COLORADO'S
Decision Support Systems
CWCB / DWR

Arkansas River Decision Support System (ArkDSS) Update

Project Manager:	Brian Macpherson, P.E., CWCB
Technical Lead:	Kelley Thompson, P.E., DWR
Div2 Project Manager:	Bill Tyner, P.E., DWR
Colors of Water PM:	John Rogers, P.E., DWR
Critical Staff:	DWR Division 2 Staff, OIT App Dev

ARCA Annual Meeting / Engineering Committee – December 7, 2022

ArkDSS Progress

COLORADO'S Decision Support Systems
CWCB / DWR

- Phase I:
  - GIS ✓
  - Admin Tools ✓
  - Modeling
    - Evapotranspiration Dataset ✓
    - Surface Water Model **IN PROGRESS**
      - Wilson Water Group
- Phase II:
  - Colors of Water and Forecasting Tool **IN PROGRESS**
  - Groundwater **PLANNING**

ArkDSS – Where to find Materials

COLORADO'S Decision Support Systems
CWCB / DWR

- Admin Tools: div2waterops.com
  - Colors of Water Training Video: drive.google.com/file/d/17SEJWtmoA2x5GgjQEKqpamjHuZA0siBH/view
- GIS and Aerial Photos: cdss.colorado.gov/gis-data/division-2-arkansas
- Modeling Documentation/Memos and ET dataset: cdss.colorado.gov/arkansas-river-dss

ArkDSS Surface Water Model

COLORADO'S Decision Support Systems
CWCB / DWR

- Developing using standard Colorado DSS approach
- StateMOD platform; publicly available (i.e. for free) on CDSS website
  - StateMOD models have been developed for all other major Colorado basins
  - Allocates water based on water rights (prior appropriation), agricultural and M&I demands, capacities, and operations
  - Uses crop irrigation requirements (CIR) to determine depletions and return flows
  - Estimates natural flows (baseflow) by removing effects of man
- Data collection and processing complete
- Most code development completed, some refinements ongoing
- Currently in calibration of historical model
  - Compare simulated results from the model to measured data at streamflow gages, diversions, and reservoir contents
  - Adjust primarily return flows and operations to improve calibration
- Baseline dataset will be developed to use for “What-If” scenarios

New Model Operations

COLORADO'S Decision Support Systems
CWCB / DWR

- Winter Water Storage Program
  - Track WWSP supplies stored in numerous reservoirs, releases by a variety of users, and carry-over supplies
- Fryingpan-Arkansas Project Operations
  - New Features to allocate/track use in three reservoirs plus allow upper reservoir releases for VFMP or for draw-down to meet intermediate demand and captures in Pueblo Reservoir
- John Martin Reservoir Storage
  - Baseflow portion of gaged flow at Las Animas and all of Purgatoire River stored in Conservation Storage account
  - Enhanced Baseflow portion of Las Animas gaged flow stored in Other account
- Trinidad Project Operations
  - Store over the winter and distribute stored water to accounts
  - During summer, check Project Account storage to determine if Project Administration or "Empty"
    - **Project Administration**- Account for water available under all Project Ditch water rights, Meet Hoehne Ditch demand, limited to 5,028 af, Divide up remaining water to each Project Ditch based on acreage and divert water to meet irrigation demand
    - **Project "Empty"**- Divert water under each Project Ditch's water rights to meet their own demand
  - Release water from Project Accounts to meet remaining demand
  - Book any remaining water from Project Ditch's Accounts back to the Project Account on Oct. 15th

COLORADO'S
Decision Support Systems
CWCB / DWR

ArkDSS Surface Water Model
Expected Timeline Before 2023 ARCA Mtg

- Next 6-9 months
  - Wrap up code refinements
  - Wrap up calibration of historical model
  - Develop Baseline Dataset
- In 9-12 months
  - Begin work on Trinidad Project Scenario
  - Coordinate and receive input on initial Scenario Modeling Methodologies developed by Consultant

ArkDSS - Phase II Colors of Water

COLORADO'S Decision Support Systems
CWCB / DWR

GOALS:

