Middle Colorado Integrated Water Management Plan
Progress Report and Hydrological Characterization
HYDROLOGY AT CAMEO

• Continuous daily streamflow record from 1933-2019
• Downstream end of study reach
• Generally, representative of Colorado River mainstem hydrology between Roaring Fork confluence and the roller dam
HISTORICAL MONTHLY PATTERNS
STREAMFLOW TRENDS

- Trends assessed between 1933 and 2019
- Hydrological variability is being reduced across annual cycles and in the summer irrigation period
- Historical data shows downward trend in peak flows and upward trend in low flows
- Consistent with expected impacts of reservoir operation
STREAMFLOW TRENDS

Colorado River at Cameo
Year Starting With April  30-day maximum
Slope estimate is -0.47% per year, Mann-Kendall p-value is 0.0457

Discharge (m³/s)


Colorado River at Cameo
Year Starting With April  30-day maximum
Slope estimate is -0.47% per year, Mann-Kendall p-value is 0.0457

Discharge (m³/s)


Colorado River at Cameo
Year Starting With April  median daily
Slope estimate is 0.44% per year, Mann-Kendall p-value is 0.000279

Discharge (m³/s)

STREAMFLOW TRENDS

Station ID: 09095500, Agency: USGS, Country: United States

- Name: COLORADO RIVER NEAR CAMEO, CO.
- State/Province: CO
- Status: Active
- Latitude: 39.24 Longitude: -108.27
- Catchment Area (km²): 26936.81
- Period: 1933-2018

**Blue Trend Line = Increasing Trend**
**Red Trend Line = Decreasing Trend**

- No Line: p-value > 0.1
- 0.05 < p-value ≤ 0.1
- 0.01 < p-value ≤ 0.05
- p-value ≤ 0.01

- **Discharge (m³/s)**
  - p = 0.03
  - Annual Maximum Series

- **Peaks Over Threshold (Q95)**
  - p = 0.02
  - 25 pct Annual Flow

- **Inter-Event Duration**
  - p = 0.09

- **Q80**
  - p = 0.05

- **Q90**
  - p = 0.02

- **25 pct - 75 pct Annual Flow Duration**
  - p = 0.01

- **Day of Year 75 pct Annual Flow**
  - p = 0.1

**Day of Annual Maximum**
- Oct
- Mar
- Sep

**No. of Days**
- Oct
- Mar
- Sep

**Center of Volume**
- Oct
- Mar
- Sep

**Ratio**
- 1.69
- p = 0.06
STREAMFLOW TRENDS

Station ID: 09095500, Agency: USGS, Country: United States

Name: COLORADO RIVER NEAR CAMEO, CO.
Previous Station: CO Status: Active
Latitude: 39.24 Longitude: 108.27
Catchment Area (km²): 26098.01
Period: 1933-2018
RHN Station

Blue Trend Line = Increasing Trend
Red Trend Line = Decreasing Trend

No Line: p-value > 0.1
0.05 < p-value <= 0.1
0.01 < p-value <= 0.05
p-value <= 0.01

Discharge (m³/s)

Drought Duration

Drought Severity

Annual Minimum Flow

Mean Annual Minimum 7-day Flow

Mean Annual Minimum 10-day Flow

Drought Start

Drought Center

Drought End

p = < 0.01
p = 0.02
p = < 0.01
p = 0.06
p = < 0.01

hydrological
RECOVERY PROGRAM

Peak Flow Augmentation

Low Flow Augmentation

2017 CROS: Peak Flow Augmentation in 15-Mile Reach

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Water Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Mtn Reservoir</td>
<td>14,410 AF</td>
</tr>
<tr>
<td>Willow Creek Reservoir</td>
<td>7,206 AF</td>
</tr>
<tr>
<td>Williams Frk + Moffat Tunnel</td>
<td>5,372 AF</td>
</tr>
<tr>
<td>Ruedi Reservoir</td>
<td>4,502 AF</td>
</tr>
<tr>
<td>Wolford Mtn Reservoir</td>
<td>4,245 AF</td>
</tr>
</tbody>
</table>

Summer 2017 Flows in the 15-Mile Reach of the Colorado River

1,240 cfs target

Total 79,038 AF flow augmentation releases from reservoirs

Cubic Feet per Second

With CROS Releases vs Without CROS Releases
ASSESS CONDITIONS AND RISKS

ECOSYSTEM PROPERTIES AND FUNCTIONS

WATERSHED-SCALE
- Flow Regime
- Sediment Regime
- Water Quality
- Network Connectivity

REACH-SCALE
- Floodplain hydrology
- Riparian vegetation
- Fluvial Geomorphology
- Structural complexity
- Aquatic biota

ECOSYSTEM GOODS AND SERVICES

PROVISIONING
- Agricultural Production
- Drinking Water Supply
- Industrial Processing
- Hydropower Production

REGULATING AND MAINTENANCE
- Flood Regulation
- Groundwater Recharge
- Erosion Control
- Pest Regulation
- Regulatory Compliance

CULTURAL
- Aesthetics and Intrinsic Values
- Symbolic & Emblematic Species
- Boating Recreation
- Angling Recreation
## ASSESSMENT METHODOLOGIES

### Measure of Ecological Integrity

<table>
<thead>
<tr>
<th>Potential Indicators</th>
<th>Relevant Data Sources</th>
<th>Assessment Tools, Techniques, &amp; Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Regime</td>
<td>Peak flow, low flow, rate of change, low flow pulse, zero flow days</td>
<td>USGS gauges, CDSS models, Hydrobase, USGS StreamStats, CBRT data dashboards</td>
</tr>
</tbody>
</table>

### Goods and Services

<table>
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<th>Goods and Services</th>
<th>Possible Indicators</th>
<th>Relevant Data Sources</th>
<th>Assessment Tools, Techniques, &amp; Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking Water Supply</td>
<td>Water use shortage/surplus. Attainment of drinking water standards</td>
<td>CDSS Hydrobase; public provider permit records; surface water monitoring data: USGS NWIS, EPA STORET, CDPHE, River Watch; CBRT data dashboards</td>
<td>Drinking water use class standards attainment; supply/demand analyses; current/historic use quantification; climate change and watershed event risk assessments</td>
</tr>
</tbody>
</table>
FISHERIES ASSESSMENT

- Continue to work with CPW/USFS/BLM biologists to complete a limiting factors analysis for native species and select cold-water sport fish
RIPARIAN ASSESSMENT

- Jet-boat tour completed
- GIS/remote sensing analysis underway
- LCLU change analysis underway
WATER QUALITY

- Trends analysis and/or predictive models where sufficient data exists
- Characterization of current conditions against state WQ standards at all locations with data
WATER RIGHTS/ADMINISTRATION

- Draft write-up on water rights and administration completed
- Draft memo discussing Demand Management completed
- Infographics and visualizations in-progress
THANKS
FOR YOUR ATTENTION