



COLORADO'S
Decision Support Systems
CWCB / DWR

Arkansas River Decision Support System (ArkDSS) Update

Project Manager: Megan Kramer, CWCB
Technical Lead: Kelley Thompson, DWR
Colors of Water PM: John Rodgers, DWR
Critical Staff: DWR Division 2 Staff, OIT App Dev

ARCA Annual Meeting / Engineering Committee – December 12, 2024

ArkDSS Progress



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- Phase I:
 - GIS ✓ cdss.colorado.gov/gis-data/division-2-arkansas
 - Admin Tools ✓ div2waterops.com
 - Modeling cdss.colorado.gov/arkansas-river-dss
 - Evapotranspiration Dataset ✓
 - Surface Water Model **95% Complete**
 - Trinidad Project Scenario **Late 2025?**
- Phase II:
 - Colors of Water
 - Data Viewer **Deployed – diversion data and tool improvements**
 - Scenario Planner **Deployed – finalizing testing and documentation**
 - Groundwater Data Project **RFP in January 2025**

ArkDSS STATEMOD Model

water right allocation / surface water planning model



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- Done... model structure and input data are complete and the model runs
- Currently.... wrapping up model coding for basin-specific operations
 - Changes for Arkansas highlighted issues / broke models for other basins
 - Current work is to finalize model code that will work for all Colorado basins
 - Have had coder in from California to work in WWG office and may do again soon
- Then... finalize natural flow estimation and model calibration
 - Estimate “natural” flows by removing effects of diversions, RFs, reservoirs, etc
 - Compare simulated results from the model to measured data at streamflow gages, diversions, and reservoir contents
 - Calibrate primarily by adjusting return flows and operations
- Then... finalize documentation and baseline model/dataset
- Then... update full model through 2024
- Then... initiate Trinidad Project Scenario for 2015-2024 period
 - Well behind original schedule but should still be timely for 10-year review

ArkDSS Groundwater Project

developing data and tools, not a new groundwater model



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- **Scope of work ready and RFP issued in January 2025**

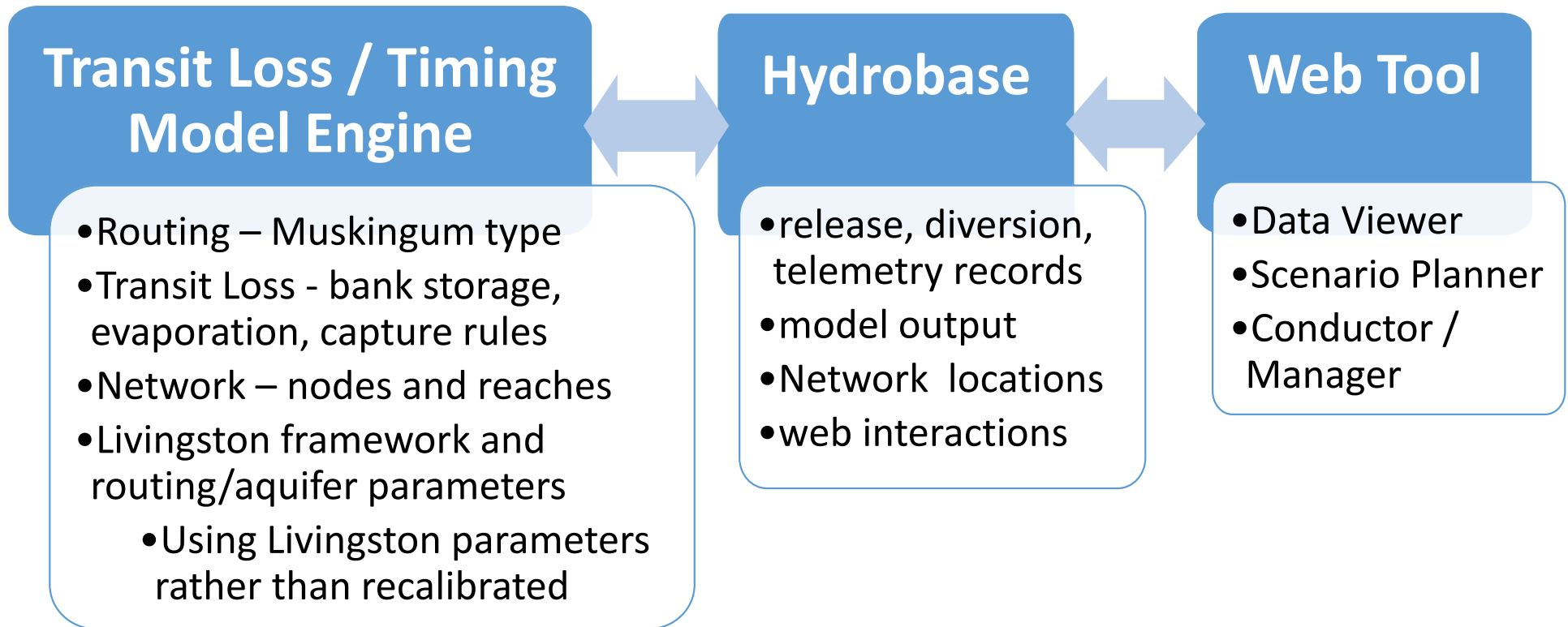
- Upper and Lower basin alluvial aquifers and major bedrock aquifers
- Tasks I and II: Compile existing data for physical parameters
 - Develop GIS based grids of geo., sat.thick, k, S, T and harmonic T
 - Map drain locations and conditions in lower aquifer
 - Collect and catalog KS v. CO hydrogeologic data and model files
 - Identify and fill data gaps, ~ 20 aquifer tests + ~ 20 monitor wells
 - Catalog futile call and hydraulic disconnect areas
 - Link hydrogeologic documents spatially
- Task III: Link Administrative Documents Spatially
 - Map spatial boundaries of aug., administrative, decree, etc areas
 - Link to documents, decrees, wdids, etc