1. **Transparency to water users and public – Viewer**
   - Show colors of all water in river in front of nodes (ie headgates etc)
2. **Tools to aid river administration – Scenario Planner**
   - Potential reservoir releases - Evaluate transit loss and design release or diversions patterns
   - Exchanges – Evaluate exchange conditions through exchange reaches
3. **Enterprise solution**
   - Sustainable system for Division 2 and usable in other Colorado basins

ArkDSS - Phase II Colors of Water

COLORADO'S Decision Support Systems
CWCB / DWR

Transit Loss / Timing Model Engine

- Routing – Muskingum type
- Transit Loss - bank storage, evaporation, capture rules
- Network – nodes and reaches
- Livingston framework and routing/aquifer parameters
  - parameters recalibrated using calibration tool

Hydrobase

- release, diversion, telemetry records
- model output
- Network locations
- web interactions

Web Tool

- Data Viewer
- Scenario Planner
- Conductor / Manager

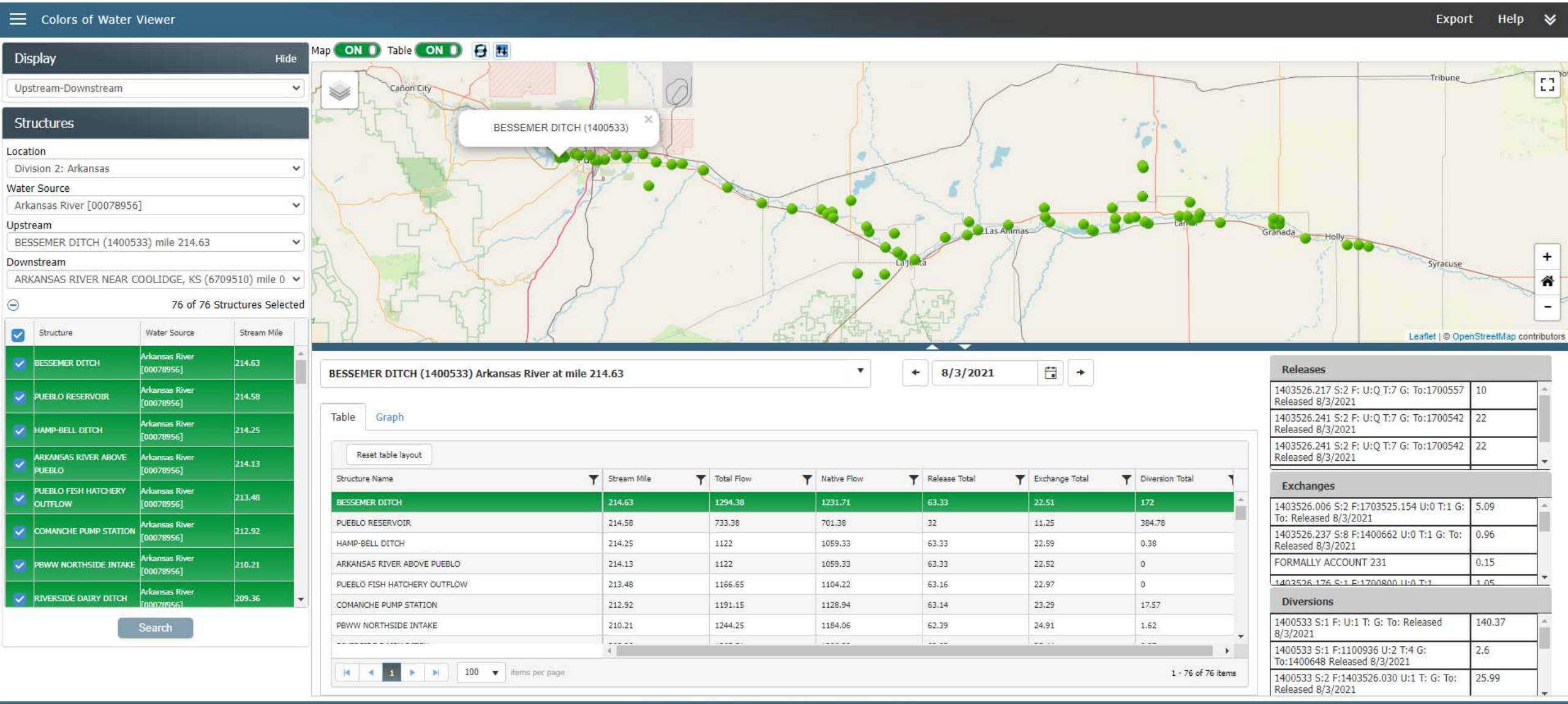
ArkDSS - Phase II Colors of Water

COLORADO'S Decision Support Systems
CWCB / DWR

- **ArkDSS + Bureau of Reclamation SmartWater Grant**
  - Initiated 2022, expected completion by end of 2023
  - Brown & Caldwell
    - assisting with calibration, forecasting, evaluation, documentation
  - DWR – development of model engine code
    - Initial code for viewer output complete
    - Reservoir release scenario planning code under development
  - Colorado OIT App Dev – development of web tools
    - Initial Web Viewer Built and under testing/evaluation

