Arizona Lower Basin Drought Contingency Plan Update

Grand Canyon State Electric Cooperative Association Inc.

Bret Esslin, Arizona Department of Water Resources
Colorado River Management

May 8, 2019
Need for Drought Contingency Plans

• Ongoing historic drought conditions in the Colorado River Basin have increased the risks of Colorado River reservoirs - Lake Mead and Lake Powell - declining to critically low elevations.

• The Lower Basin is facing increased risk of severe shortages to Colorado River supplies.

• Interstate Drought Contingency Plans have been negotiated among the seven Colorado River Basin states to reduce risks to the Basin.
Risk of Lake Mead < 1,020’

Full Hydrology (1906-2015)

- **2007 Projections**
  - (1906-2005 hydrology)
  - **No DCP** (April 2018 Projections)
  - **With DCP** (April 2018 Projections with Upper & Lower Basin DCPs & Binational WSCP)

Stress Test Hydrology (1988-2015)

- **2007 Projections**
  - (1906-2005 hydrology)
  - **No DCP** (April 2018 Projections)
  - **With DCP** (April 2018 Projections with Upper & Lower Basin DCPs & Binational WSCP)

5.7 maf
22%

RECLAMATION
Managing Water in the West
Lower Basin Drought Contingency Plan (LBDCP)

- Lower Basin state representatives developed the LBDCP as an overlay on the 2007 Interim Guidelines to improve sustainability and increase Intentionally Created Surplus (ICS) flexibility.
- Lower Basin representatives (and USBR) are continuing to finalize and approve LBDCP documents.
- The LBDCP is one component of a basin-wide approach that will ultimately incorporate Mexico’s participation, as well as the Upper Basin DCP.
## 2007 Interim Guidelines Shortage Reductions and Incremental DCP Contributions

<table>
<thead>
<tr>
<th>Lake Mead Elevation</th>
<th>AZ 2007</th>
<th>AZ DCP</th>
<th>AZ TOTAL</th>
<th>NV 2007</th>
<th>NV DCP</th>
<th>NV TOTAL</th>
<th>CA 2007</th>
<th>CA DCP</th>
<th>CA TOTAL</th>
<th>BOR DCP</th>
<th>MX Min 323</th>
<th>MX BWSCP</th>
<th>MX Total</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>≤1090 &gt;1075</td>
<td>0</td>
<td>192K</td>
<td>192K</td>
<td>0</td>
<td>8K</td>
<td>8K</td>
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<td>0</td>
<td>0</td>
<td>100k</td>
<td>0</td>
<td>41k</td>
<td>41k</td>
<td>341k</td>
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<tr>
<td>≤1075&gt;1050</td>
<td>320K</td>
<td>192K</td>
<td>512K</td>
<td>13K</td>
<td>8K</td>
<td>21K</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100k</td>
<td>50k</td>
<td>30k</td>
<td>80k</td>
<td>713k</td>
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<td>≤1050&gt;1045</td>
<td>400K</td>
<td>192K</td>
<td>592K</td>
<td>17K</td>
<td>8K</td>
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<td>0</td>
<td>0</td>
<td>100k</td>
<td>70k</td>
<td>34k</td>
<td>104k</td>
<td>821k</td>
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<tr>
<td>≤1045&gt;1040</td>
<td>400K</td>
<td>240K</td>
<td>640K</td>
<td>17K</td>
<td>10K</td>
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<td>0</td>
<td>200K</td>
<td>200K</td>
<td>100k</td>
<td>70k</td>
<td>76k</td>
<td>146k</td>
<td>1,113k</td>
</tr>
<tr>
<td>≤1040&gt;1035</td>
<td>400K</td>
<td>240K</td>
<td>640K</td>
<td>17K</td>
<td>10K</td>
<td>27K</td>
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<td>250K</td>
<td>250K</td>
<td>100k</td>
<td>70k</td>
<td>84k</td>
<td>154k</td>
<td>1,171k</td>
</tr>
<tr>
<td>≤1035&gt;1030</td>
<td>400K</td>
<td>240K</td>
<td>640K</td>
<td>17K</td>
<td>10K</td>
<td>27K</td>
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<td>300K</td>
<td>300K</td>
<td>100k</td>
<td>70k</td>
<td>92k</td>
<td>162k</td>
<td>1,229k</td>
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<tr>
<td>≤1030&gt;1025</td>
<td>400K</td>
<td>240K</td>
<td>640K</td>
<td>17K</td>
<td>10K</td>
<td>27K</td>
<td>0</td>
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<td>100k</td>
<td>70k</td>
<td>101k</td>
<td>171k</td>
<td>1,288k</td>
</tr>
<tr>
<td>≤1025</td>
<td>480K</td>
<td>240K</td>
<td>720K</td>
<td>20K</td>
<td>10K</td>
<td>30K</td>
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<td>350K</td>
<td>350K</td>
<td>100k</td>
<td>125k</td>
<td>150k</td>
<td>275k</td>
<td>1,475k</td>
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</table>
CAP Priority Pools & Shortage