ArkDSS Colors of Water (COW) Tool



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Webtool to evaluate transit losses and display colors of all water in river and to design and evaluate reservoir releases and (eventually) exchanges



ArkDSS Colors of Water Data Viewer



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Visual webtool to evaluate river and release transit losses and display colors of water in river – releases, native, and exchanges, at all primary nodes including in front of headgates

- **Data Viewer Webtool Deployed**

- Currently missing current year release/diversion records
- Just built connection to Pueblo and JMR DWR daily transaction (google sheet) worksheets
 - Will plug into webtool soon after ARCA if Div2 agrees

- **Bureau of Reclamation Water-Smart Grant wrapped up**



Colors of Water – Viewer



Display Hide

Upstream-Downstream

Structures

Location: Division 2: Arkansas

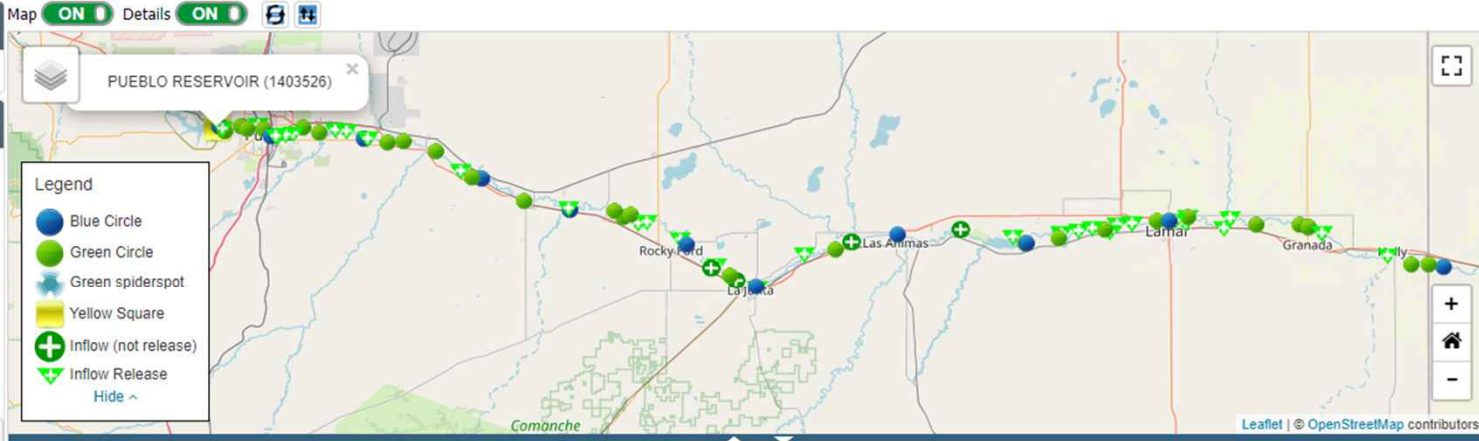
Water Source: Arkansas River [00078956]