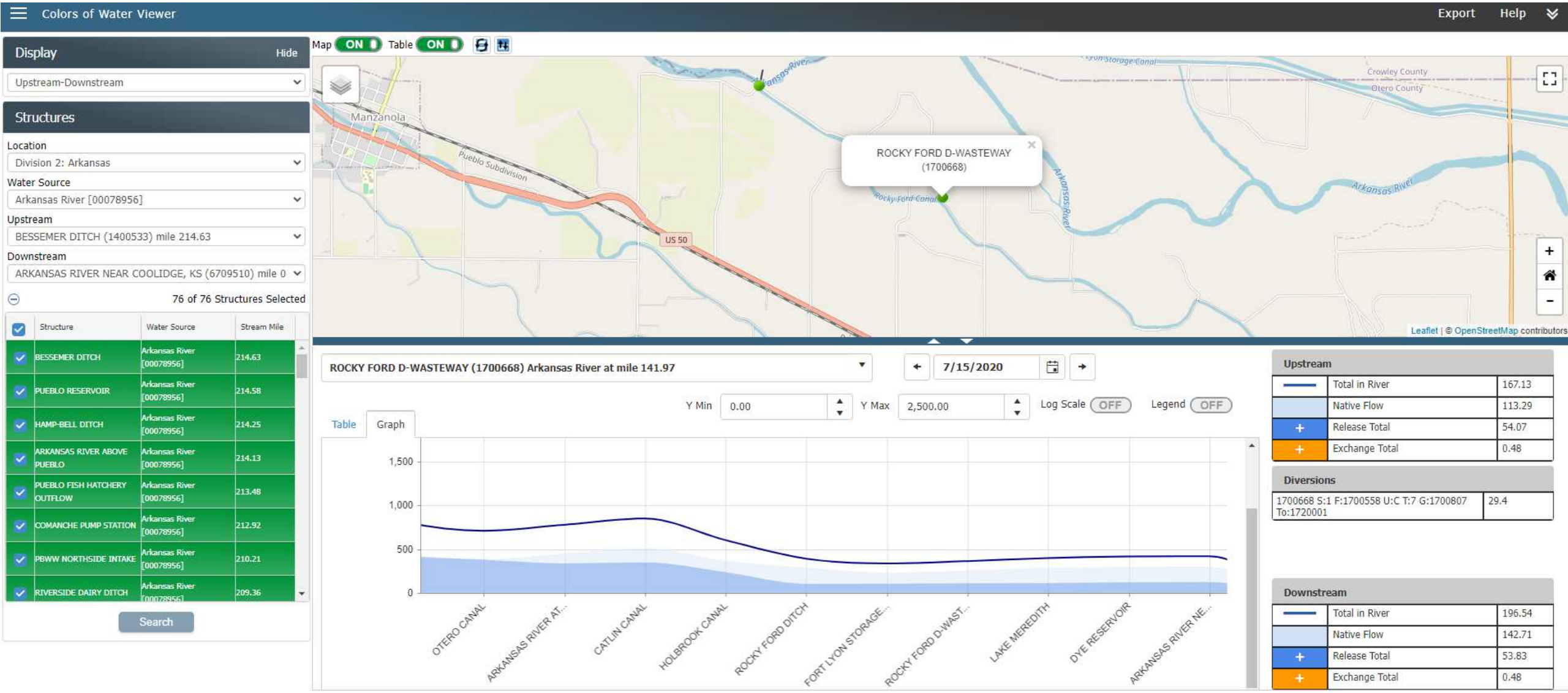
Colors of Water – Viewer

COLORADO'S
Decision Support Systems
CWCB / DWR