2007 Guidelines:
- Indian Priority
- M&I Priority
- NIA Priority
- Ag Pool
- Other Excess

T1, T2, T3

LBDCP:
- Indian Priority
- M&I Priority
- NIA Priority
- Ag Pool
- Other Excess

T1, T2, T3
LBDCP Implementation Plan – 2 Components

• Mitigation Component
  • Wet water CAP deliveries for mitigation
  • Payment for reductions (compensated mitigation) when wet water mitigation is insufficient
  • Money for new groundwater infrastructure for CAP Ag

• Offset Component
  • System conservation and ICS creation to replace CAP ICS that is used for mitigation
  • Pre-firming concept to address NIA firming obligations from Indian water settlements
Mitigation Component- Key Terms

- 2020 – 2022
  - 100% mitigation for NIA Pool (annual determination of vol.)
  - Fixed volume for CAP AG, dependent on annual tier determination

- 2023 – 2025
  - No CAP Ag Mitigation (except USF to GSF and groundwater infrastructure)
  - M&I and Indian priority fully mitigated first
  - NIA volume based on actual orders/operating conditions
  - NIA 75% under T1 and T2a (until no supplies)
  - NIA 50% under T2b (until no supplies)

- 2026
  - Zero mitigation
  - No mitigation for any water user in T3 or 2026, whichever occurs first
<table>
<thead>
<tr>
<th>Resources</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
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</thead>
<tbody>
<tr>
<td>Ag Pool</td>
<td>105 KAF Tier 1</td>
<td>105 KAF Tier 1</td>
<td>**</td>
<td>70 KAF Tier 2a/2b</td>
<td>No CAP Wet Water Mitigation</td>
<td></td>
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</tr>
<tr>
<td>NIA Pool</td>
<td>100% Tier 1/2a/2b</td>
<td>100% Tier 1/2a/2b</td>
<td>100% Tier 1/2a/2b</td>
<td>75%* Tier 1/2a</td>
<td>75%* Tier 1/2a</td>
<td>50%* Tier 2b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Until no supplies</td>
<td></td>
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<tr>
<td></td>
<td>Phoenix AMA USF-GSF ~46.5 KAF/Yr</td>
<td></td>
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<tr>
<td></td>
<td>Tucson AMA GSF 35 KAF/Yr</td>
<td></td>
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<tr>
<td></td>
<td>** Tier 2a/2b</td>
<td></td>
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<tr>
<td></td>
<td>CAWCD ICS ~400 KAF</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(includes 50 KAF SRP Exchange)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CAWCD Lake Pleasant ~50 KAF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAWCD Operational Supplies ~30 KAF</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CAWCD $60 Million for Compensated Mitigation or acquisition of additional wet water mitigation supplies</td>
<td></td>
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</tr>
</tbody>
</table>
Offset Component – Key Terms

• Conserve 400 kaf to offset use of CAP ICS
• Offsets provided through:
  – 100 kaf US-GRIC ICS
    ▪ Pre-firming for US Tribal firming obligation
  – 50 kaf AWBA-GRIC ICS
    ▪ Pre-firming for Arizona’s AWSA firming obligation
  – 150 kaf System Conservation
  – 50 kaf Additional Tribal ICS
  – 50 kaf - CAP-SRP Exchange payback
Participants in Funding & Water

