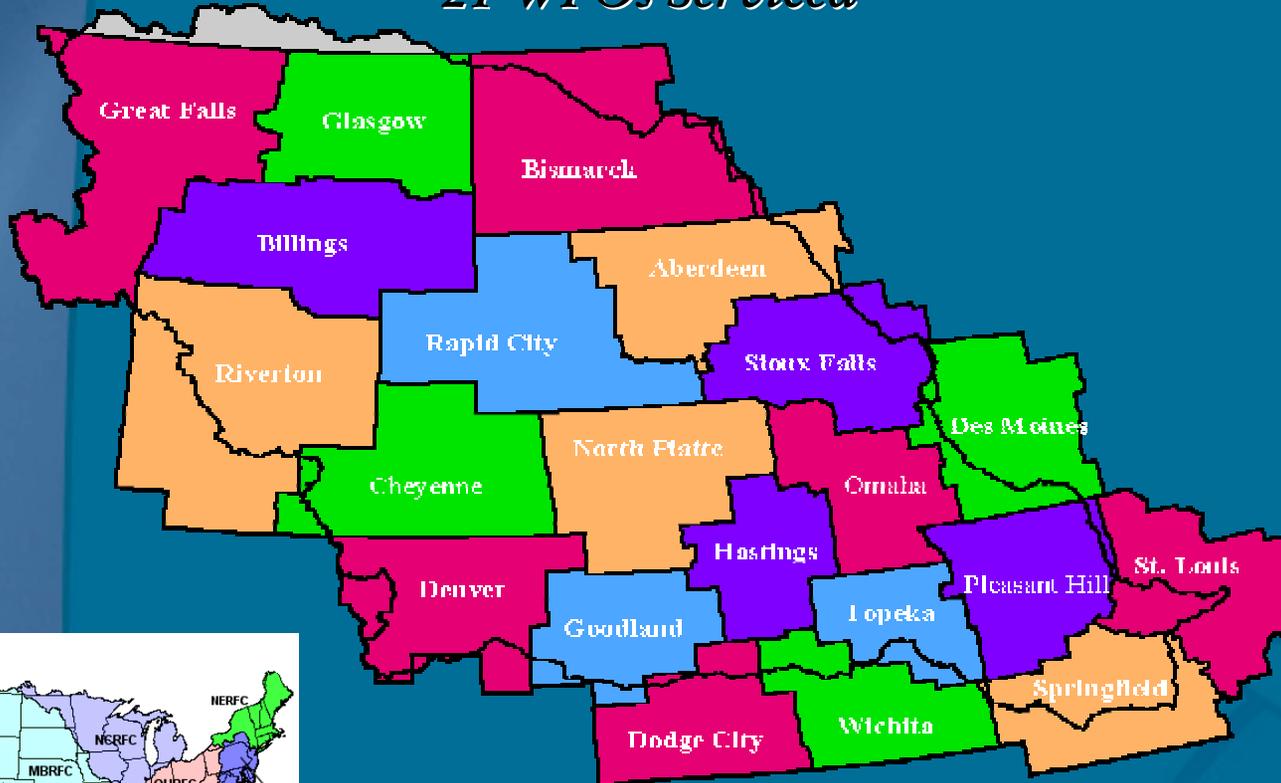
Gregg Schalk, Senior Hydrologist

Outline

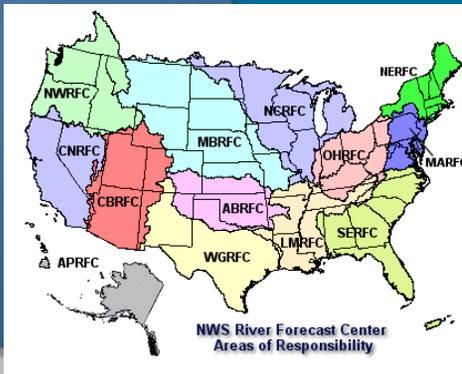
- *Brief introduction MBRFC operations*
- *Description of the MBRFC's operational river forecast model for the St. Mary River and Milk River basins*
- *Ensemble flow forecasting for the St. Mary River and Milk River basins*

Missouri River Basin River Forecast Center

*One of 13 River Forecast Centers
21 WFOs Serviced*

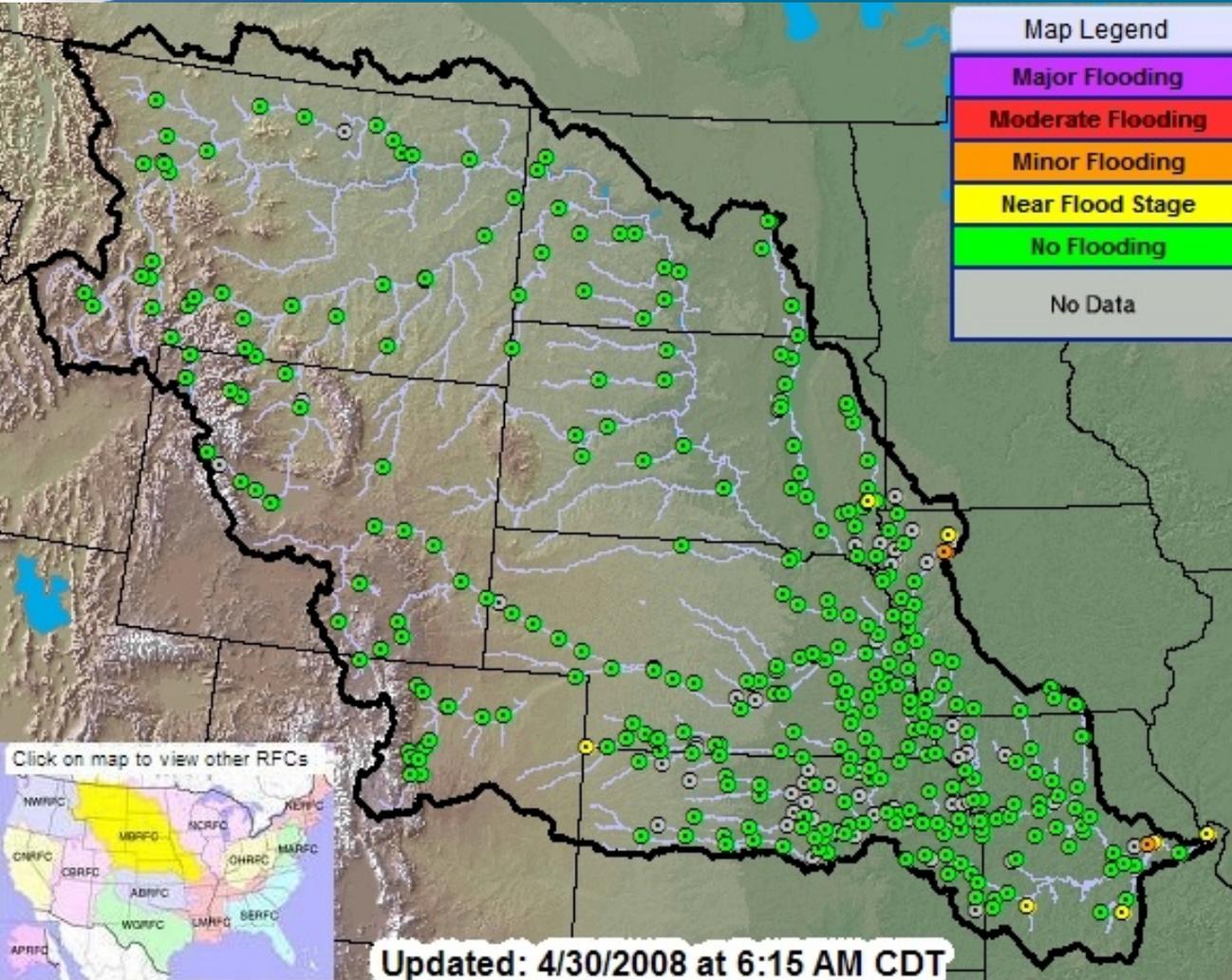


*Great Falls, MT
Billings, MT
Glasgow, MT
Bismarck, ND
Cheyenne, WY
Riverton, WY
Rapid City, SD
Aberdeen, SD
Sioux Falls, SD
North Platte, NE
Hastings, NE
Omaha, NE
Denver, CO
Goodland, KS
Dodge City, KS
Wichita, KS
Topeka, KS
Des Moines, IA
Pleasant Hill, MO
St. Louis, MO
Springfield, MO*