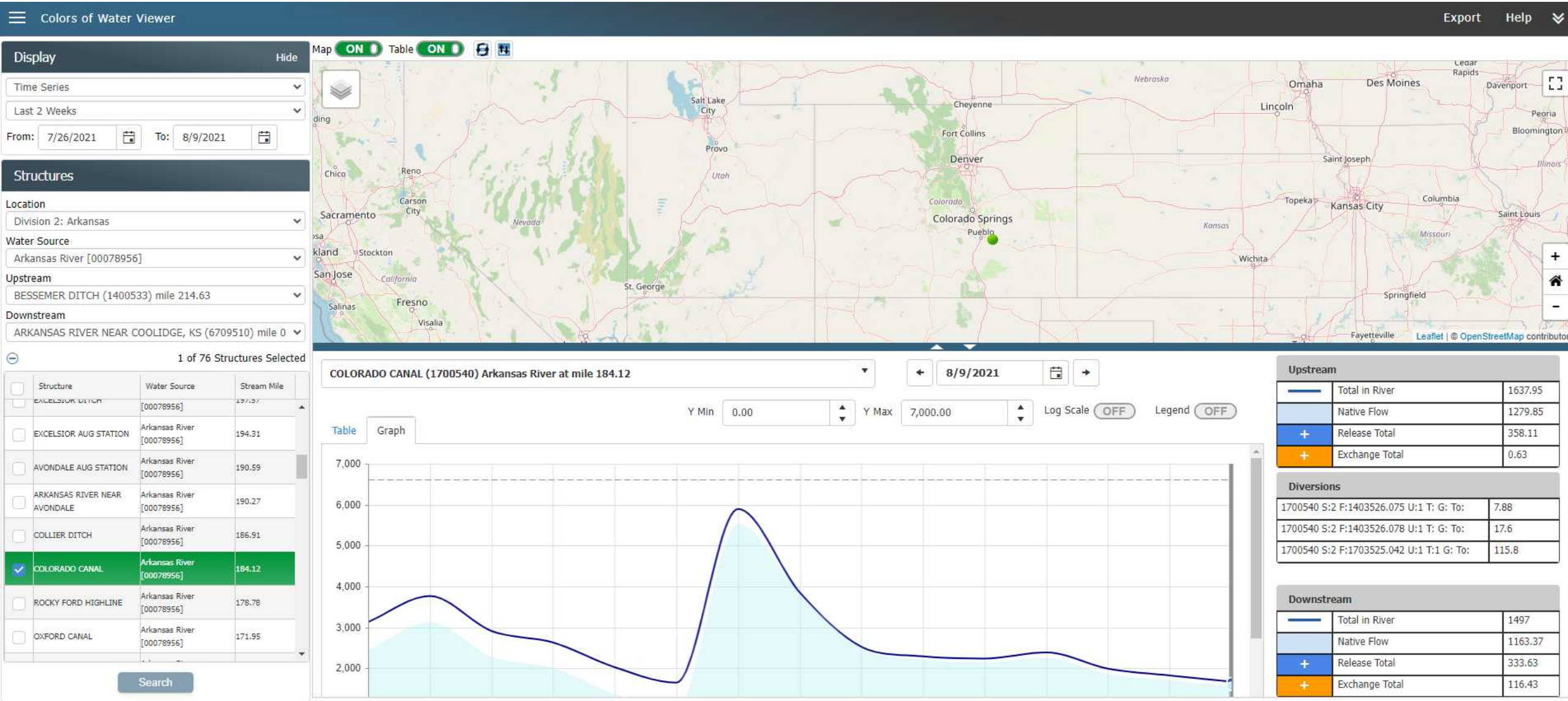
Colors of Water – Spatial View

COLORADO'S
Decision Support Systems
CWCB / DWR

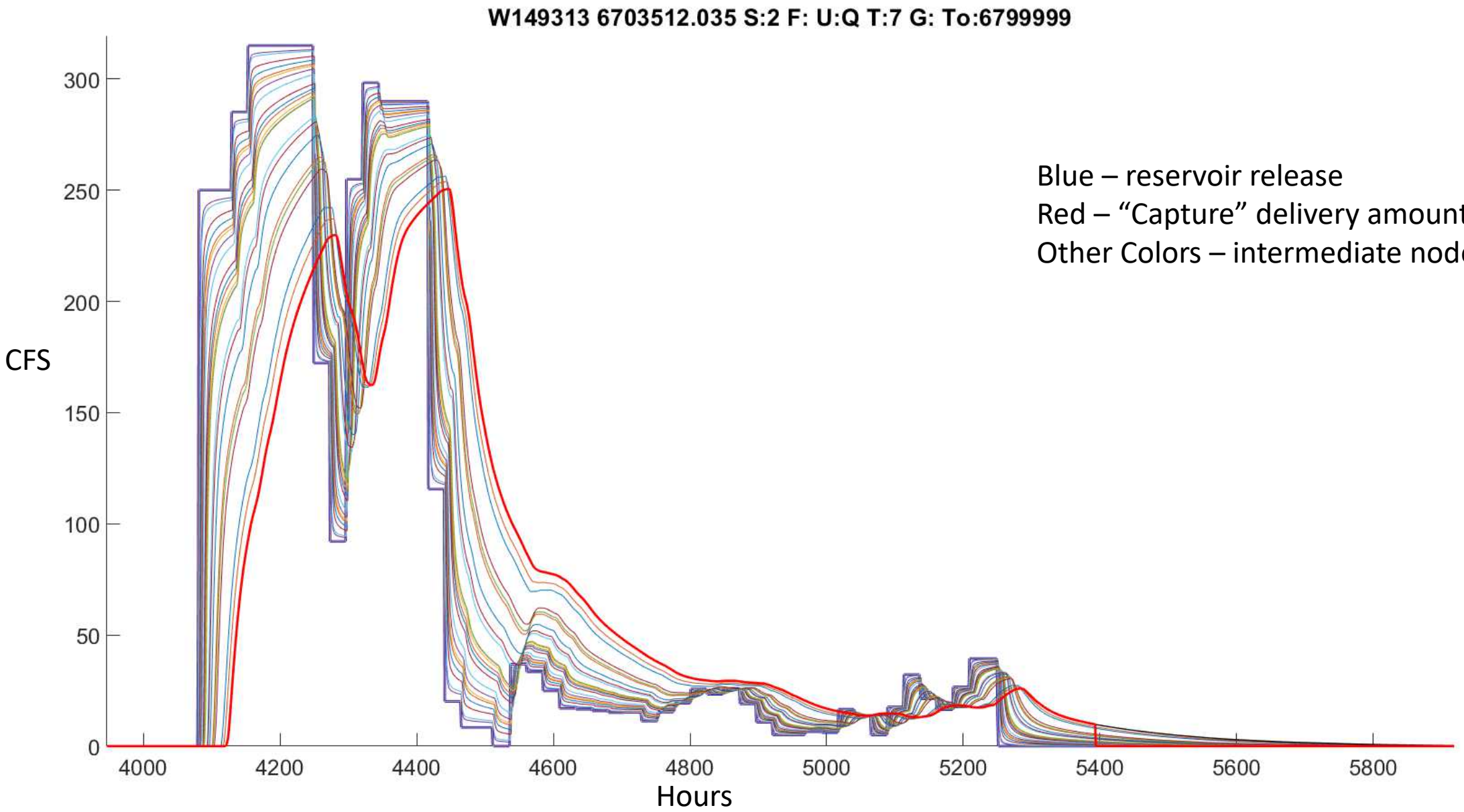


