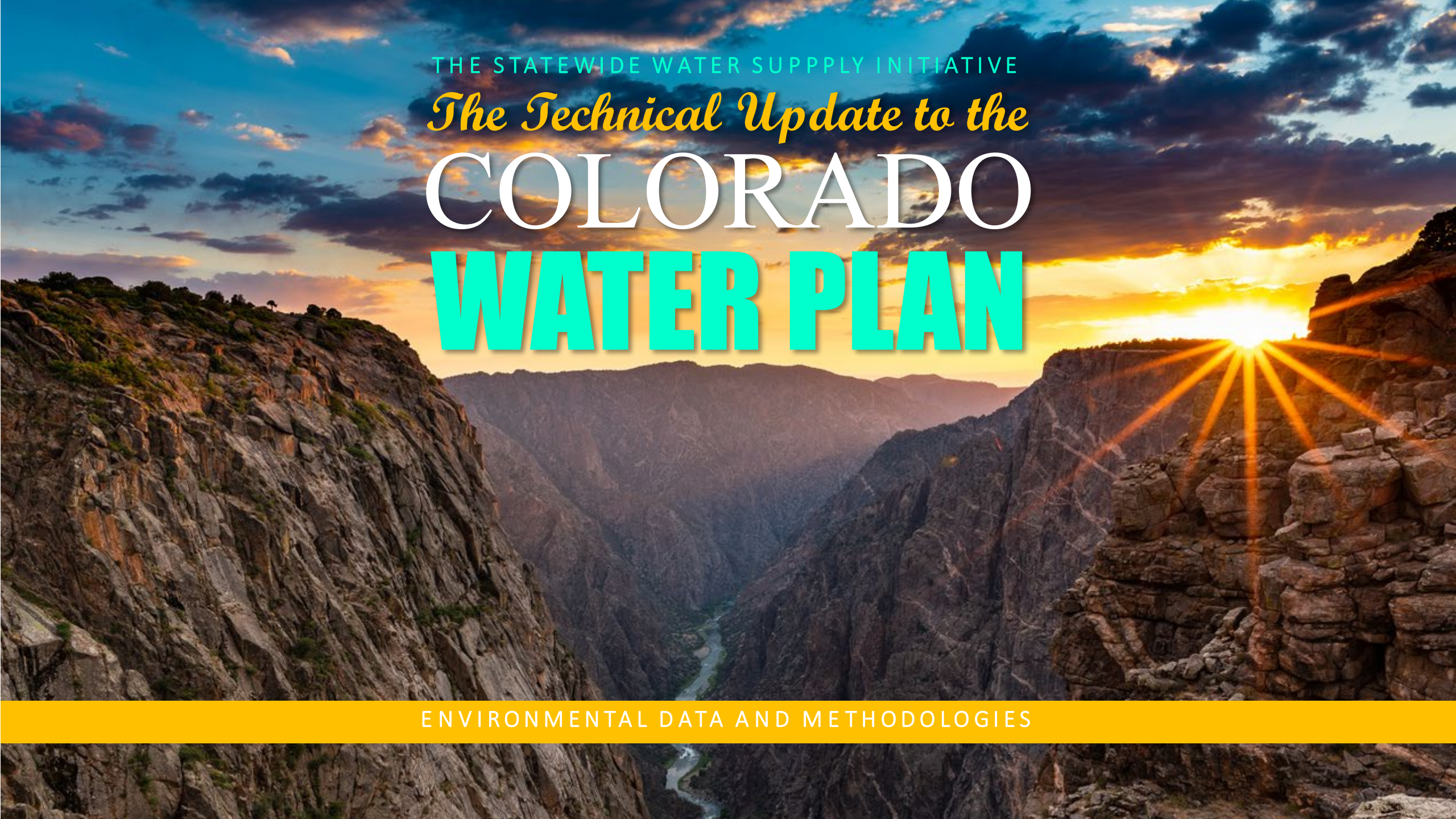

THE STATEWIDE WATER SUPPPLY INITIATIVE
The Technical Update to the
COLORADO
WATER PLAN
ENVIRONMENTAL DATA AND METHODOLOGIES

PRESENTATION

AGENDA

- Background / Process/ Methodology
- Environment and Recreation / Database Update/ Environmental Flow Tool

TECHNICAL WEBINARS

- **February 19** SWSI Methodologies Overview and Population Data
- **March 19** Municipal and Industrial Data & Methodologies
- **April 23** Agricultural Data & Methodologies
- **May 21** Environmental Data & Methodologies
- **June 25** SWSI Tools & Next Steps

SIGN-UP FOR WEBINARS

WEBINARS

ENHANCED STAKHOLDER

ENGAGEMENT

- 2017
  - Technical Advisory Groups
- 2018
  - Roundtable Presentations
- 2019
  - Implementation Working Group
  - Technical Webinars (Recorded and Posted)
  - Iterative Process with Basin Implementation Plans

UPDATING THE WATER PLAN

A ANALYSIS + TECHNICAL UPDATE PHASE

B BASIN PLAN UPDATE PHASE

C COMPREHENSIVE UPDATE PHASE

THE COLORADO WATER PLAN

A B C

TABLE 11-1 CYCLICAL PLANNING PROCESS PROPOSED BY THE CWCB

Product	Year Initiated
Basin Implementation Plans	2013
Colorado's Water Plan	2013
Statewide Water Supply Initiative	2016
Basin Implementation Plans	2018
Colorado's Water Plan	2020
Statewide Water Supply Initiative	2022

ACTIONS

1. The CWCB will work with other state agencies, the basin roundtables, and the people of Colorado to update Colorado's Water Plan, beginning no later than 2020.
2. The CWCB will develop guidelines for Basin Roundtable WSRA grants to help facilitate the implementation of the BIPs.

LONG-TERM TIME LINE

YEAR 1
Procurement & Project Lists

YEAR 2
Document Updates

2019 SEPT

2020 SEPT

2021 SEPT

C-9

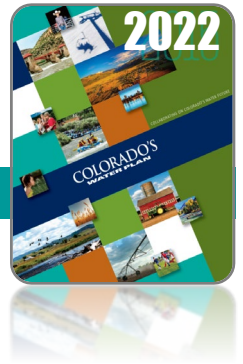
HIRE CONTRACTORS
SEPT '19 – JAN'20

UPDATE IPPS
FEB'20 – AUG '20

ANALYZE + UPDATE BIP DOCUMENT
SEPT '20 – SEPT '21

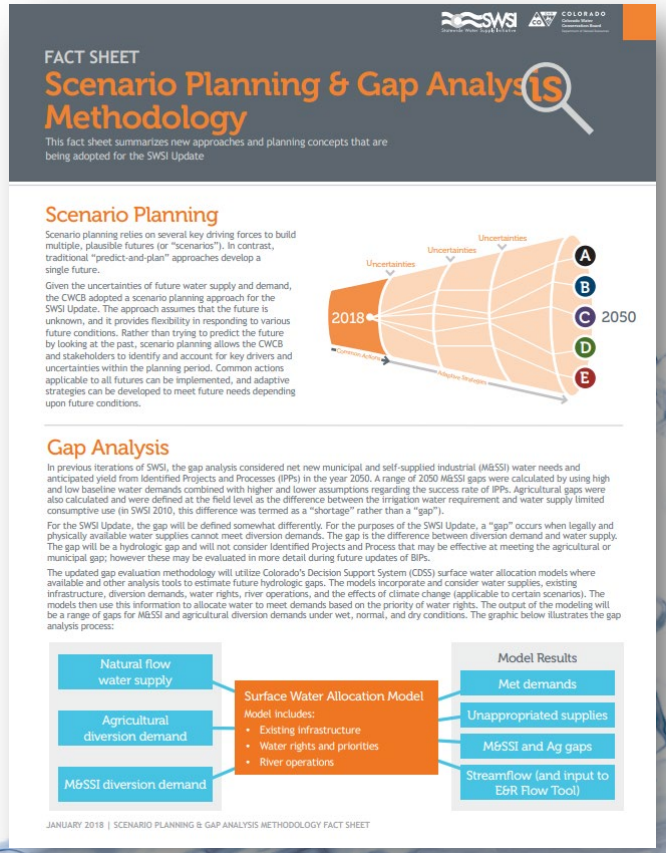
C-9

WATER PLAN UPDATE
NOV '20 – NOV '22



TECHNICAL UPDATE
METHODOLOGY

- New Water Plan-based approach
- First update since the Water Plan
- First update to incorporate climate
- First update to use the hydrologic modeling