MBRFC Area of Responsibility

Forecast Point Locations

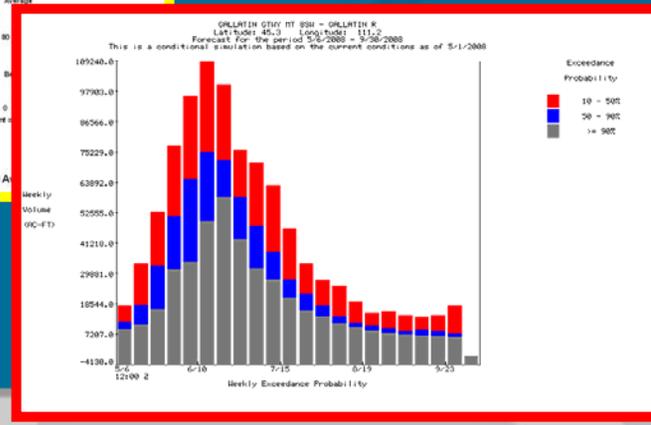
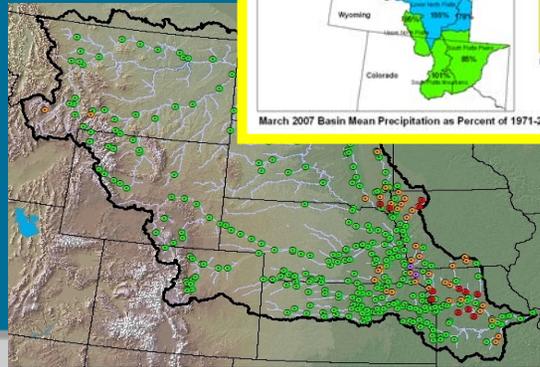
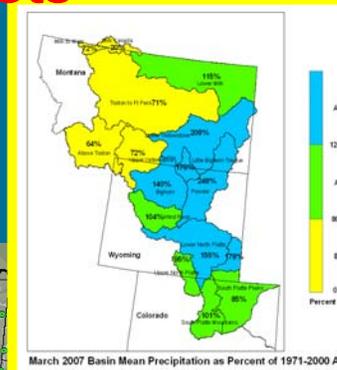
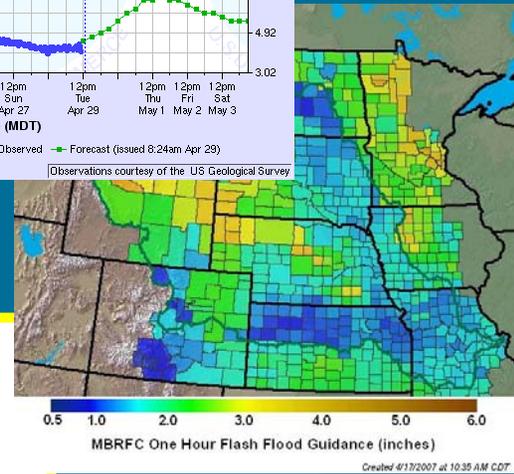


530,000 Square Miles of
Drainage Area
25 Major River Basins
550+ Forecast Locations
78 Reservoir Inflows
174 Headwater
Locations

What MBRFC Does

Provides Hydrologic support to WFOs and other agencies in the form of:

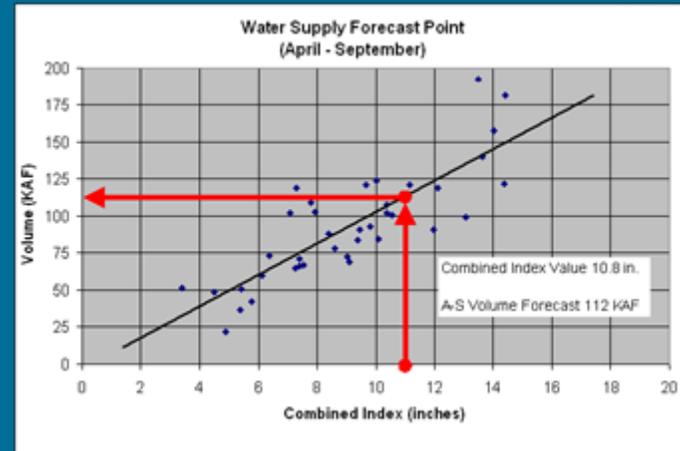
- Flood Forecasts
- Daily Stage Forecasts
- Contingency Forecasts
- Headwater / Flash Flood Guidance
- Water Supply Forecasts
- Long Range Probabilistic Forecasts
- Spring Snowmelt Outlooks
- Reservoir Inflows
- Gridded QPE and QPF
- Flood Outlook Product



MBRFC Forecasting Models

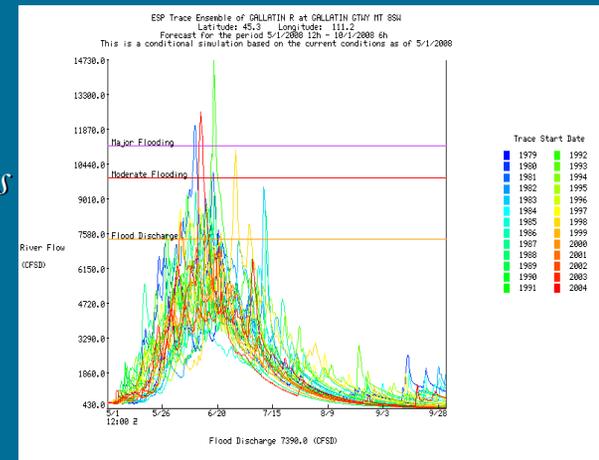
Statistical Water Supply

- Seasonal Volumetric Forecasts
 - Regression techniques



NWS River Forecast System

- Short, Medium, and Long term capabilities
 - Generates output in deterministic AND probabilistic (ESP) formats
 - Variable Outputs for ESP