Colors of Water – Time Series View

COLORADO'S Decision Support Systems
CWCB / DWR

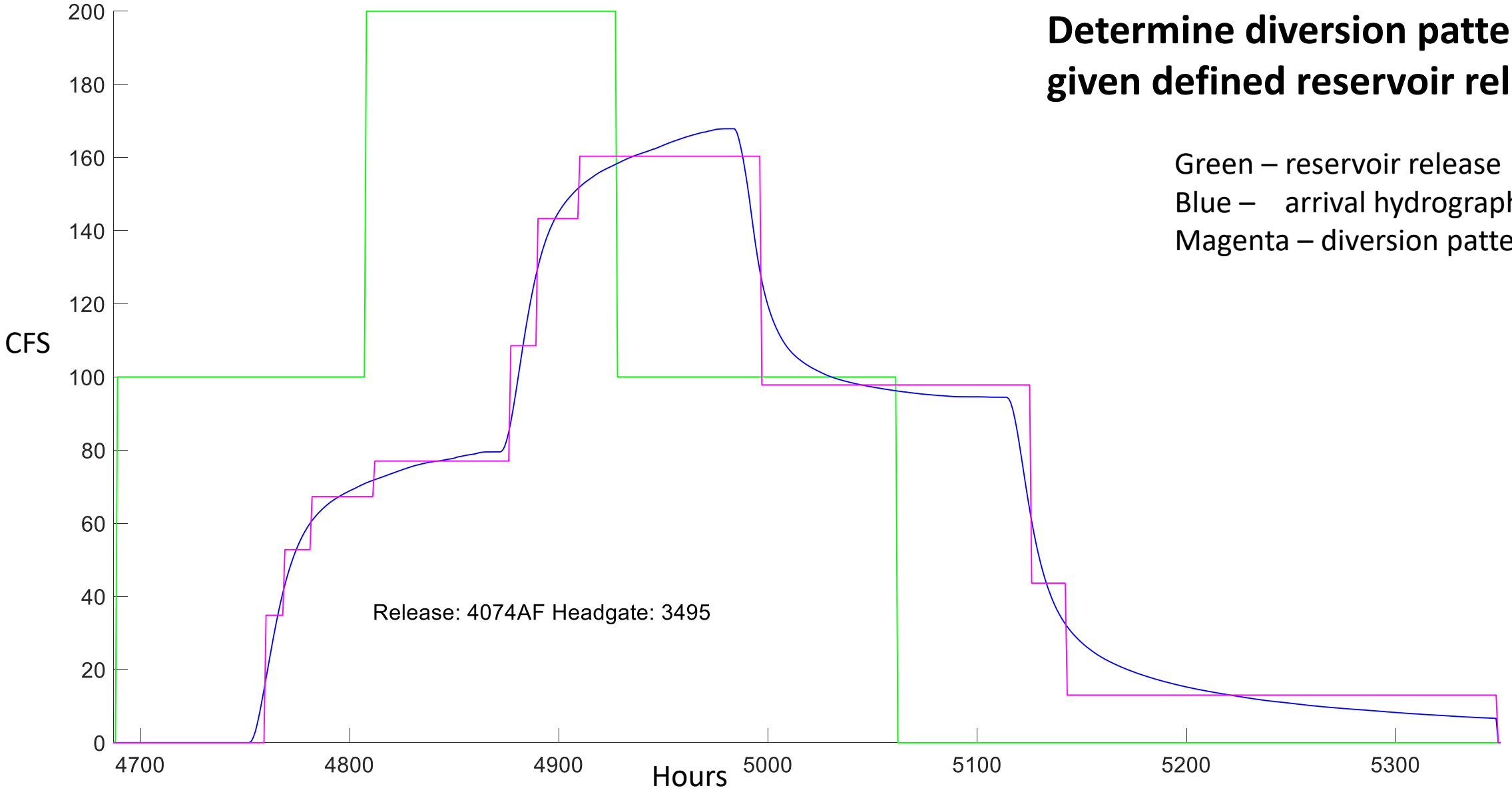


Colors of Water – Transit Losses



Blue – reservoir release
Red – “Capture” delivery amounts
Other Colors – intermediate nodes