- CAWCD: Funding and Water
- SRP: Water in exchange
- CAP M&I Users: Water for USF-GSF
- GRIC: Water for ICS and Firming
- CAP AG: Funding for GW infrastructure
- State of Arizona: Funding for GW infrastructure, System Conservation and Firming
- AWBA: LTSC for USF-GSF exchange, Firming
- US: Funding of GW Infrastructure and Firming
- NGOs: Funding for System Conservation
- CRIT: Water for System Conservation
Why LBDCP is Important to Arizona

- Risks are increasing due to poor hydrology. We are projected to be in Tier 1 shortage in the next couple of years. A Tier 1 shortage will reduce by 11% the amount of Colorado River water that Arizona receives.

- The vast majority of reductions in a Tier 1 shortage would be concentrated on CAP water users, reducing the CAP supply by about 20%.

- DCP likely will not prevent a Tier 1 shortage, but DCP reduces the risk that the river system will decline to critically low levels and protects the highest priority water users in Arizona—CAP Municipal and Industrial and Indian Priority water.
Why LBDCP is Important to Arizona

- Without LBDCP, entities that have stored water in Lake Mead will likely remove the water earlier than they otherwise would.
- Lake Mead elevations will be protected through collective actions by California, Arizona, Nevada, and Mexico.
- Mexico has already agreed to take reductions in parity and alignment with those agreed to by the Lower Basin states if LBDCP is adopted.
- We are in the midst of a 20 year historic drought. Even in the absence of these conditions, more water has been allocated than Mother Nature normally provides and there is a structural deficit.
Benefits of the Implementation Plan

- Mitigation (wet water) provided to the CAP Ag Districts to reduce the impacts of DCP on their water supplies
- Mitigation (wet water and funding) to the CAP Cities and Tribes to reduce the impacts of DCP on their water supplies
- Funding for new groundwater and efficiency infrastructure for CAP Ag Districts to reduce the impacts of DCP on their water supplies, and to enhance the recovery of underground storage for the AWBA
- Additional protection for Lake Mead through the Offset Program
Arizona Came Together and Got It Done
Congressional Testimony

• Commissioner Burman and state governor’s representatives from Arizona, Nevada and Wyoming testified before the Senate Committee on Energy & Natural Resources Subcommittee on Water and Power, chaired by Arizona Senator Martha McSally, March 27.


To direct the Secretary of the Interior to execute and carry out agreements concerning Colorado River Drought Contingency Management and Operations, and for other purposes. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, SECTION 1. SHORT TITLE. This Act may be cited as the “Colorado River Drought Contingency Plan Authorization Act”.

SEC. 2. COLORADO RIVER BASIN DROUGHT CONTINGENCY PLANS. (a) IN GENERAL.—Notwithstanding any other provision of law expressly addressing the operation of the applicable Colorado River System reservoirs, immediately upon execution of the March 19, 2019, versions of the Agreement Concerning Colorado River Drought Contingency Management and Operations and the agreements attached thereto as Attachments A1, A2, and B, by all of the non-Federal parties thereto, the Secretary of the Interior shall, without delay, execute such agreements, and is directed and authorized to carry out the provisions of such agreements and operate applicable Colorado River System reservoirs accordingly. (b) EFFECT.—Nothing in this section shall— (1) be construed or interpreted as precedent for the litigation of, or as altering, affecting, or being deemed as a congressional determination regarding, the water rights of the United States, any Indian Tribe, band, or community, any State or political subdivision or district of a State, or any person; or (2) exempt the implementation of such agreements and the operation of applicable Colorado River System reservoirs from any requirements of applicable Federal environmental laws.
Colorado River Basin 24-Month Study

• What if hydrology improves in 2020 or 2021?
  • If conditions remain the same, we are not expected to be in a Tier 1 or Tier 2 shortage for 2020.
  • There will be a “Tier 0” shortage if the elevation of Lake Mead is between 1,090 and 1,075 feet.
    —Tier 0 shortage results in 192,000 acre-foot reduction for Arizona
  • An adjustment from an 8.23 maf release from Lake Powell has been increased to a 9.0 maf release
  • The August 2019 24-Month Study projections will determine the operating tiers for Lake Powell and Lake Mead in 2020.
Colorado Basin River Forecast Center
Lake Powell 104 Group