Source: Adapted from Northwest Basin River Forecast Center



National Weather Service Advanced Hydrologic Prediction Service

Home News Organization Search for: NWS All NOAA

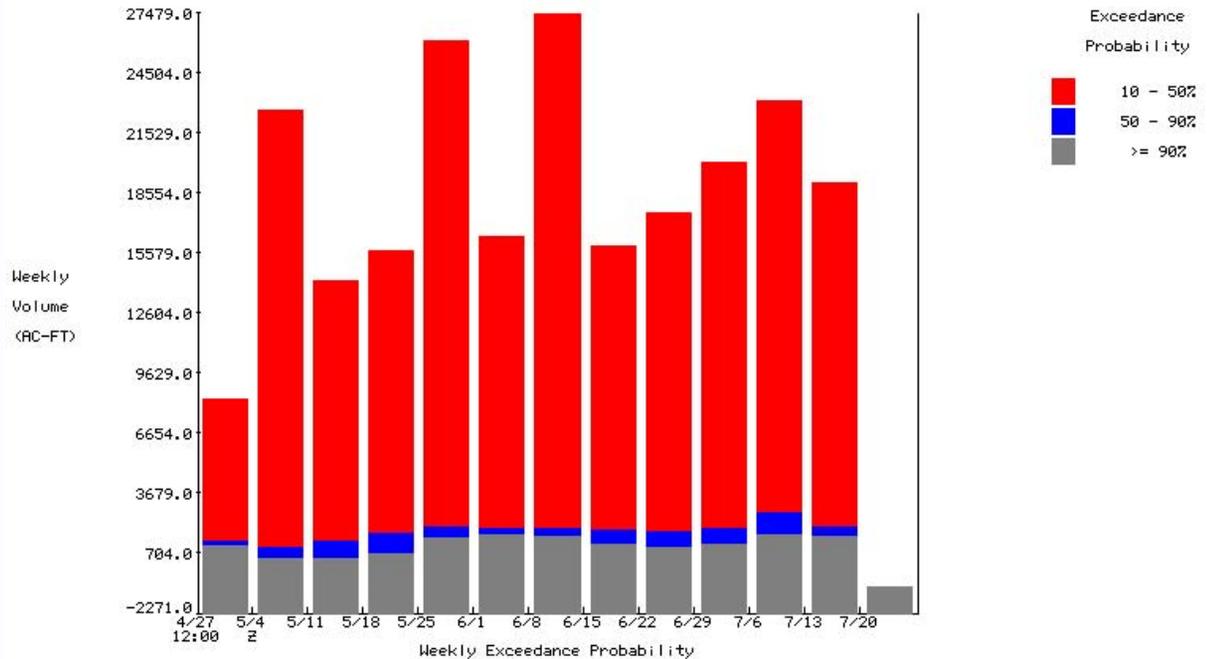
Weather Forecast Office Glasgow, MT

Missouri Basin River Forecast Center

This probabilistic forecast is issued by the Missouri Basin River Forecast Center.

[Hydrograph](#) [River at a Glance](#) [Download](#) [Weekly Chance of Exceeding Levels](#) [Chance of Exceeding Levels During Entire Period](#)

1 Week Chances of Exceeding River Levels on the MILK R +29 at NASHUA MT \$
Latitude: 48.1 Longitude: 106.4
Forecast for the period 4/27/2008 - 7/20/2008
This is a conditional simulation based on the current conditions as of 4/22/2008



[About this graph](#)

Forecasts for the Milk River at Nashua are issued routinely during the warm season, and as needed at other times of the year.

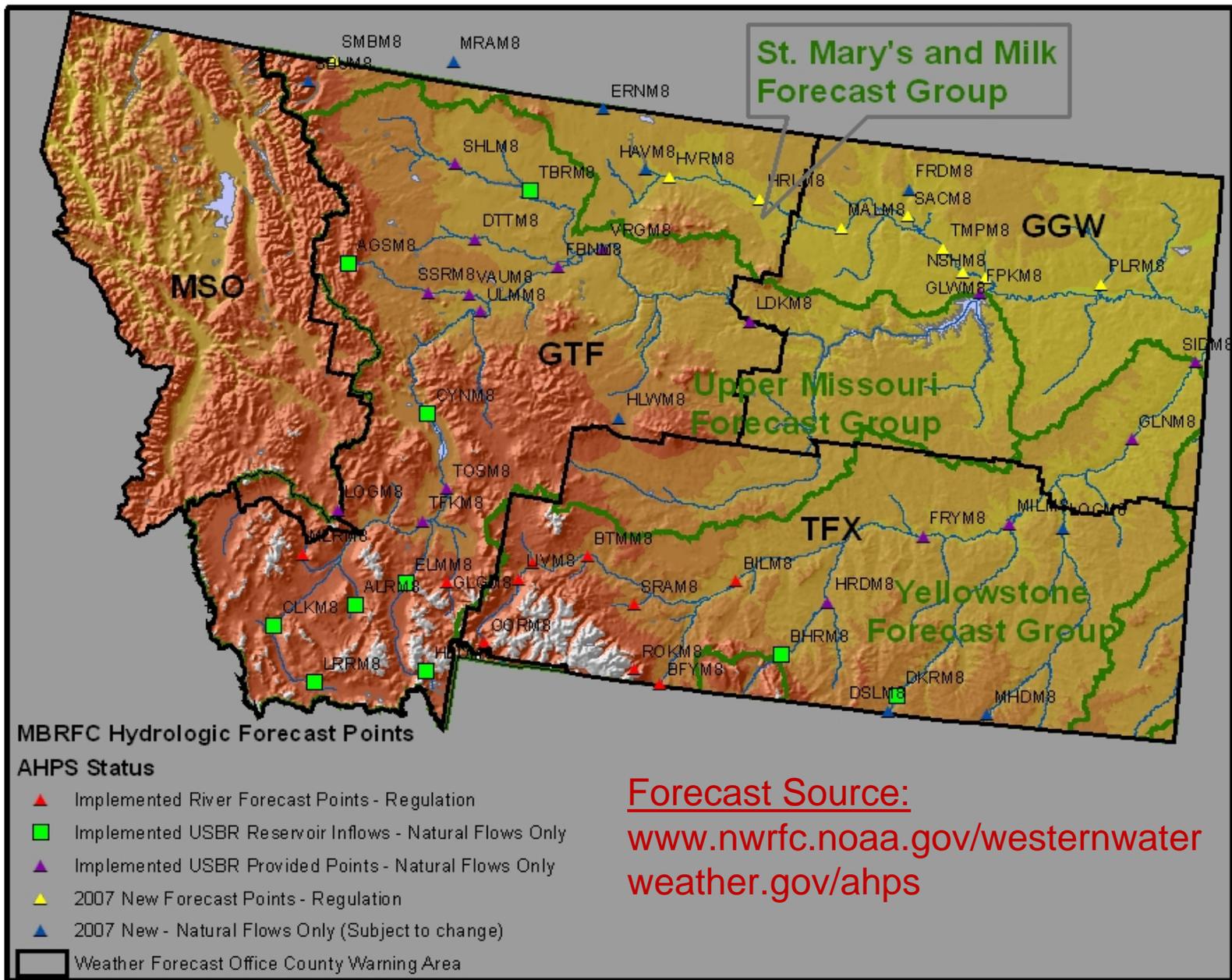
Volume - Weekly Chance of Exceeding Levels

[Return to Area Map](#)