FACT SHEET

Scenario Planning & Gap Analysis Methodology

This fact sheet summarizes new approaches and planning concepts that are being adopted for the SWSI Update

Scenario Planning

Scenario planning relies on several key driving forces to build multiple, plausible futures (or "scenarios"). In contrast, traditional "predict-and-plan" approaches develop a single future.

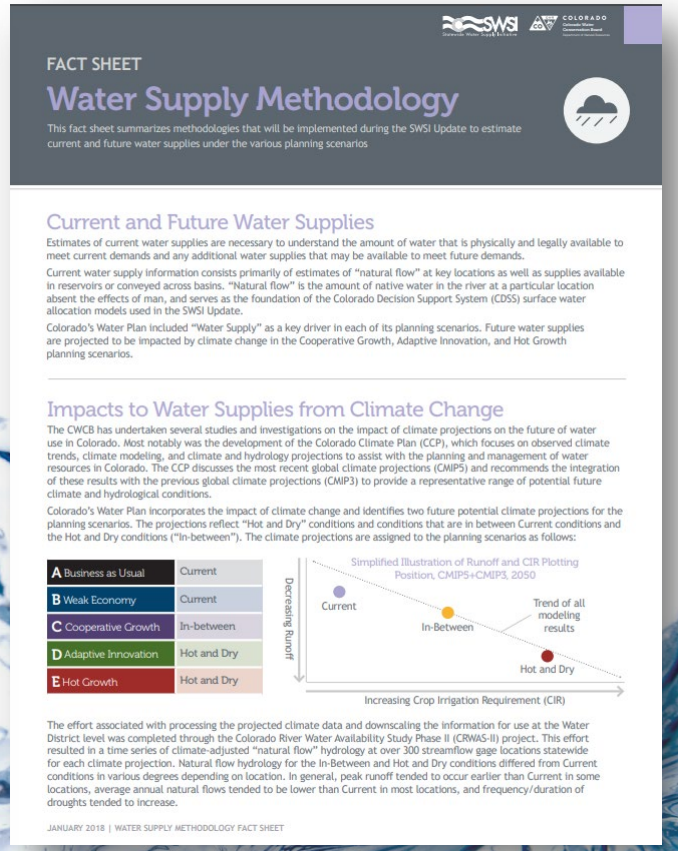
Given the uncertainties of future water supply and demand, the CWCB adopted a scenario planning approach for the SWSI Update. The approach assumes that the future is unknown, and it provides flexibility in responding to various future conditions. Rather than trying to predict the future by looking at the past, scenario planning allows the CWCB and stakeholders to identify and account for key drivers and uncertainties within the planning period. Common actions applicable to all futures can be implemented, and adaptive strategies can be developed to meet future needs depending upon future conditions.

Gap Analysis

In previous iterations of SWSI, the gap analysis considered net new municipal and self-supplied industrial (M&SSI) water needs and anticipated yield from identified Projects and Processes (IPPs) in the year 2050. A range of 2050 M&SSI gaps were calculated by using high and low baseline water demands combined with higher and lower assumptions regarding the success rate of IPPs. Agricultural gaps were also calculated and were defined at the field level as the difference between the irrigation water requirement and water supply limited consumptive use (in SWSI 2010, this difference was termed as a "shortage" rather than a "gap").

For the SWSI Update, the gap will be defined somewhat differently. For the purposes of the SWSI Update, a "gap" occurs when legally and physically available water supplies cannot meet diversion demands. The gap is the difference between diversion demand and water supply. The gap will be a hydrologic gap and will not consider identified Projects and Process that may be effective at meeting the agricultural or municipal gap; however these may be evaluated in more detail during future updates of BIPs.

The updated gap evaluation methodology will utilize Colorado's Decision Support System (CDSS) surface water allocation models where available and other analysis tools to estimate future hydrologic gaps. The models incorporate and consider water supplies, existing infrastructure, diversion demands, water rights, river operations, and the effects of climate change (applicable to certain scenarios). The models then use this information to allocate water to meet demands based on the priority of water rights. The output of the modeling will be a range of gaps for M&SSI and agricultural diversion demands under wet, normal, and dry conditions. The graphic below illustrates the gap analysis process:



FACT SHEET

Water Supply Methodology

This fact sheet summarizes methodologies that will be implemented during the SWSI Update to estimate current and future water supplies under the various planning scenarios

Current and Future Water Supplies

Estimates of current water supplies are necessary to understand the amount of water that is physically and legally available to meet current demands and any additional water supplies that may be available to meet future demands.

Current water supply information consists primarily of estimates of "natural flow" at key locations as well as supplies available in reservoirs or conveyed across basins. "Natural flow" is the amount of native water in the river at a particular location absent the effects of man, and serves as the foundation of the Colorado Decision Support System (CDSS) surface water allocation models used in the SWSI Update.

Colorado's Water Plan included "Water Supply" as a key driver in each of its planning scenarios. Future water supplies are projected to be impacted by climate change in the Cooperative Growth, Adaptive Innovation, and Hot Growth planning scenarios.

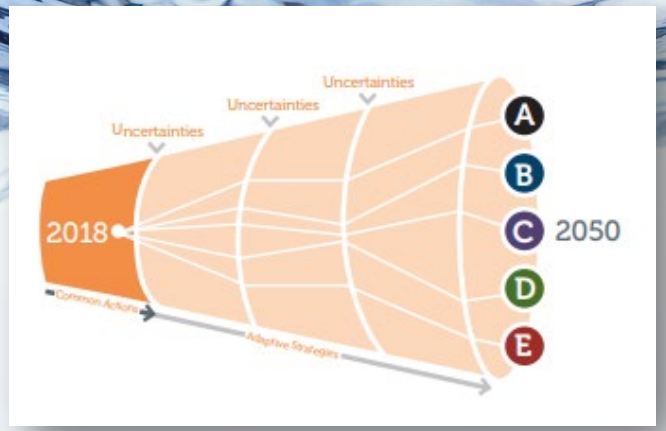
Impacts to Water Supplies from Climate Change

The CWCB has undertaken several studies and investigations on the impact of climate projections on the future of water use in Colorado. Most notably was the development of the Colorado Climate Plan (CCP), which focuses on observed climate trends, climate modeling, and climate and hydrology projections to assist with the planning and management of water resources in Colorado. The CCP discusses the most recent global climate projections (CMIP5) and recommends the integration of these results with the previous global climate projections (CMIP3) to provide a representative range of potential future climate and hydrological conditions.