05/01/2019 Percent Median: 128% (16.2 / 12.7)
Percent Seasonal Median: 101% (16.2 / 16.1)
3 Day Accum Rate: 0.1 in/day

NOAA/CBRFC, 2019

Median 1981-2010  2019  2018  

Past  Future
Lake Mead Elevation Projected Elevation: Shift from Jan '19 to Mar '19
(EOM Jan 2000 - Jan '19 Project Feb '19 - Dec '20 vs. Mar '19 - Feb '21)
Imperial Irrigation District Action

• The Imperial Irrigation District in California notified the Seven Basin States on April 15 that it is suing the Metropolitan Water District under the California Environmental Quality Act.
• As part of its case, IID challenges the approval of the LBDCP by the Board of Directors of Metropolitan Water District.
• IID’s suit would direct Metropolitan to desist from implementing the LBDCP.
WAPA Energy Considerations

• Glen Canyon Dam (Lake Powell)
  – Upper & Lower Basin Drought Contingency Plans Potential Effects on CRSP Hydropower Production & Value Preliminary Analysis

• Hoover Dam (Lake Mead)
  – Boulder Canyon Project Engineering & Operations Committee
Methods and Approach

• WAPA used the CRSS model runs developed by USBR for the states to help develop the DCPs
  – Runs included both the UC and LC DCPs
• The “stress years” model runs were used, of which 20 of the 28 CRSS stress year traces were randomly selected
• WAPA’s GT Max Superliterate model was used to run each trace
  – The model simulates CRSP power by unit/hour using monthly water inputs, unit operational criteria, reservoir elevation levels, electrical demand and market prices
  – A post-modeling spreadsheet calculates hourly firming purchases and market sales
Methods and Approach, cont’d.

• WAPA enters hourly operational outputs from the GT Max Superlite into a CRSP Basin Fund model
  – This model provides estimates of Basin Fund balances and the likelihood of a CRC being triggered; and
  – Helps illustrate the potential impacts of different scenarios.
**Implementing the Drought Contingency Plan**

Comparison with the baseline case (no implementation of the DCP)

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Baseline (no DCP)</th>
<th>Drought Contingency Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood of a Cost Recovery Charge (CRC) – over a 10-year period, over all modeled traces – a wide range of GCD releases and hydrology</td>
<td>35%</td>
<td>30.5%</td>
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<tr>
<td>Average Annual Firming Expense</td>
<td>$45 million</td>
<td>$37 million</td>
</tr>
<tr>
<td># of months that Lake Powell falls below 3490 (min. power) (out of 3,360 monthly values)</td>
<td>477 (14% of months)</td>
<td>97 (2.9% of months)</td>
</tr>
</tbody>
</table>
Conclusions & Considerations

• Implementing a DCP will have both negative and positive potential impacts to power
  – **Negative:**
    • Less than average annual Lake Powell releases
    • Lower releases when responsive CRSP units reservoirs have to be refilled
    • Less load following and additional bypass required during high water releases from responsive CRSP units
  – **Positive:**
    • CRSP units are generating more power
    • Greater power head at Lake Powell
    • Lake Powell elevations less likely to fall below the minimum power pool

• Potential negative impacts of changed operations outweighed by beneficial effects:
  – Gain in Lake Powell power head results in more total production
  – Lake Powell elevations less likely to fall below the minimum power pool

• No change in operation of CRSP units if DCP not implemented
  – Years following DCP implementation may see greater hydro production (total Mwh) due to increased power head
Lower Basin Drought Contingency Plan
Stressed DCP Impacts on Hoover Total Releases (Acre-Feet)