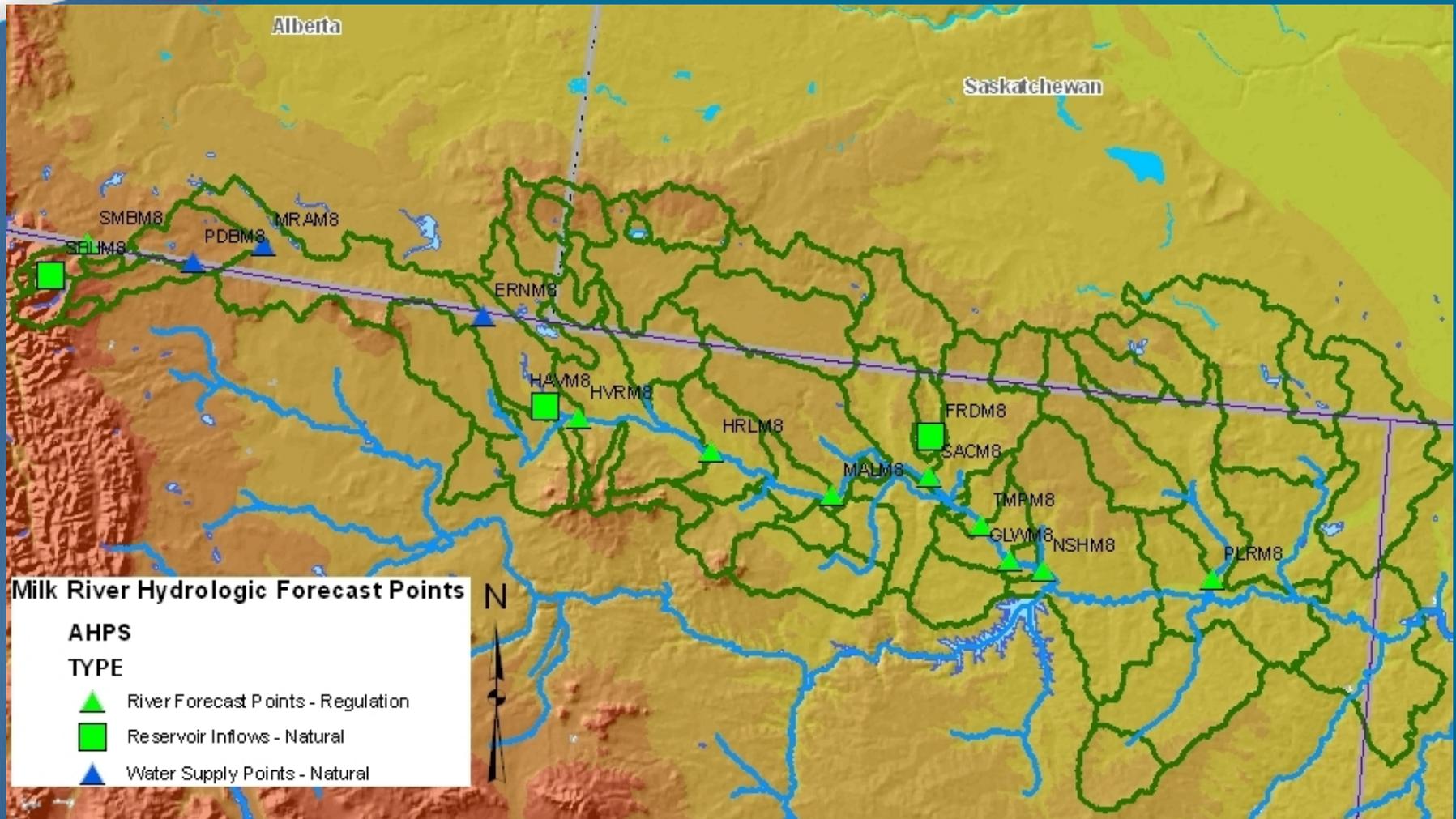
- Local forecast "City, St" or Zip C
- Local weather forecast by "City, ST"
- Rivers & Hydrology
- Observed River Conditions
- Forecast River Conditions
- Forecasts & Info
- Quick Briefing
- 5-Day Flood Outlook
- Flash Flood Guide
- National AHPSP
- Precip & Weather
- Observed Precip
- Forecast Precip
- Weather Forecast Radar
- Satellite
- National Snow
- Climate & History
- National Drought
- Local Drought In
- Historical Floods
- Archive Data
- Additional Info
- MBRFC Water Supply Site
- New Western Water
- Hydrology links
- Climate links
- Radar Z/R Settings
- About the MBRFC
- Contact Us
- Our Office

- Local weather forecast by "City, ST"
- National Conditions
- Rivers
- Satellite
- Climate
- Observed Precip
- Local Conditions
- Warnings
- Weather Forecast Radar
- What is AHPSP?
- Facts
- Our Partners
- Feedback/Questions
- Provide Feedback
- Ask Questions
- Observations courtesy of
- USGS
- USGS logo





St. Mary and Milk Modeled Sub-basins and Reservoirs



NWS River Forecast System Model Components (simplified)

Snow Model

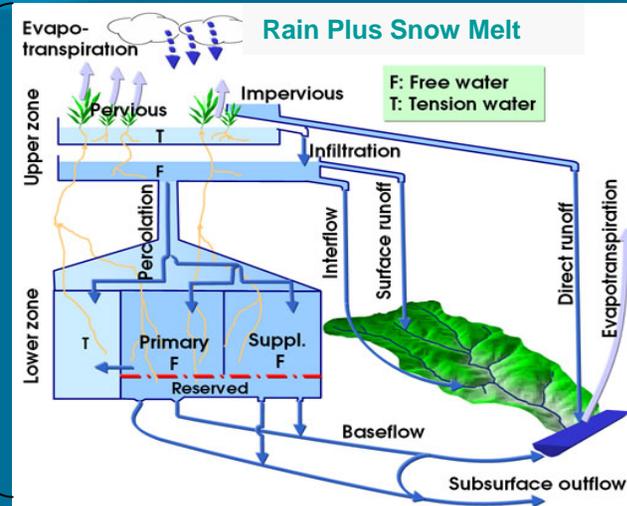
Soil Moisture/Runoff

Consumptive Use

River Routing

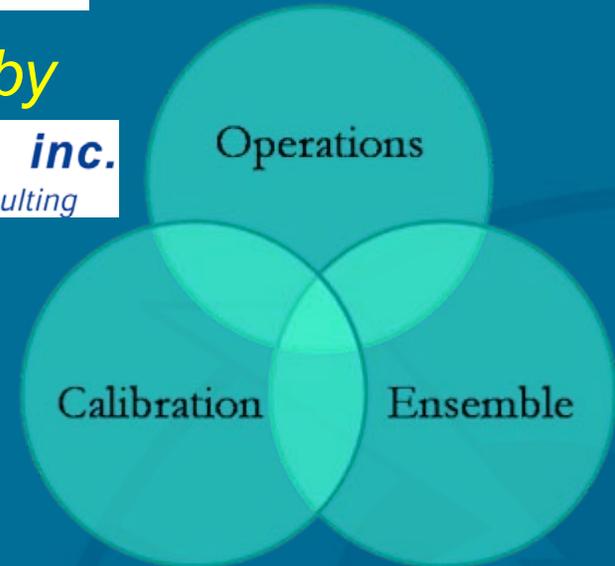
Reservoir and River
Regulation

Flow and Stage
Forecasts



*Hydrologic Model
Calibrated from
Natural Flows*

Calibrations performed by



Regulation Modeling Objectives

- *Provide capability to forecast long-term probabilistic forecasts for regulated flows.*
- *Model major diversions separately, but*
- *Lump small diversions and return flows for a reach.*
- *Model general behavior, not meant to model exactly on 6-hour time-step.*
- *Does not in any way supersede regulating agencies' forecasts or observed values.*
- *Provide guidance for the 5-day deterministic forecast. Generally will use persistence for forecasting river regulation in the short-term.*