Colorado's Water Plan incorporates the impact of climate change and identifies two future potential climate projections for the planning scenarios. The projections reflect "Hot and Dry" conditions and conditions that are in between Current conditions and the Hot and Dry conditions ("In-between"). The climate projections are assigned to the planning scenarios as follows:

A Business as Usual	Current
B Weak Economy	Current
C Cooperative Growth	In-between
D Adaptive Innovation	Hot and Dry
E Hot Growth	Hot and Dry

The effort associated with processing the projected climate data and downscaling the information for use at the Water District level was completed through the Colorado River Water Availability Study Phase II (CRWAS-II) project. This effort resulted in a time series of climate-adjusted "natural flow" hydrology at over 300 streamflow gage locations statewide for each climate projection. Natural flow hydrology for the In-Between and Hot and Dry conditions differed from Current conditions in various degrees depending on location. In general, peak runoff tended to occur earlier than Current in some locations, average annual natural flows tended to be lower than Current in most locations, and frequency/duration of droughts tended to increase.



A Business as Usual	Current
B Weak Economy	Current
C Cooperative Growth	In-between
D Adaptive Innovation	Hot and Dry
E Hot Growth	Hot and Dry

Brown AND Caldwell

Presentation by
Matt Lindburg - Principal
www.brownandcaldwell.com

OVERARCHING GOALS

Technical Update update goals:

- A **consistent statewide framework** for examining future water supply and demand scenarios.

- **Tools and data for roundtables** to update their basin plans (e.g. identify local solutions).

- Meet other **Water Plan timing goals and actions** (e.g. Chapter 6 Actions)
  - Monitor Drivers
  - Promote the use of scenario planning and adaptive strategies
  - Support the Colorado Decision Support System

STAKEHOLDER-DRIVEN

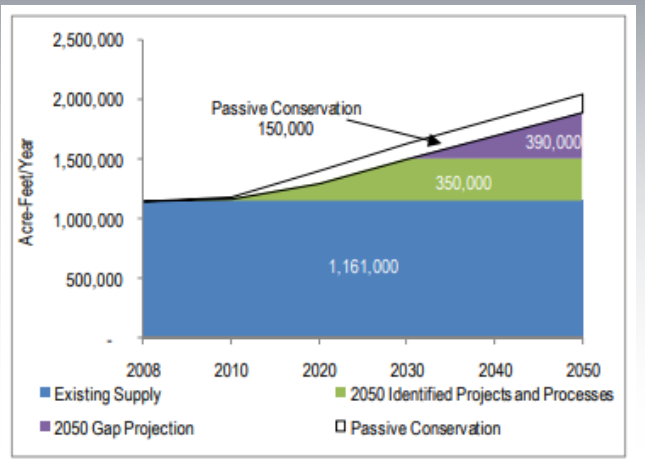
METHODOLOGIES

2050 Demand Projections

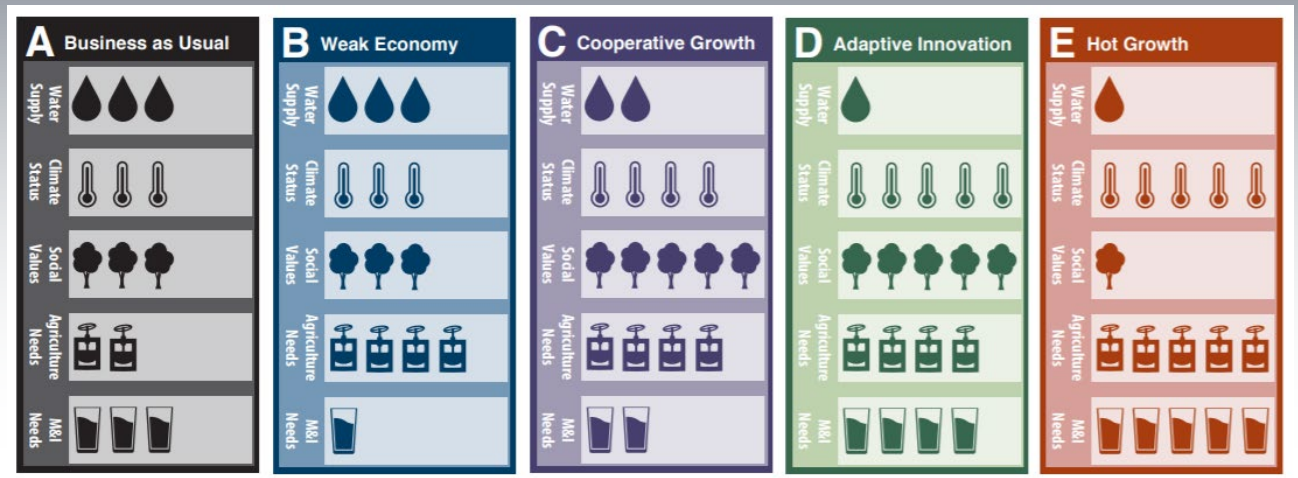
- IPPs

_____

= 2050 M&I Gap



- Hydrologic Modeling
- Municipal Modeling
- Agricultural Modeling
- Environmental Modeling
- Scenario Planning Across Major Drivers



Environmental and Recreational Data and Methodologies

FACT SHEET

Environmental and Recreational Methodology

This fact sheet summarizes methodologies that will be implemented during the SWSI Update for the Environmental and Recreational component

The Environmental and Recreational component of the SWSI Update will focus on the development of two tools:

1. Environmental and Recreational Database Update
2. Environmental and Recreational FlowTool

Environmental and Recreational Database Update

During the SWSI 2010 process, basin roundtables identified projects and methods required to meet the nonconsumptive needs identified as part of their Needs Assessment and focus area development process. In 2010, CWCB developed a survey to collect information on existing or planned nonconsumptive projects, methods and studies. In addition, CWCB facilitated numerous meetings to gather additional data from stakeholders.

A database was developed in 2010, known as the "Nonconsumptive Needs Database" to help manage the nonconsumptive data received by basin roundtables and other stakeholders. The database included information related to nonconsumptive attributes, projects, and protections.

A significant focus of the SWSI Update will be enhancing the Nonconsumptive Needs Database (note that it is being renamed the "Environmental and Recreational database" in the SWSI Update). The update of the Environmental and Recreational database (E&Rdb) will include the following improvements:

Overall Goal	Action and Results
Enhanced Technical Foundation	Data loading processes will be consistent and streamlined to add efficiency and improve data quality.
	The Source Water Route Framework will be implemented as a common spatial unit to provide statewide consistency.
Engaging and Meaningful User Experience	Excel-based templates for data entry will be developed, which will improve uniformity of data and add efficiency.
	Standard reports will be developed to enhance consistency of data retrieval.
	An on-line mapping tool will be developed to increase ease of use and enable visualization of database content.
	User feedback will be collected to identify improvements.
Integration into Colorado Water Planning Processes	Database content will be improved and expanded to include project identification, project descriptions, dates, etc. making it more useful and meaningful for planning purposes.