Upstream: PUEBLO RESERVOIR (1403526) mile 214.57

Downstream: ARKANSAS RIVER NEAR COOLIDGE, KS (6709510) mile 0

91 of 91 Structures Selected

Structure	Water Source	Stream Mile
<input checked="" type="checkbox"/> PUEBLO RESERVOIR	Arkansas River [00078956]	214.57
<input checked="" type="checkbox"/> HAMP-BELL DITCH	Arkansas River [00078956]	214.25
<input checked="" type="checkbox"/> ARKANSAS RIVER ABOVE PUEBLO	Arkansas River [00078956]	214.13
<input checked="" type="checkbox"/> PUEBLO FISH HATCHERY OUTFLOW	Arkansas River [00078956]	213.48
<input checked="" type="checkbox"/> COMANCHE PUMP STATION	Arkansas River [00078956]	212.92
<input checked="" type="checkbox"/> PBWW NORTHSIDE INTAKE	Arkansas River [00078956]	210.21
<input checked="" type="checkbox"/> RIVERSIDE DAIRY DITCH	Arkansas River [00078956]	209.36
<input checked="" type="checkbox"/> PUEBLO WEST SEWAGE	Arkansas River [00078956]	208.22



PUEBLO RESERVOIR (1403526) Arkansas River at mile 214.57 8/3/2021

Table Graph

Layout: Default layout

Structure Name	Stream Mile	Total Flow	Native Flow	Release Total
PUEBLO RESERVOIR	214.58	733.38	701.38	32
HAMP-BELL DITCH	214.25	1122	1059.33	63.33
ARKANSAS RIVER ABOVE PUEBLO	214.13	1122	1059.33	63.33
PUEBLO FISH HATCHERY OUTFLOW	213.48	1166.65	1104.22	63.16
COMANCHE PUMP STATION	212.92	1191.15	1128.94	63.14
PBWW NORTHSIDE INTAKE	210.21	1244.24	1184.05	62.39

1 - 82 of 82 items

Releases

1403526.217 S:2 F:U:Q:T:7 G:	10
To:1700557 Released 8/3/2021	
1403526.241 S:2 F:U:Q:T:7 G:	22
To:1700542 Released 8/3/2021	

Exchanges

1403526.006 S:2 F:1703525.154 U:0 T:1 G: To: Released 8/3/2021	5.09
1403526.176 S:1 F:1700800 U:0 T:1 G:1707700 To: Released 8/3/2021	1.05
1403526.237 S:8 F:1400662 U:0 T:1 G:1400662 To: Released 8/3/2021	0.96

Diversions

STORAGE RECORD OF STRATMOOR FRY-ARK WATER TRACKED DOWN FOUNTAIN CREEK FOR STORAGE IN PUEBLO RES.	0.17
1403526.234 S:8 F:1101200 U:0 T: G:1107015 To: Released	0.08

Colors of Water – Spatial View



Colors of Water (all values in CFS)
Export Help My Account

Display Hide

Upstream-Downstream

Structures

Location
Division 2: Arkansas

Water Source
Arkansas River [00078956]

Upstream
PUEBLO RESERVOIR (1403526) mile 214.57

Downstream
ARKANSAS RIVER NEAR COOLIDGE, KS (6709510) mile 0

91 of 91 Structures Selected

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<input checked="" type="checkbox"/>	ARKANSAS RIVER ABOVE PUEBLO	Arkansas River [00078956]	214.13
<input checked="" type="checkbox"/>	PUEBLO FISH HATCHERY OUTFLOW	Arkansas River [00078956]	213.48
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<input checked="" type="checkbox"/>	PBWW NORTHSIDE INTAKE	Arkansas River [00078956]	210.21
<input checked="" type="checkbox"/>	RIVERSIDE DAIRY DITCH	Arkansas River [00078956]	209.36
<input checked="" type="checkbox"/>	PUEBLO WEST SEWAGE	Arkansas River	208.71

Search

Map ON Details ON
Layers

Legend
 Blue Circle
 Green Circle
 Green spiderspot
 Yellow Square
 Inflow (not release)
 Inflow Release
Hide ^

TIMPAS - ARKANSAS CONFLUENCE (1729075) Arkansas River at mile 126....
7/15/2021

Table
Graph

Y Min 0.00
Y Max 1,800.00
Log Scale OFF
Legend OFF

Upstream

+	Exchange Total	78.64
—	Total in River	225.53
+	Release Total	30.94
—	Native Flow	194.67