Regulation Modeling

Reservoirs Modeled

Sherburne

Fresno

Nelson

Altawan

Middle Cr

*Frenchman
system*

Diversions Modeled

St. Mary Canal

Harlem Canals

Dodson Canals

Nelson Canals

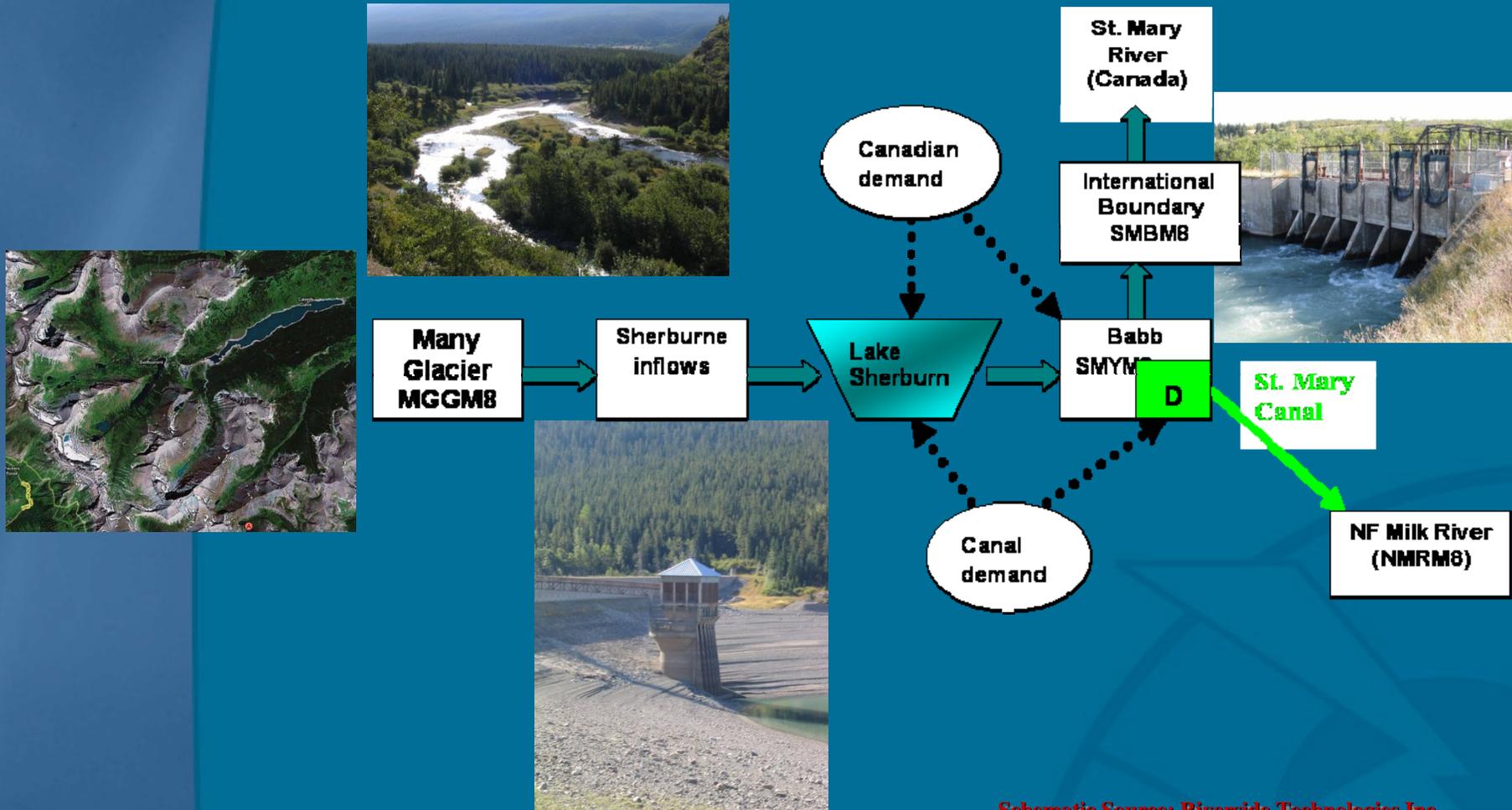
*Vandalia/Glasgow
Canal*

Local reaches

Return flows

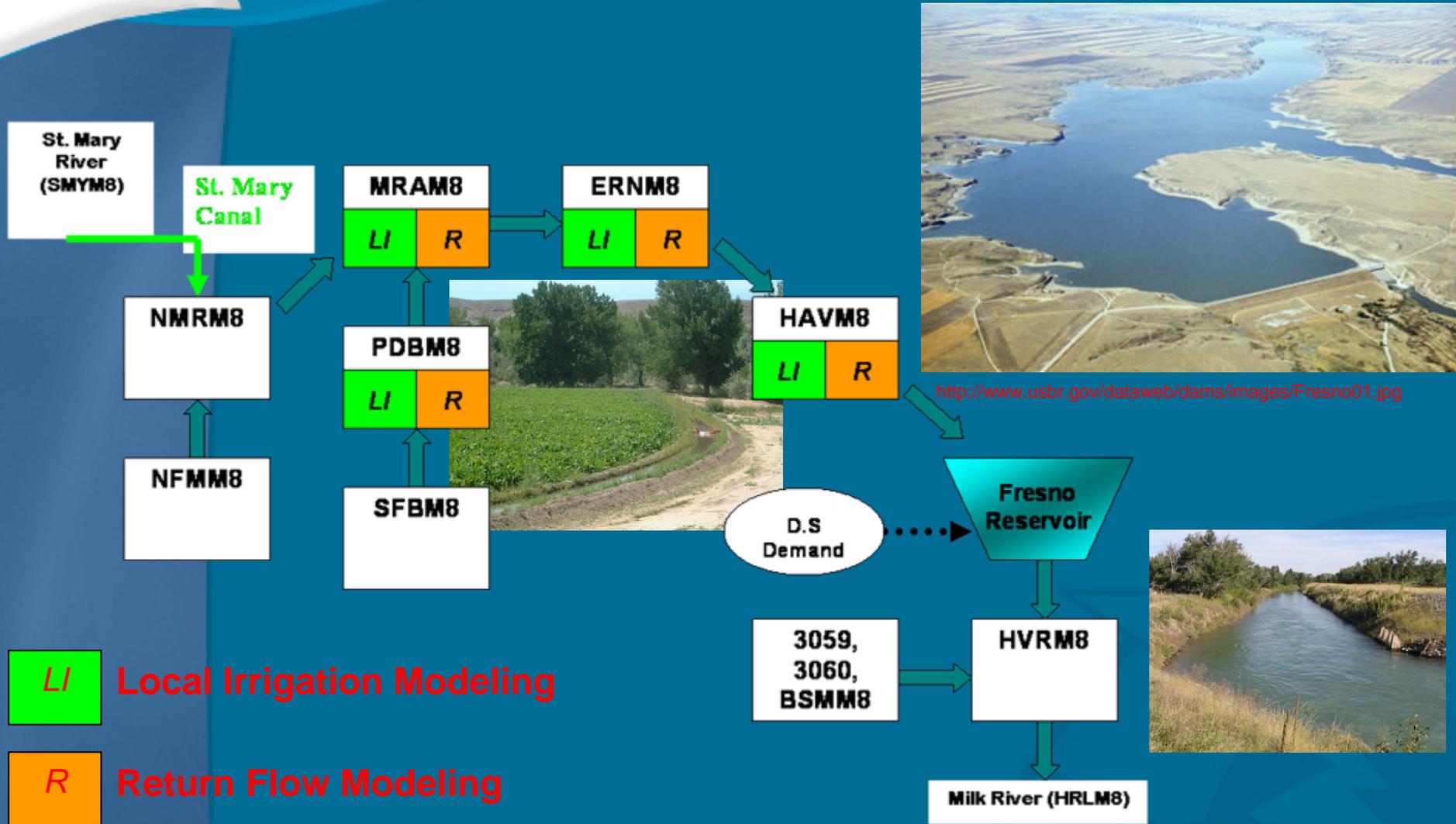