The updated database will use the Source Water Route Framework as a common spatial unit for statewide consistency

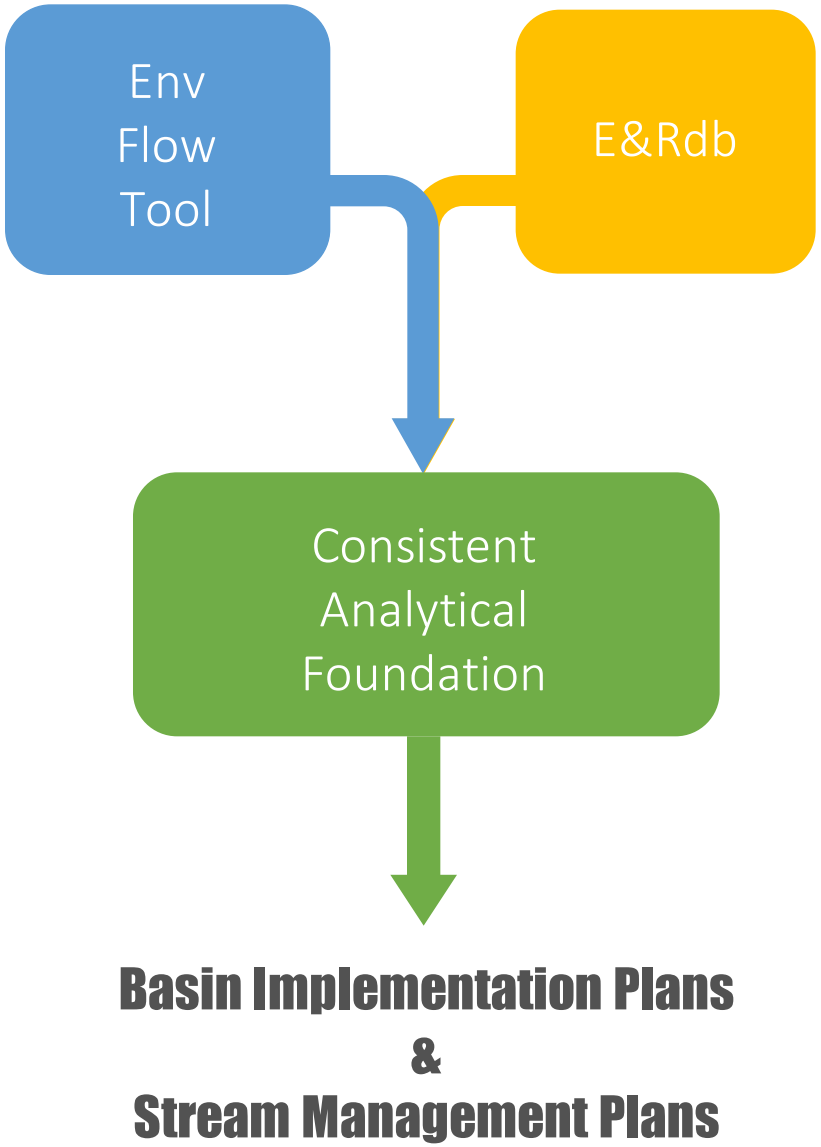
CDM Smith

Presentation by
Becky Dunavant
www.cdmsmith.com

Webinar Agenda

Environmental & Recreational Tools

- Methodology Review
- Database Update
  - Previous Efforts
  - Current Enhancements
- Environmental Flow Tool
  - What it is/is not
  - Overview and Data Inputs
  - Output Summary



Environmental and Recreational Methodology

- The Technical Update of the Environmental and Recreational Methodology focused on tool development including:
  - Enhancements to the *E&R Database* and
  - Development of an *E&R Flow Tool*.

Method/Tool 1

Environmental and Recreation Database Update

- Based on 3 success factors:
- Enhanced Technical Foundation
- Engaging and Meaningful User Experience
- Integration into Colorado Water Planning Process

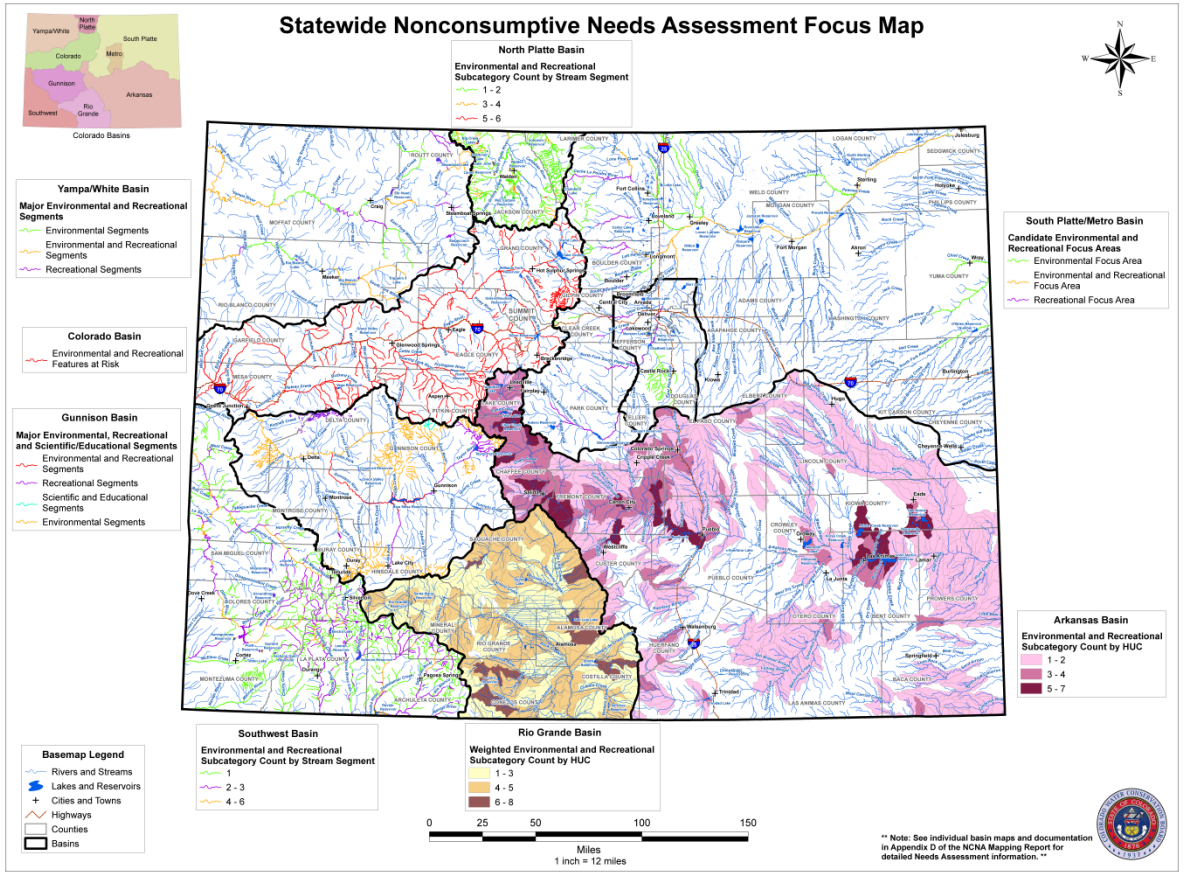
Method/Tool 2

Environmental Flow Tool

- Aid in E&R project refinement, categorization, and prioritization
- Assess variation across Planning Scenarios

Environmental and Recreational Database – Previous Efforts

- SWSI 2010 Nonconsumptive Needs Assessment
- SWSI 2010 Nonconsumptive Projects and Methods
- Nonconsumptive Needs Assessment Database