Downstream

+	Exchange Total	74.96
—	Total in River	292.19
+	Release Total	30.86
—	Native Flow	261.32

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Colors of Water – Time Series View



Colors of Water (all values in CFS)
Export Help My Account

Display Hide

Time Series

Custom Dates

From: 7/26/2021 To: 8/9/2021

Structures

Location: Division 2: Arkansas

Water Source: Arkansas River [00078956]

Upstream: PUEBLO RESERVOIR (1403526) mile 214.57

Downstream: ARKANSAS RIVER NEAR COOLIDGE, KS (6709510) mile 0

91 of 91 Structures Selected

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<input checked="" type="checkbox"/> PUEBLO WEST SEWAGE	Arkansas River	208.64

Search

Map ON Details ON

CATLIN CANAL (1700552)

CATLIN CANAL (1700552) Arkansas River at mile 150.78

8/2/2021

Y Min 0.00 Y Max 4,000.00 Log Scale OFF Legend OFF

Table Graph

Account Details

Change Password

My Subscriptions

Web Service Token Manager

Portal Home

Sign out

Upstream

Exchange Total	22.22
Total in River	2135.95
Release Total	81.14
Native Flow	2054.81

Diversions

1700552 S:1 F:U:1 T:G:To:	278.29
1700552 S:2 F:1403526.056 U:1 T:G:To:	0
1700552 S:2 F:1403526.059 U:1 T:G:To:	16.71
1700552 S:8 F:1400993 U:Q T:G:1707151 To:1703529	3
1700552 S:8 F:1400993 U:Q T:G:1707030 To:1703529	3

Downstream

Exchange Total	22.22
Total in River	1841.32
Release Total	63.03
Native Flow	1778.29

ArkDSS COW Scenario Planner



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Webtool to estimate transit losses and design headgate diversion patterns for future reservoir releases or evaluate past releases

- **Used TL Livingston parameters rather than re-calibrated**
 - For both WD17 (Pueblo-JMR) and WD67 (JMR to stateline)
 - In WD17 testing, median TL difference with TLAP was +1.2%
- **3 step options – same TL but different headgate patterns**
 - Livingston recommended number of steps (using TLAP adaptive)
 - Specify number of equal steps (using TLAP adaptive)
 - Original COW method with variable “optimized” steps
- **Deployed and in final testing and documentation**
 - On public web server but only permissioned for CDWR
 - Anticipated for use for 2025 Water Year for Pueblo to JMR
 - Still hope to build out capability to design exchanges



ArkDSS COW Scenario Planner



NEW SCENARIO

List OFF Detail ON



Scenario Name: ARCA2024

Setup

Scenario Name:* ARCA2024 Scenario Type: Release Headgate Pattern: YES

Water Source: Arkansas River River Flow Basis: Actual River, Steady State

Upstream Structure: PUEBLO RESERVOIR (1403526) at mile 214.57 Date Range for Steady State Value: From: [] To: []

Downstream Structure: FORT LYON CANAL (1700553) at mile 122.99 Date Basis: Upstream Release Dates

Owner: FORT LYON CANAL Rate Basis: Upstream Release Blocks

Water Class: 1403526.313 S:2 F: U:Q T:7 G: To:1700553 Step Count: Livingston Recommended

Planned Major Delivery Steps

Block	Date	Time	Rate (CFS)	
1	07/15/2024	08:00 AM	266.87	<input checked="" type="checkbox"/>
2				<input checked="" type="checkbox"/>
3				<input checked="" type="checkbox"/>
4				<input checked="" type="checkbox"/>
5				<input checked="" type="checkbox"/>
End	08/17/2024	04:00 AM		
			Total (AF): 17379.89	

Optional Headgate Pattern and Transit Loss Settings

Option	Value
<input type="checkbox"/> Minimum headgate step (CFS)	##.##
<input type="checkbox"/> Maximum headgate step (CFS)	##.##
<input type="checkbox"/> Flatten delivery blocks by varying release	
<input type="checkbox"/> Maximum release (CFS) when flattening	##.##
<input type="checkbox"/> Limit hours of turnout and changes	Start: 8:00 AM
	End: 5:00 PM
<input type="checkbox"/> Transit loss percentage, override default	Percent per mile ##.##
<input type="checkbox"/> Gage / Baseflow Evaluation of past release	
<input type="checkbox"/> Is past event but is hypothetical (not in gage)	