St. Mary's Basin Model

Natural and Regulated Flows



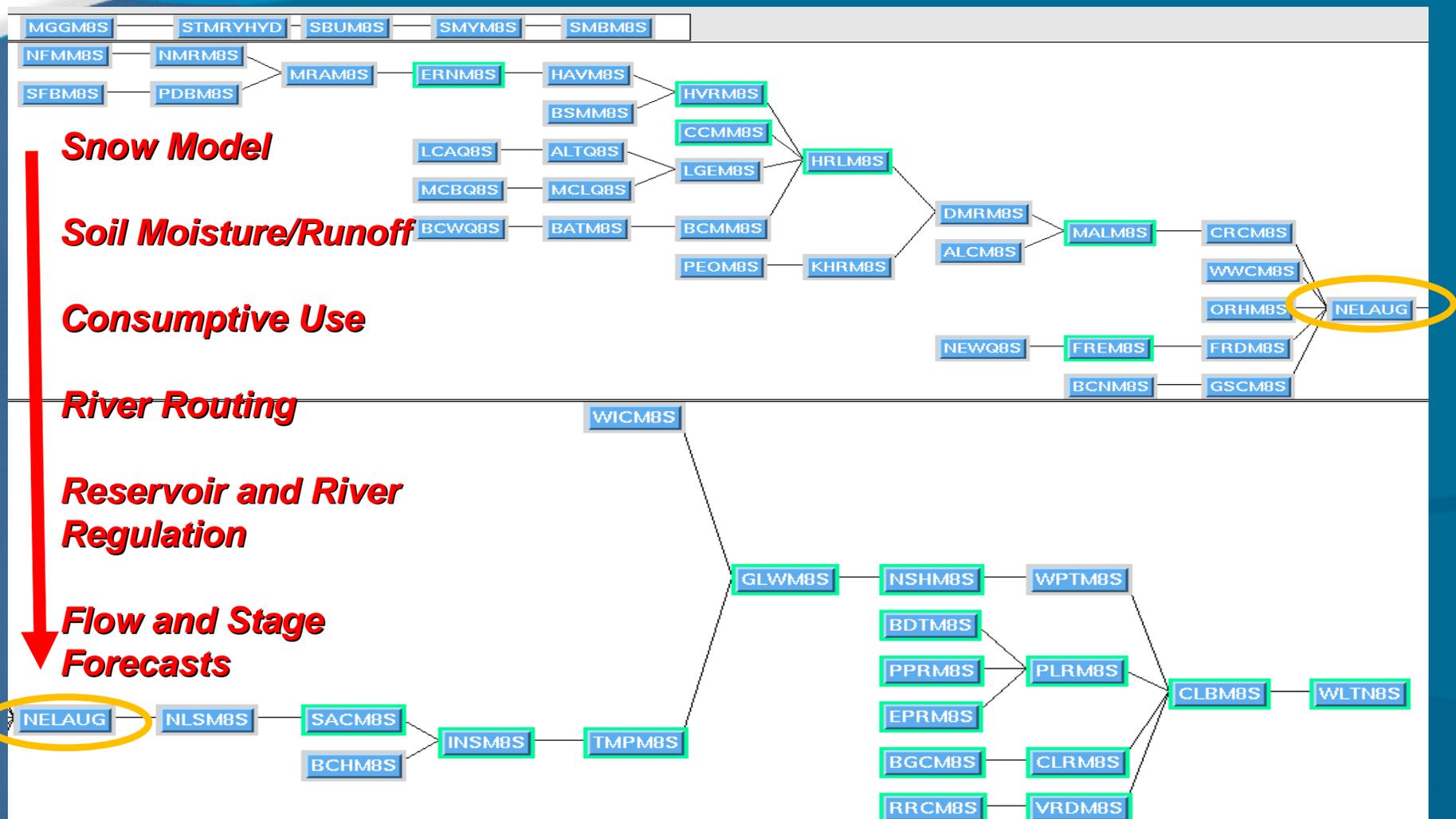
Upper Milk Basin Model

Natural and Regulated Flows



Schematic Source: Riverside Technologies Inc.

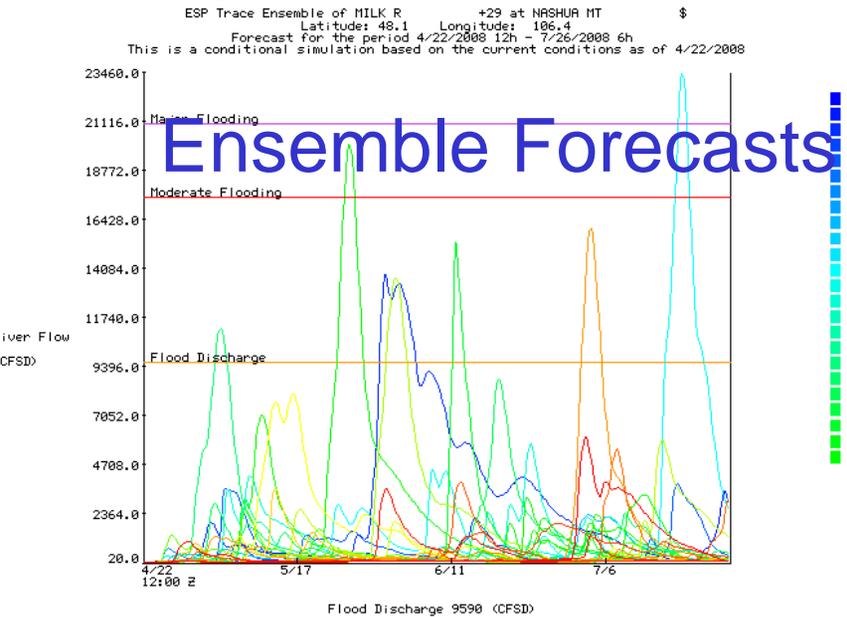
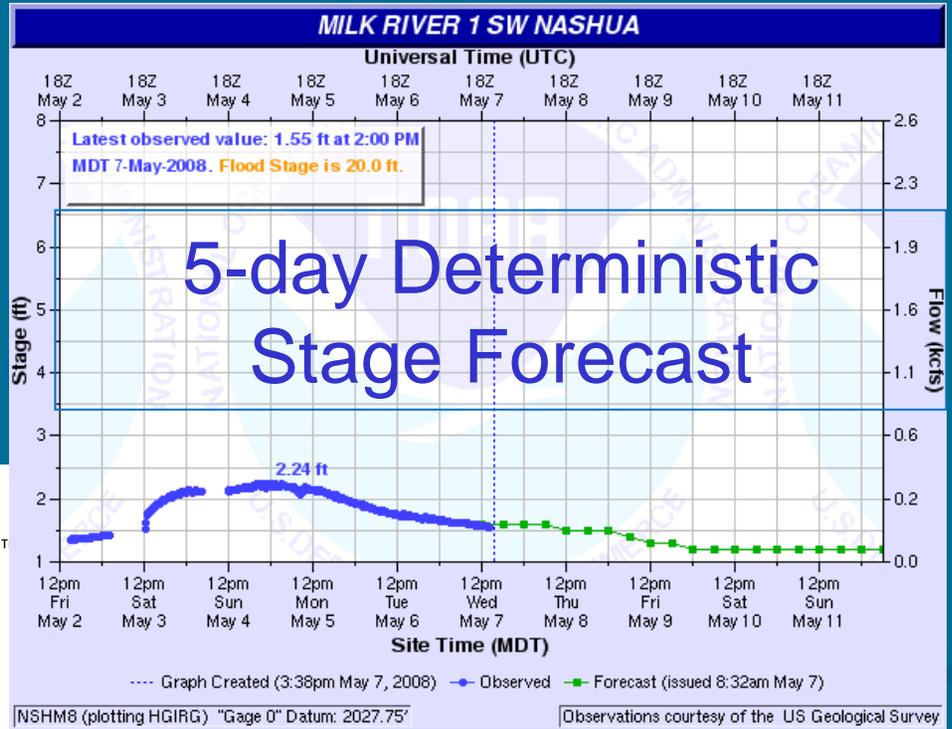
St. Mary and Milk Basin Model