Environmental and Recreational Database Update

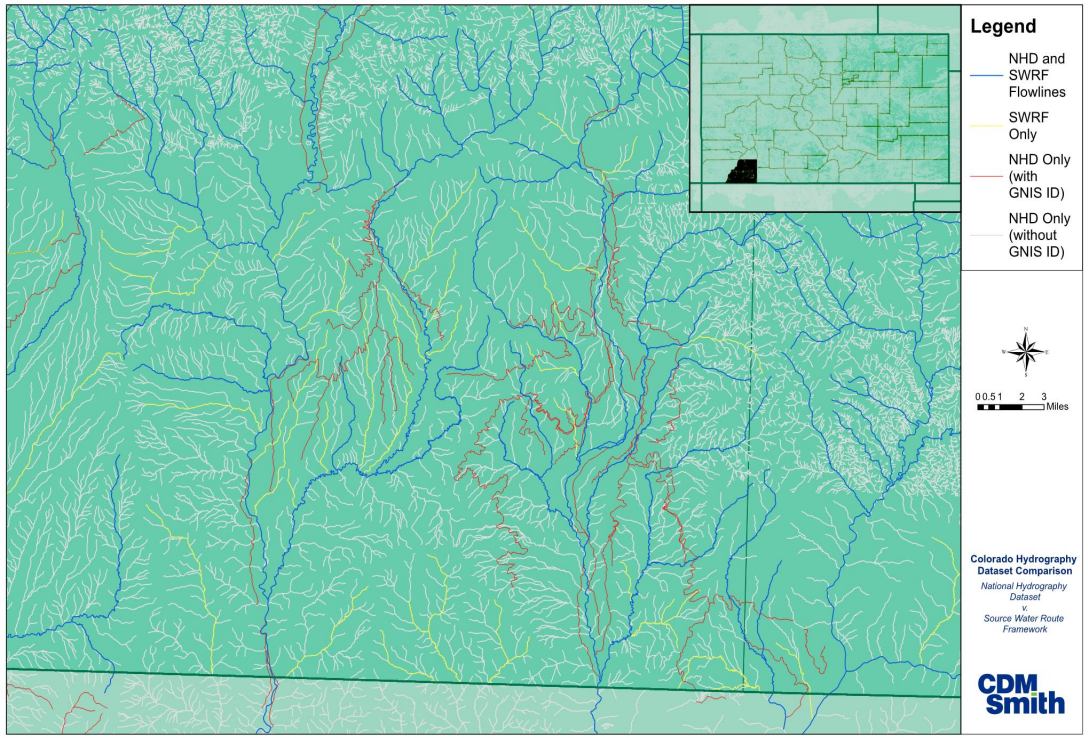
Environmental and Recreational Database Update – Enhanced Technical Foundation

Update Data Loading Processing Procedures

- User Guide
- Streamlined data loading process through Excel templates
- Facilitates transparency with data processing
- Increases quality and consistency of data

Update Spatial Unit Analysis

- Uses both USGS NHD and Source Water Route Framework (SWRF) segment IDs
- Data linked to stream segment and HUC



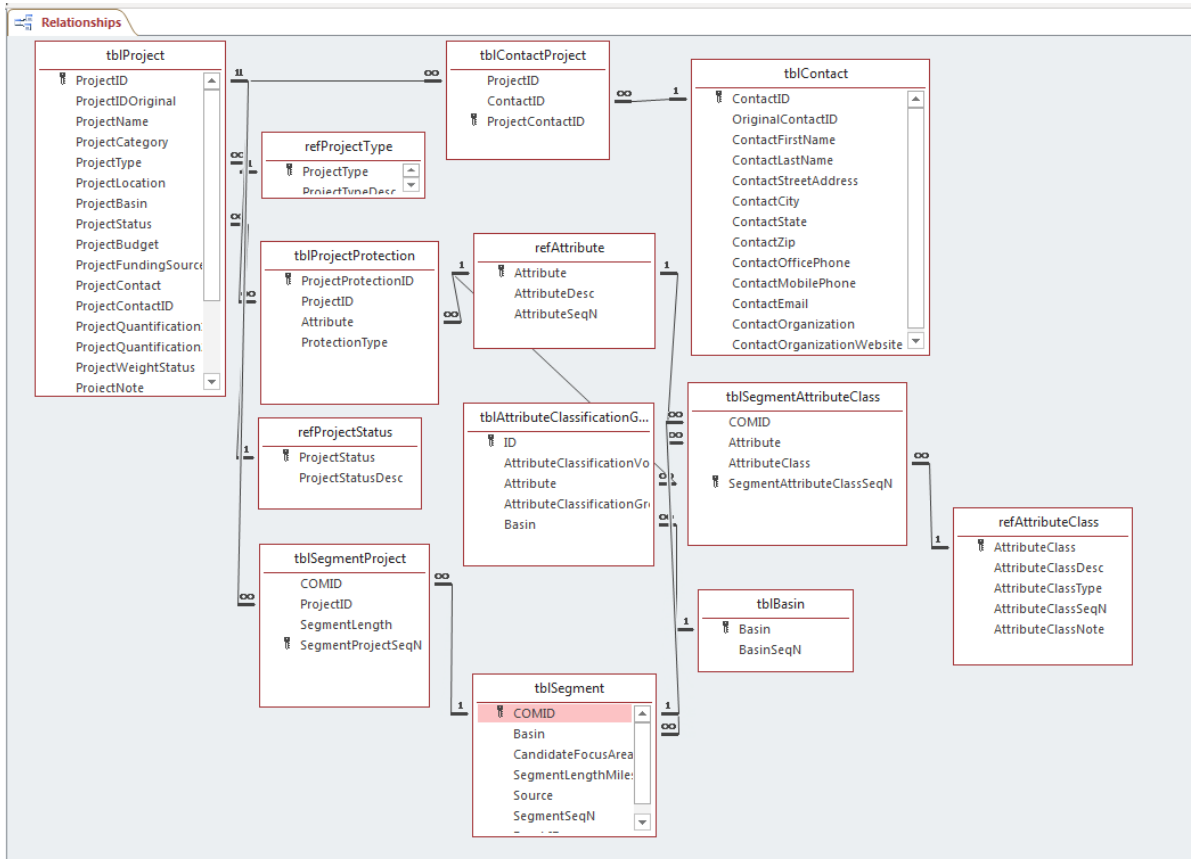
Environmental and Recreational Database Update – Engaging and Meaningful User Experience

Excel-based Templates

- Use of a common, well-known platform
- Ability to utilize validation functions to increase data integrity
- Streamline data loading process

Ease of loading or retrieving database information

- Consistent, replicable reporting process for all users



Database Tables and Relationships

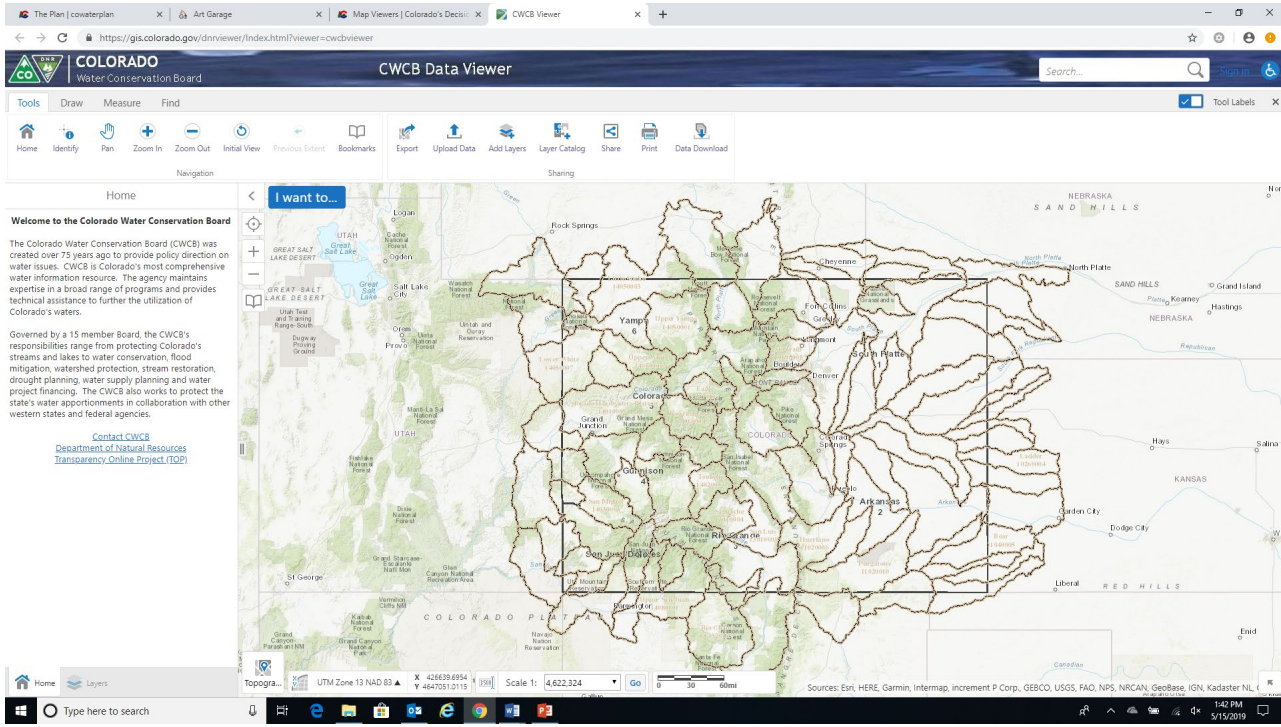
Environmental and Recreational Database Update – Engaging and Meaningful User Experience