**STRESSED DCP VS BASELINE RELEASES (MAF)**

<table>
<thead>
<tr>
<th></th>
<th>FY 2020</th>
<th>FY 2021</th>
<th>FY 2022</th>
<th>FY 2023</th>
<th>FY 2024</th>
<th>FY 2025</th>
<th>FY 2026</th>
<th>FY 2027</th>
<th>FY 2028</th>
<th>FY 2029</th>
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<tr>
<td>BASELINE</td>
<td>9.3</td>
<td>9.0</td>
<td>9.0</td>
<td>9.0</td>
<td>9.0</td>
<td>8.9</td>
<td>8.9</td>
<td>8.9</td>
<td>8.9</td>
<td>8.9</td>
</tr>
<tr>
<td>DCP</td>
<td>9.0</td>
<td>8.8</td>
<td>8.7</td>
<td>8.7</td>
<td>8.6</td>
<td>8.6</td>
<td>8.5</td>
<td>8.9</td>
<td>9.0</td>
<td>8.9</td>
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Lower Basin Drought Contingency Plan
Stressed DCP & Baseline Impacts on Hoover Generation (GWH)

ACTUAL vs BASELINE vs DCP
GROSS ENERGY

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Baseline</th>
<th>DCP</th>
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<tbody>
<tr>
<td>FY 2020</td>
<td>3,614</td>
<td>3,422.9</td>
<td>3,347.0</td>
</tr>
<tr>
<td>FY 2021</td>
<td>3,565.5</td>
<td>3,289.0</td>
<td>3,356.5</td>
</tr>
<tr>
<td>FY 2022</td>
<td>3,292.5</td>
<td>3,229.5</td>
<td>3,235.0</td>
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<td>FY 2023</td>
<td>3,161.5</td>
<td>3,201.0</td>
<td>3,211.0</td>
</tr>
<tr>
<td>FY 2024</td>
<td>3,054.8</td>
<td>3,100.1</td>
<td>3,161.5</td>
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<td>FY 2025</td>
<td>2,982.1</td>
<td>3,063.8</td>
<td>3,100.1</td>
</tr>
<tr>
<td>FY 2026</td>
<td>2,922.8</td>
<td>3,055.4</td>
<td>3,063.8</td>
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<td>FY 2027</td>
<td>2,865.6</td>
<td>3,108.9</td>
<td>3,055.4</td>
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<td>FY 2028</td>
<td>2,819.9</td>
<td>3,038.7</td>
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</table>

% Change from 2018 Actual

Projected with DCP

<table>
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<tr>
<th>Year</th>
<th>FY 2020</th>
<th>FY 2021</th>
<th>FY 2022</th>
<th>FY 2023</th>
<th>FY 2024</th>
<th>FY 2025</th>
<th>FY 2026</th>
<th>FY 2027</th>
<th>FY 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change from 2018 Actual</td>
<td>(7.12)</td>
<td>(10.49)</td>
<td>(11.15)</td>
<td>(11.43)</td>
<td>(14.22)</td>
<td>(15.23)</td>
<td>(15.46)</td>
<td>(13.98)</td>
<td>(15.92)</td>
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Projected Baseline

<table>
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<th>Year</th>
<th>FY 2020</th>
<th>FY 2021</th>
<th>FY 2022</th>
<th>FY 2023</th>
<th>FY 2024</th>
<th>FY 2025</th>
<th>FY 2026</th>
<th>FY 2027</th>
<th>FY 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change from 2018 Actual</td>
<td>(5.3)</td>
<td>(9.0)</td>
<td>(10.6)</td>
<td>(12.5)</td>
<td>(15.5)</td>
<td>(17.5)</td>
<td>(19.1)</td>
<td>(20.7)</td>
<td>(22.0)</td>
</tr>
</tbody>
</table>
Powell Annual Energy

Full Hydrology

Scenario
- Baseline
- UB, LB, and MX DCP

Stress Test

percentile
- 10th
- 50th
- 90th

Results from August 2018 CRSS.

CAP
CENTRAL ARIZONA PROJECT
Mead Annual Energy

Full Hydrology

Scenario
- Baseline
- UB, LB, and MX DCP

(GWh)

Stress Test

percentile
- 10th
- 50th
- 90th

Results from August 2018 CRSS runs.

Central Arizona Project (CAP)
Mead Average Power Capacity

Full Hydrology

Stress Test

Scenario
Baseline
UB, LB, and MX DCP

percentile
10th
50th
90th

Results from August 2018 CRSS runs.

CAP
Central Arizona Project
Thank You.