SAVE SAVE AS UNDO | RUN

ArkDSS COW Scenario Planner



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Results

Table Graph

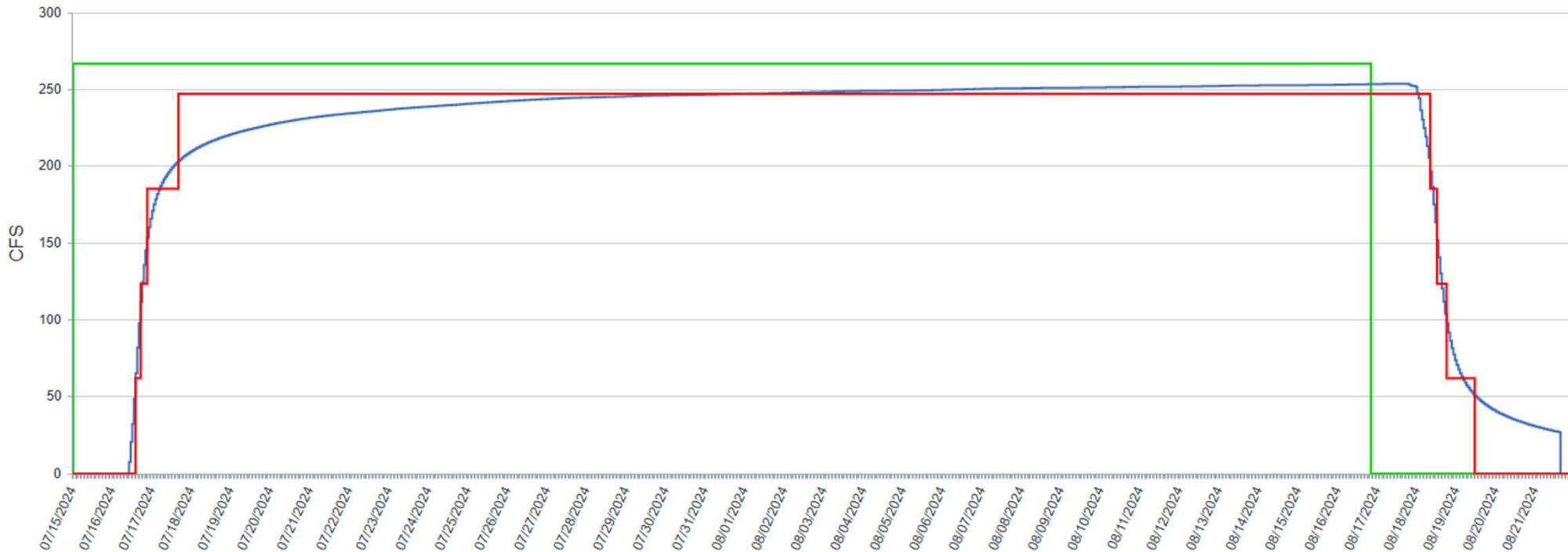
Totals (AF)	Release	Delivery	Headgate	Evaporation	Unconsumed TL	Gage Eval	Percent	Delivery TL	Potential TL	Gage Eval TL
	17379.89	16060.46	16060.46	625.54	693.88	N/A		7.59	7.59	N/A

SEND EMAIL

PDF



TL Rule: Cutoff at 10% of average release



ArkDSS COW Scenario Planner



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Totals (AF)

Release	Delivery	Headgate	Evaporation	Unconsumed TL	Gage Eval
17379.89	16060.46	16060.46	625.54	693.88	N/A

Totals (%)

Delivery Transit Loss	Potential Transit Loss	Gage Eval Transit Loss
7.59	7.59	N/A

Infrequent

Structure	Type	Date	Amount (CFS)
PUEBLO RESERVOIR (1403526)	Release (CFS)	07/15/2024 07:00 AM	0.00
PUEBLO RESERVOIR (1403526)	Release (CFS)	07/15/2024 08:00 AM	266.87
PUEBLO RESERVOIR (1403526)	Release (CFS)	08/17/2024 03:00 AM	0.00
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	07/16/2024 09:00 PM	0.00
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	07/16/2024 10:00 PM	61.71
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	07/17/2024 01:00 AM	123.42
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	07/17/2024 05:00 AM	185.13
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	07/18/2024 12:00 AM	246.85
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	08/18/2024 04:00 PM	185.13
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	08/18/2024 08:00 PM	123.42
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	08/19/2024 02:00 AM	61.71
FORT LYON CANAL (1700553)	Headgate Intake(CFS)	08/19/2024 07:00 PM	0.00