Online Mapping Tool

- Supported through CWCB web-based GIS viewer
- Helps visualize and retrieve data in a meaningful manner

Feedback from users

- Technical Advisory Group (TAG) process during methodology development
- Additional feedback solicited to gauge usefulness and future needs.



https://gis.colorado.gov/dnrviewer/Index.html?viewer=cwcbviewer

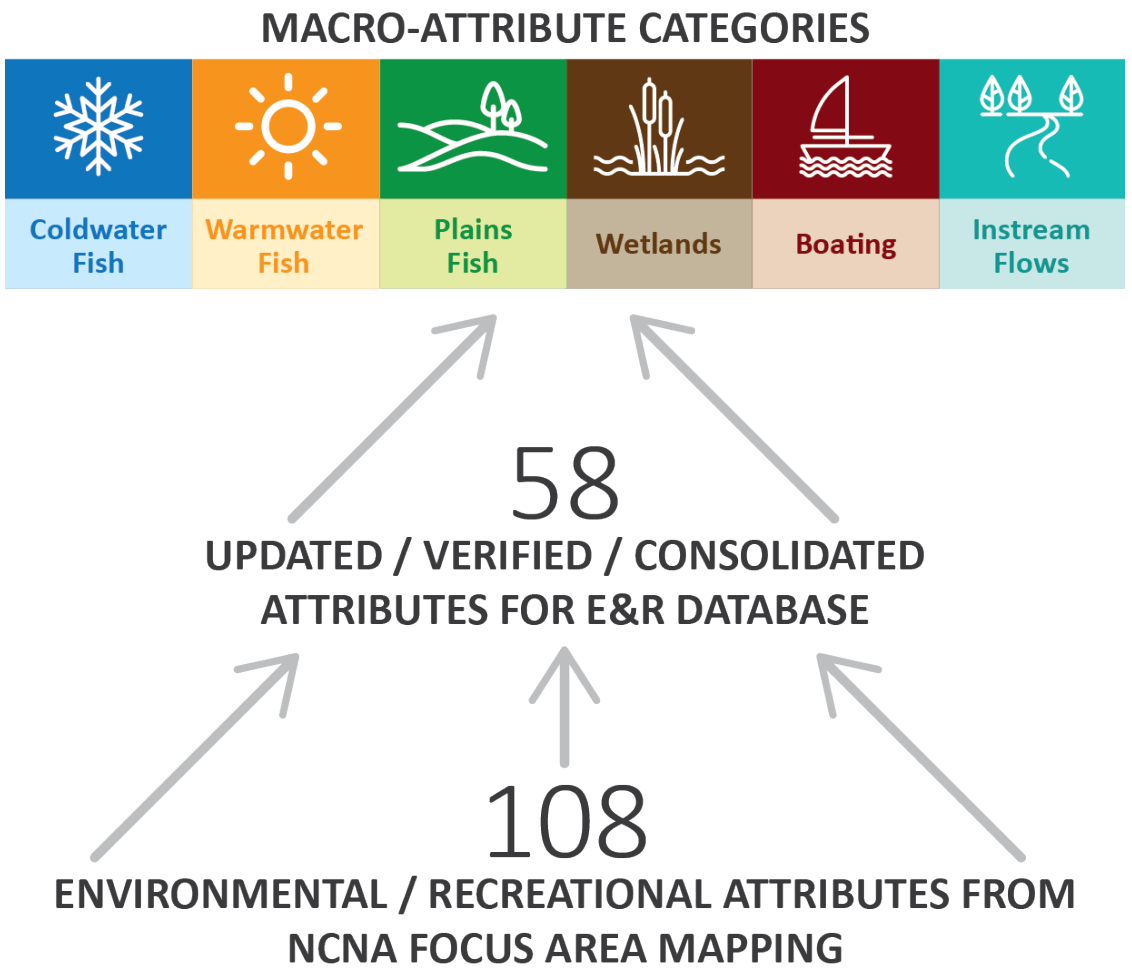
Environmental and Recreational Database Update – Integration into Colorado's Water Plan Process

Improve Database Content

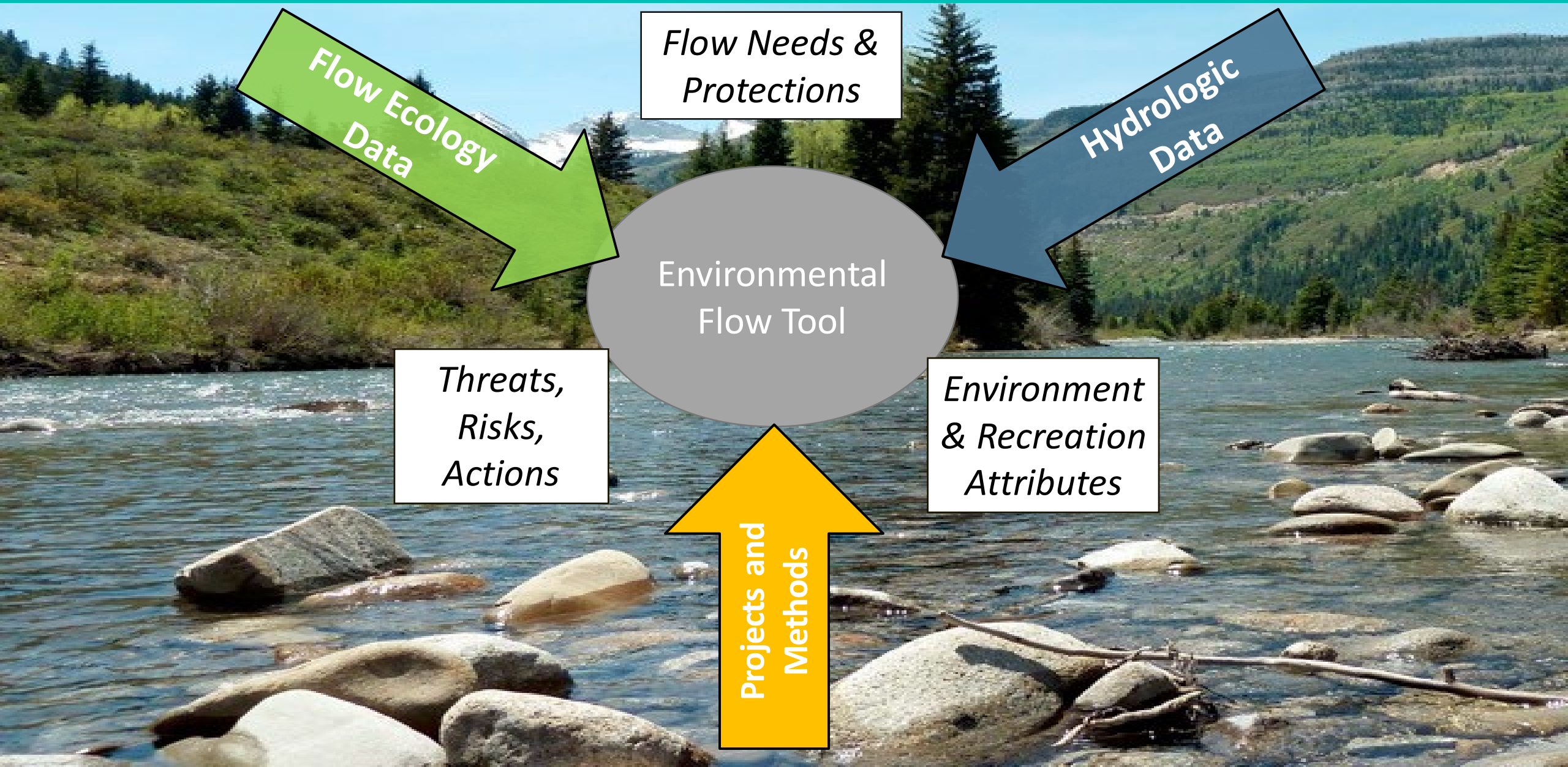
- Attributes have been consolidated, duplicates removed, categorized into "macro-attributes"
- Spatial data updated through agency-supported, publically-available GIS sources