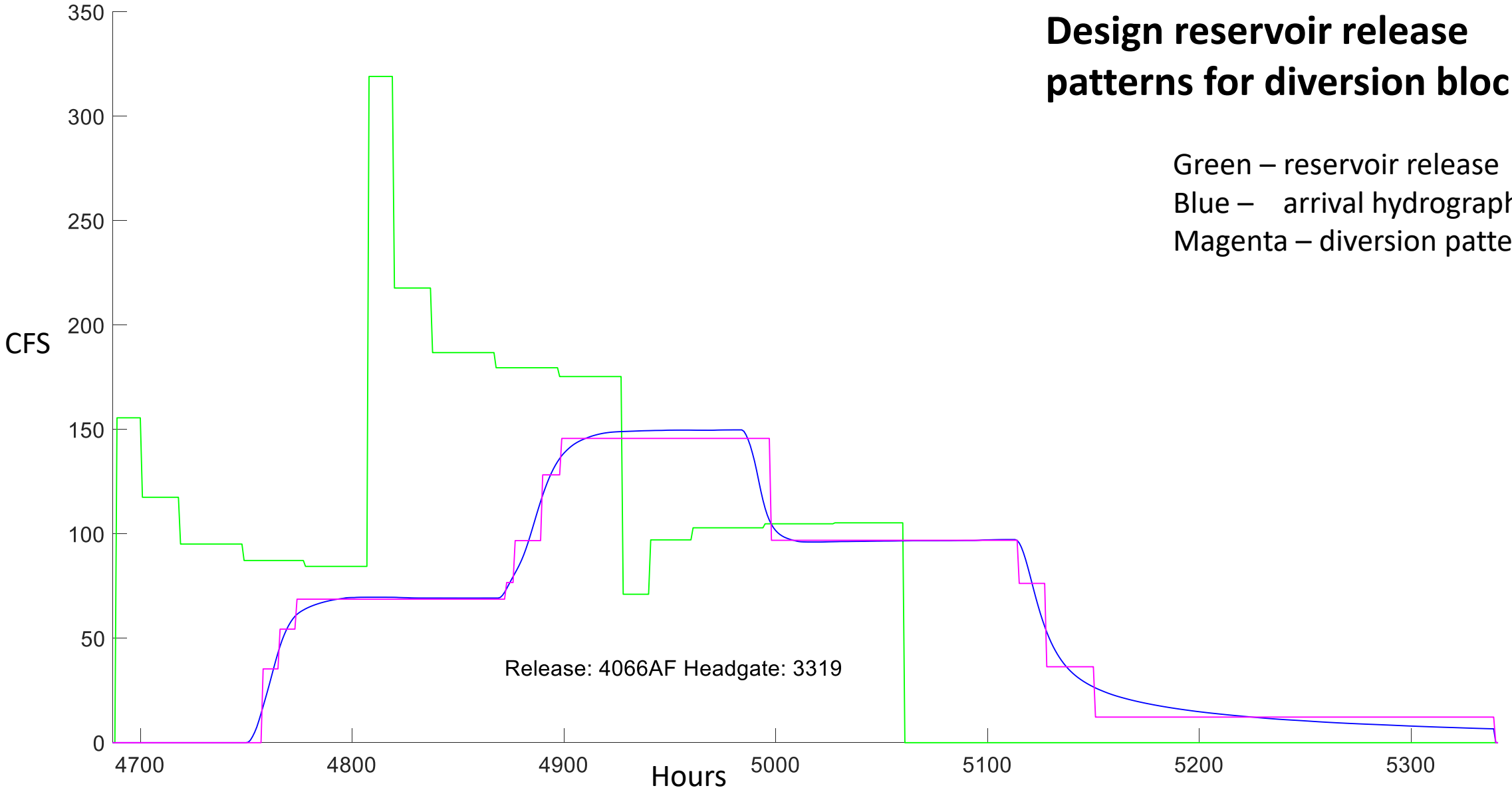
Colors of Water – Scenario Planner



Determine diversion pattern given defined reservoir release

Green – reservoir release
Blue – arrival hydrograph
Magenta – diversion pattern

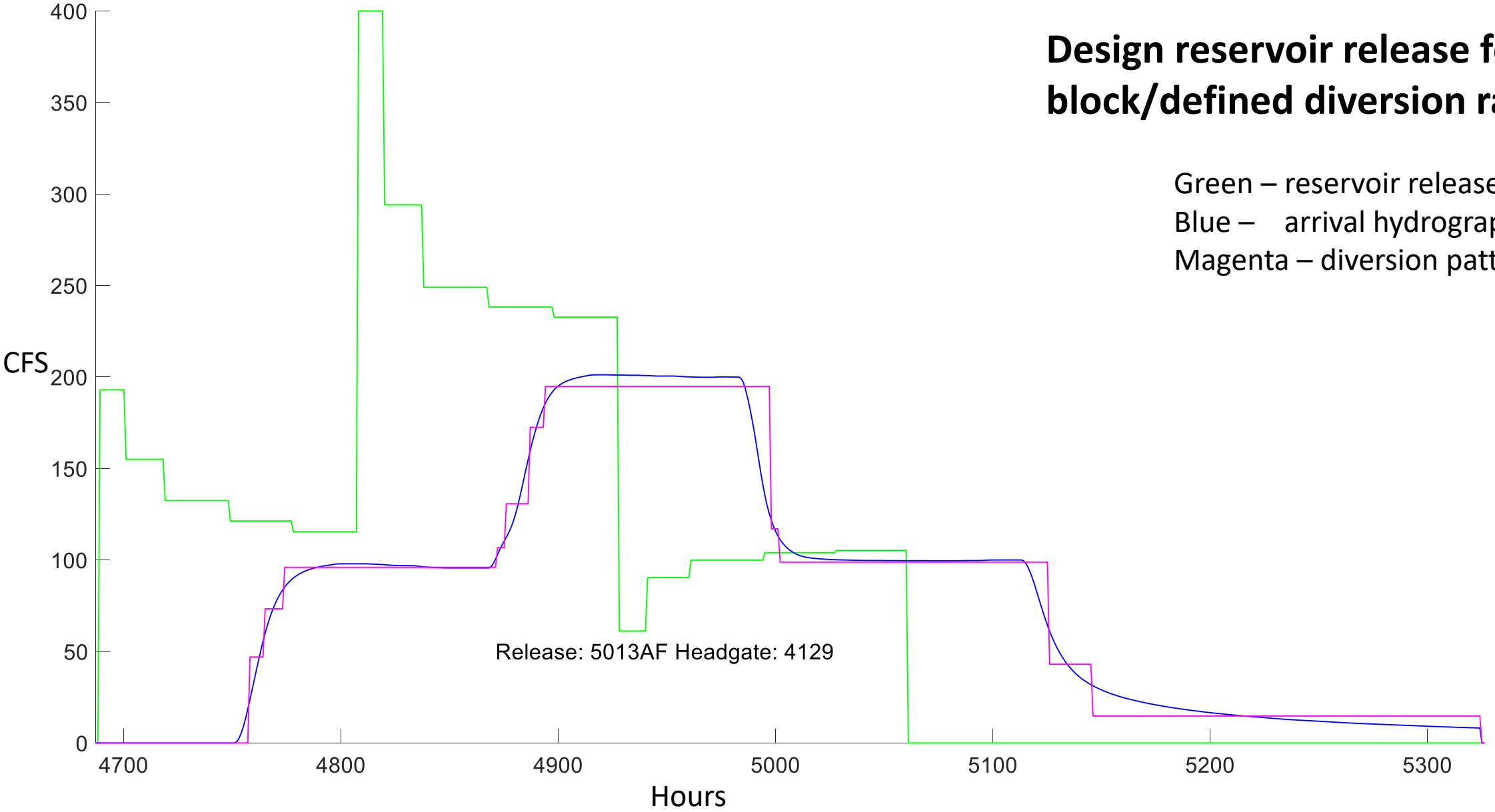
Colors of Water – Scenario Planner



Design reservoir release patterns for diversion blocks

Green – reservoir release
Blue – arrival hydrograph
Magenta – diversion pattern

Colors of Water – Scenario Planner



Design reservoir release for block/defined diversion rates

Green – reservoir release
Blue – arrival hydrograph
Magenta – diversion pattern

ArkDSS –Groundwater Component

COLORADO'S Decision Support Systems
CWCB / DWR

- **Additional funding available July 2023**
- **Scope / RFP under development**
  - Phase I
    - Compile Existing Data for Physical Parameters
      - Develop GIS based grids based on compiled data
      - Map drain locations and conditions, etc.
    - Evaluate Futile Call Areas and Hydraulic Disconnects
    - Link Administrative Documents Spatially
  - Phase II
    - Fill Identified Data Gaps and Redevelop Aquifer Extents and Grids
      - Install monitoring wells, run aquifer tests, etc.