Forecast Information from the Model

Observed data providers:

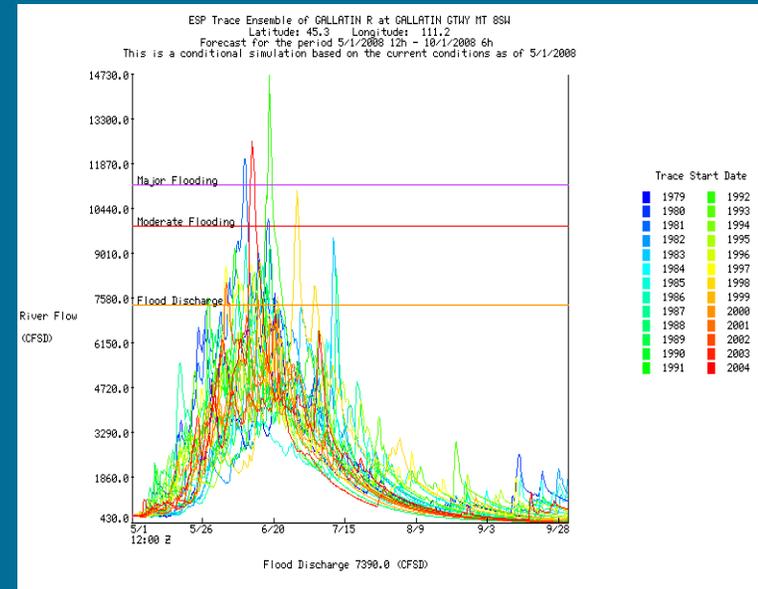
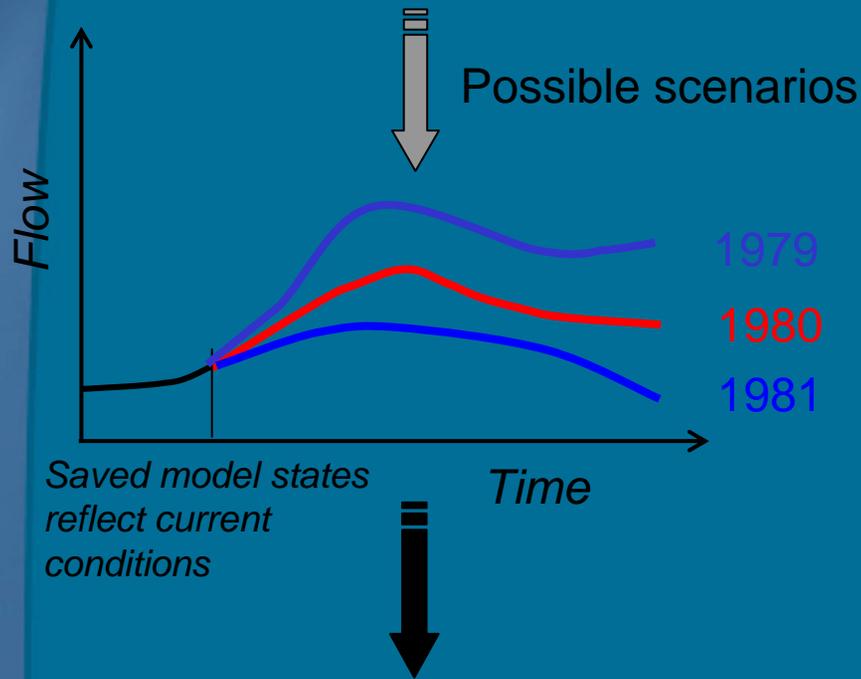
- USGS
- USBR
- WS Canada
- NWS
- Montana