Expand Available Project Information

- Historical E&Rdb Projects data linked through archives
- Excel-based templates created to ensure adequate and consistent Project information loaded to future iteration of E&R DB



Environmental Flow Tool



Environmental Flow Tool

What it is :

High-level tool that :

- Builds on previous efforts - Watershed Flow Evaluation Tool (WFET)
- Post-processes DSS projections to provide summaries of changes in monthly flow regime at pre-selected locations under different planning horizons
- Identifies potential risks through flow-ecology calculation projections
- Serves as a complementary tool to the DSS to refine, categorize, and prioritize projects
- Provides guidance during Stream Management Plan development and BIP development

Environmental Flow Tool

What it is not:

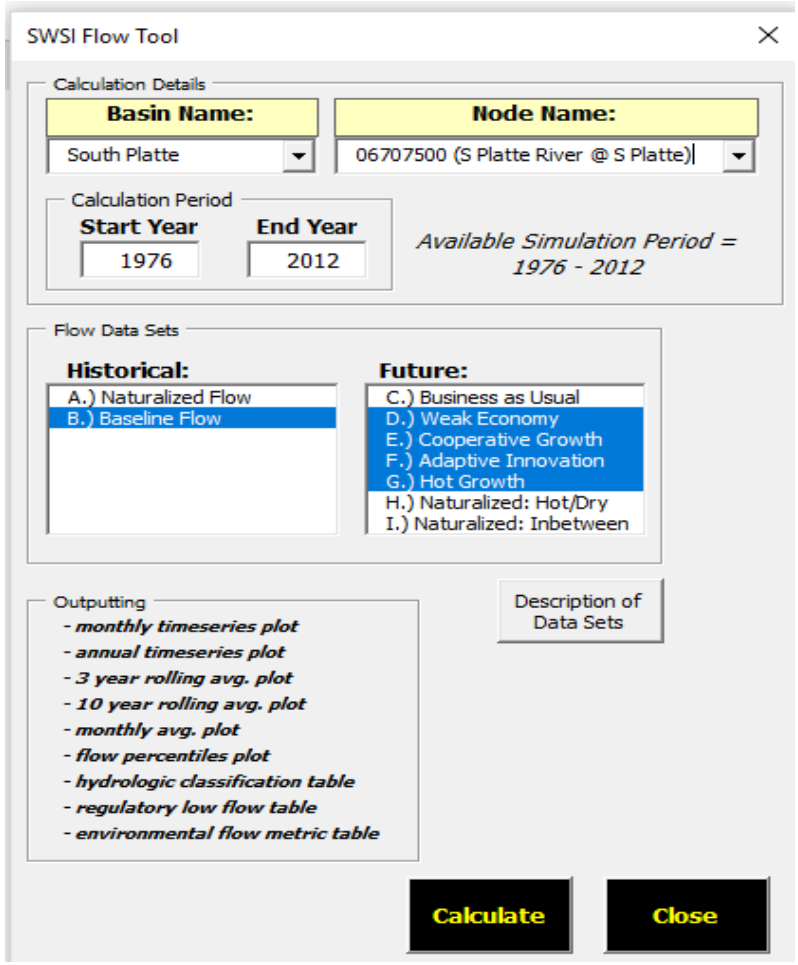
The Tool is *NOT* Prescriptive

- Does not designate any gap values
- Does not provide the basis for any regulatory actions
- Does not identify areas where ecological change may be associated with factors other than streamflow
- Does not provide results as detailed or as accurate as a site-specific analysis

Environmental Flow Tool

Software Overview

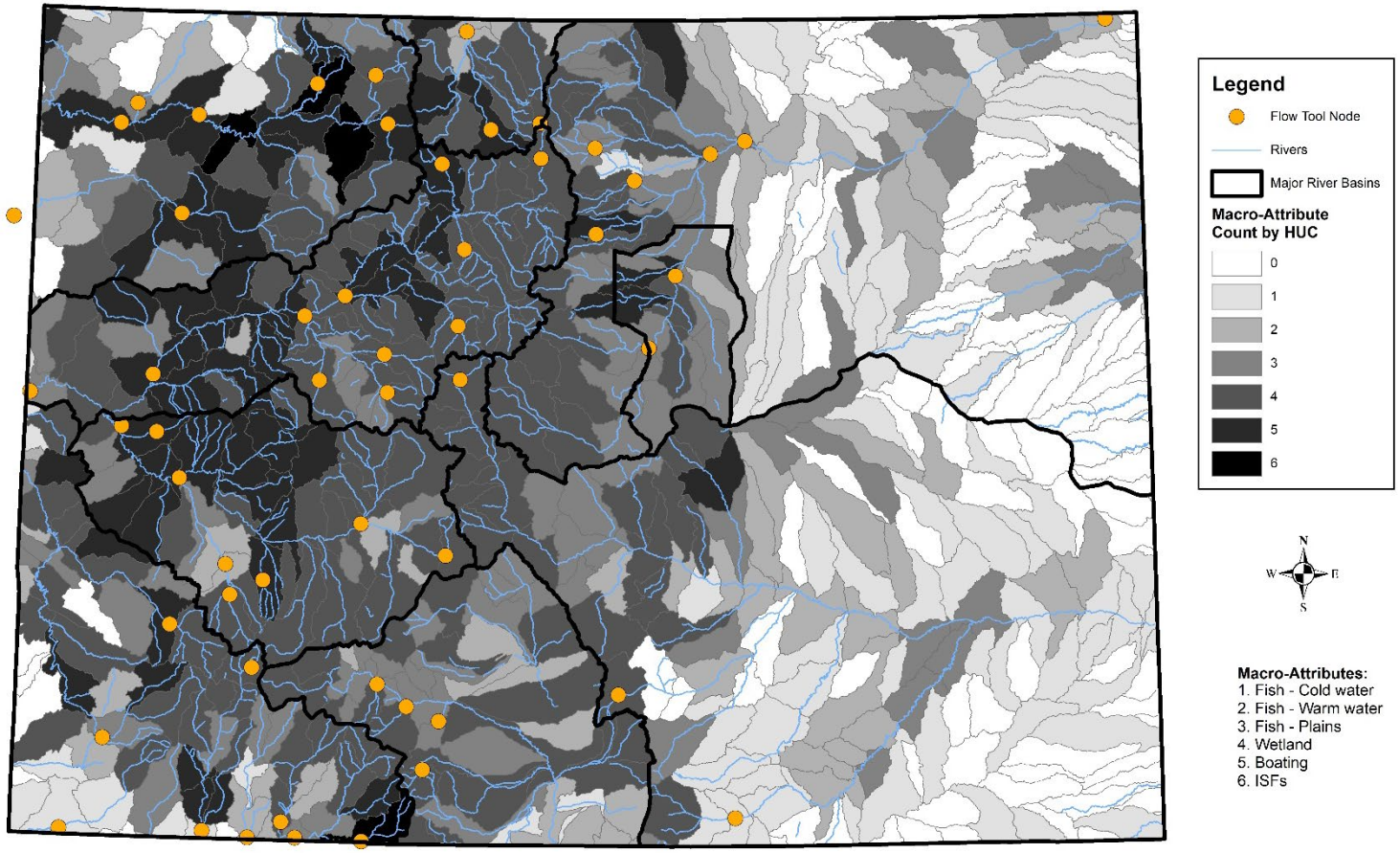
- Visual Basic for Applications, Excel workbook
- User-friendly form-based interface functionality
- User-defined node, scenario(s), and calculation period



Environmental Flow Tool – Data Inputs

Flow Tool Nodes:

- Presence of E&R Attributes
- Spatial consideration by basin
- Data Availability (completeness, period of record)

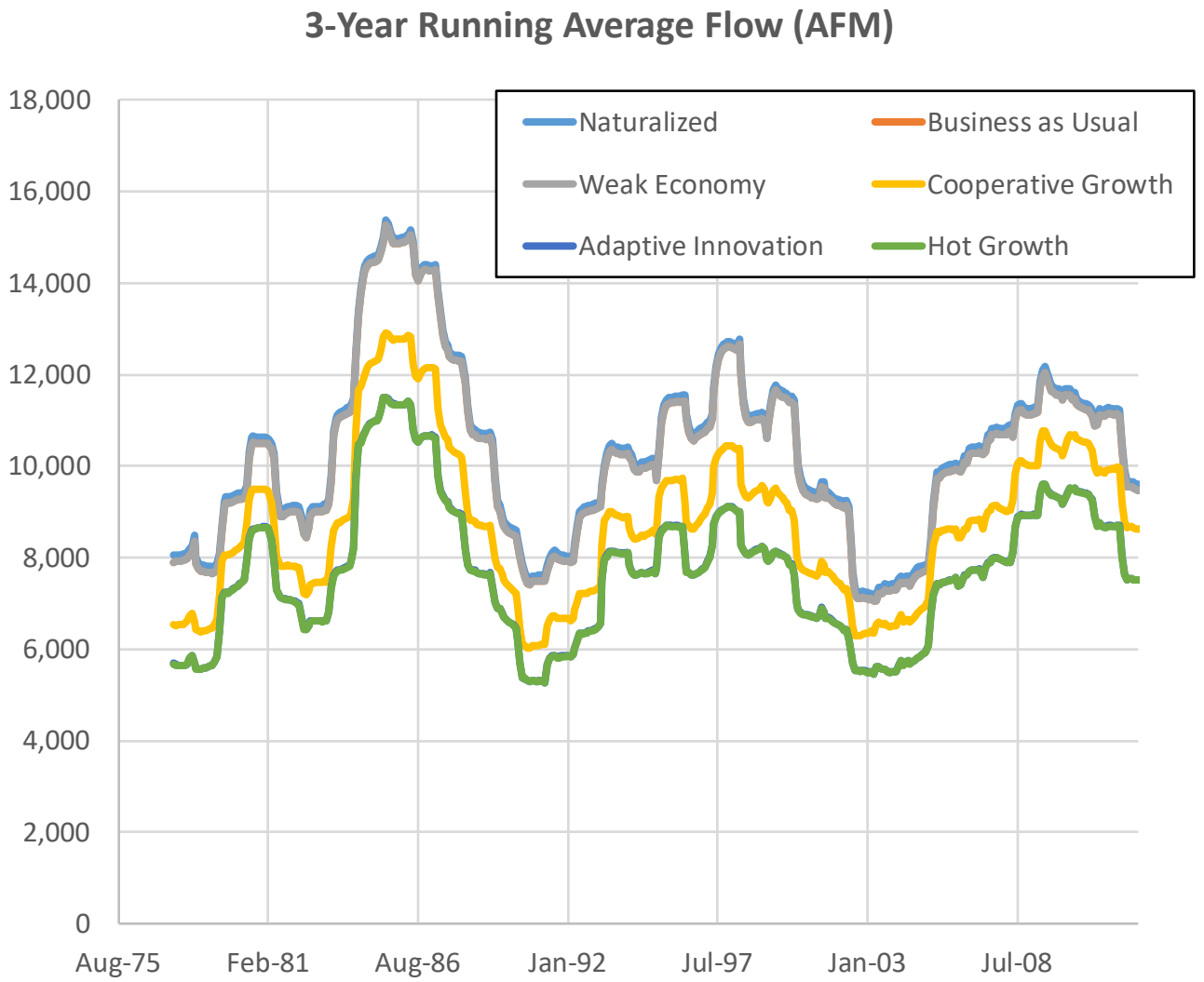


Environmental Flow Tool – Data Inputs

Modeled Flow Data:

- Monthly time-step
- Includes baseline, naturalized, and the 5 planning scenarios* (from the Colorado Water Plan)

**Arkansas and Rio basins do not have models*



Environmental Flow Tool – Data Inputs

Flow-Ecology Relationships:

- Drawn from the Watershed Flow Evaluation Tool reports (developed in SWSI 2010), the Nonconsumptive Toolbox, and the Nonconsumptive sections of the Water Plan.
- Relationships reviewed and refined with TNC for Coldwater/Warmwater/Plains Fish, Riparian, Instream Flow Rights, and Boating (recreational in-channel diversions).
- Relationships include risk classes based on percent change to key metrics.

Environmental Flow Tool

Output Summaries:

- Flow statistics
- Environmental Flow Analyses
- Impairment Anomalies Chart
- Hydrologic Classification Table
- Regulatory Low Flow Table

Flow Metric	*Naturalized*	*Scenario 1: Business as Usual*	*Scenario 2: Weak Economy*	*Scenario 3: Cooperative Growth*	*Scenario 4: Adaptive Innovation*	*Scenario 5: Hot Growth*
Cold Water Fish Baseflow Fraction: Aug, Sep						
Change in Peak Flow, for Wetland Plants						
Change in Max Sucker Biomass						
Change in Peak Flow, for Warmwater Fish						
Change in Average Annual Flow						
Change in Average Winter Flow						
Change in Average Late Summer Flow						

Color Key:

- *= low ecological risk due to changes in flow*
- *= moderate ecological risk due to changes in flow*
- *= less moderate ecological risk due to changes in flow*
- *= high ecological risk due to changes in flow*
- *= very high ecological risk due to changes in flow*


QUESTIONS ?
CO
COLORADO