Same model just different inputs

Applying Climate Information at the RFC Using ESP

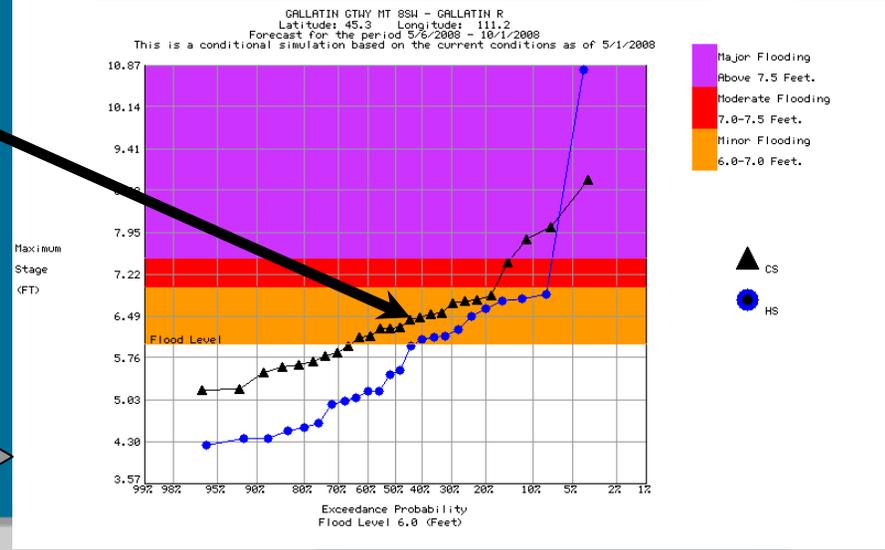
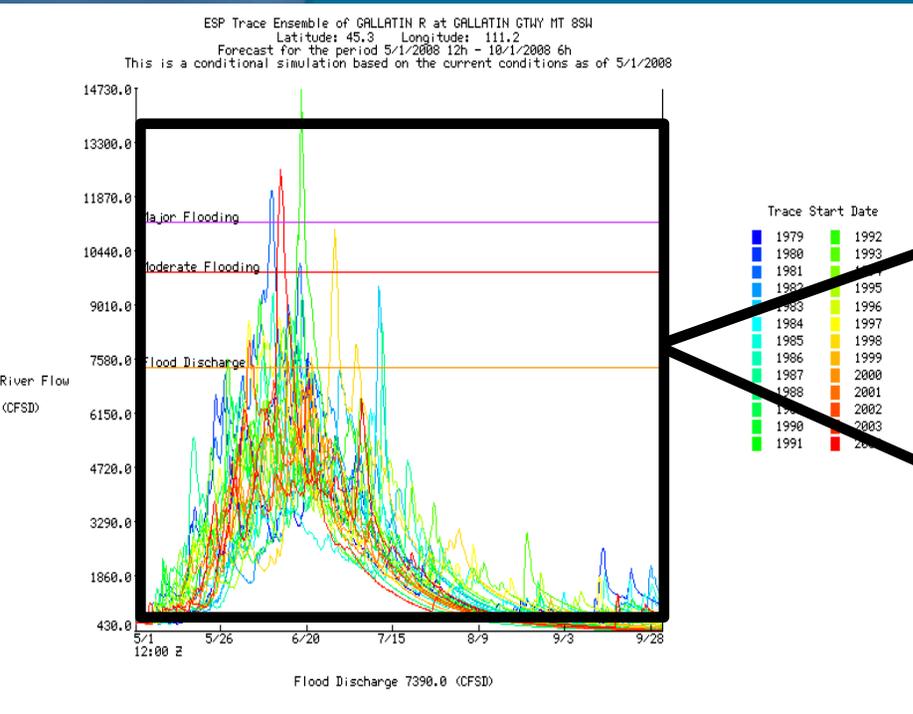
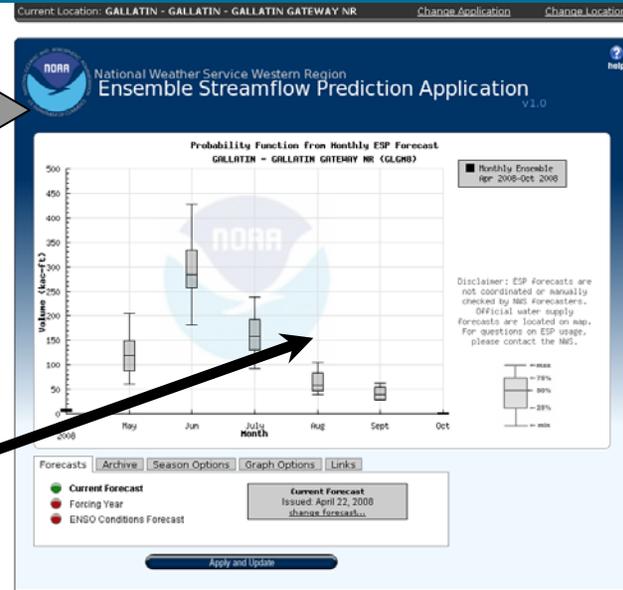
Multiple streamflow scenarios with historic meteorological or forecast weather/climatic data



Results used in statistical analysis to produce forecasts with probabilistic values

Hydrograph Ensembles the Source for all the ESP products.

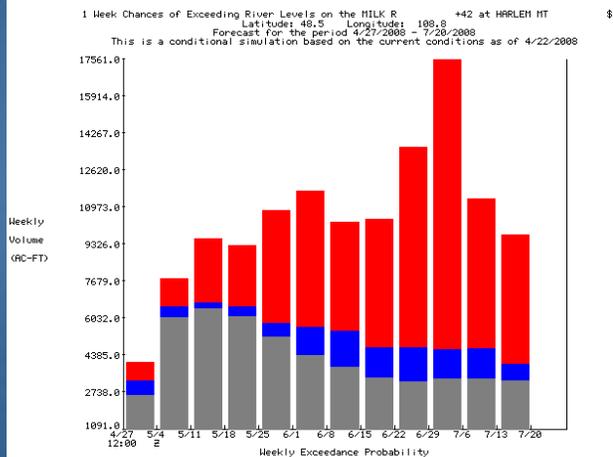
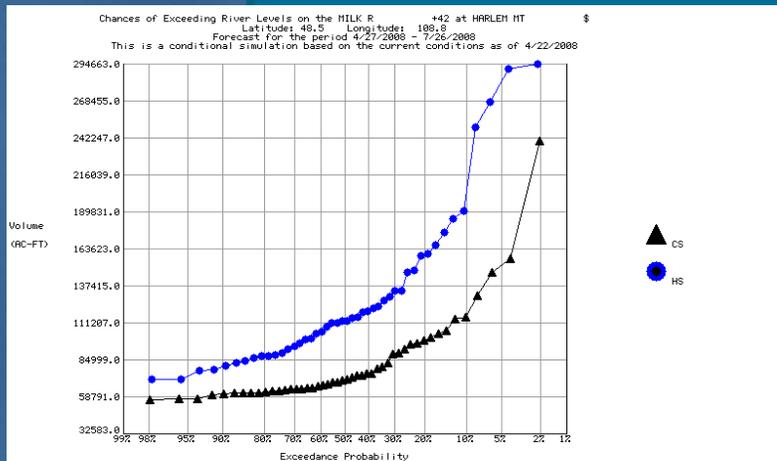
www.nwrfc.noaa.gov/westernwater



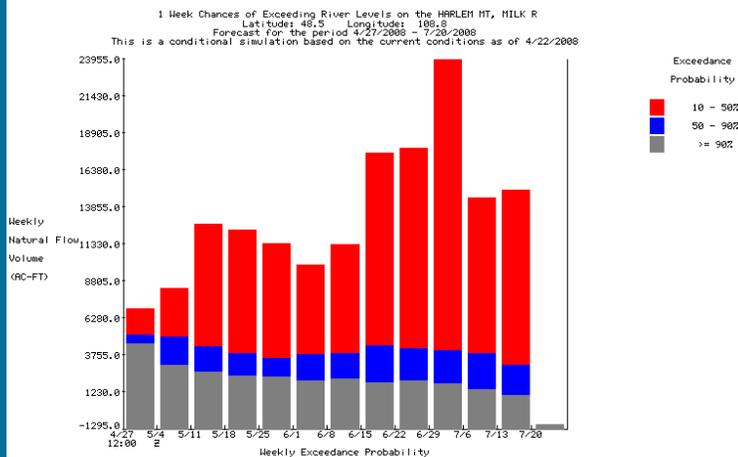
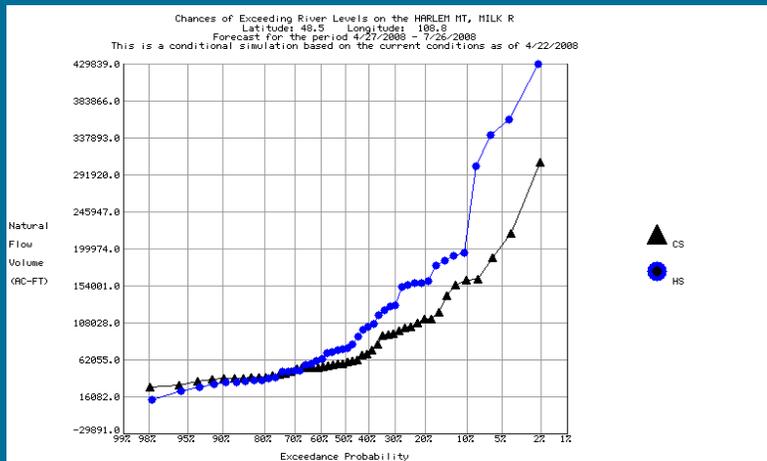
www.weather/ahps

Exceedance Probabilities Natural and Regulated Flows

Regulated



Natural



THE END

REFLECTIONS?

