Recovery Planning Advisory Group

Banking Water Now for Arizona’s Future

12th Meeting, May 19, 2020
Agenda

1. Welcome and Introductions – Vineetha Kartha
2. Status of Recovery Planning Update, Sections 1-4 – Vineetha Kartha
3. CRSS Modeling and AZ Supply – Vineetha Kartha
4. P4 On-River Shortage & Firming – Vineetha Kartha
5. CAP Shortage & Firming – Ken Seasholes
6. Recovery Modeling Results – Ken Seasholes
7. Next Steps – Vineetha Kartha
Overview of Recovery Modeling

1. Elevation of Lake Mead
2. Supply to AZ
3. Use by On-River P1-3
4. Supply to CAP
5. Supply by CAP Priority
6. Impact to NIA & M&I Firmed by AWBA
7. Supply to On-River P4
8. Impact to P4 M&I Firmed by AWBA

RPAG, 5/19/20. All content subject to change. #3
Overview of Recovery Modeling

- Elevation of Lake Mead
- Supply to AZ
- Use by On-River P1-3
- Supply to CAP
- Supply by CAP Priority
- Impact to NIA & M&I Firmed by AWBA
- Supply to On-River P4
- Impact to P4 M&I Firmed by AWBA
Timing & Magnitude of Shortages to AZ
CRSS Modeling
Major Inputs to the Colorado River Simulation System model (CRSS)

- Hydrology
- Upper Basin Demands
- Lower Basin Demands
- Initial Reservoir Conditions
- CRSS Model
- Operational Rules
CRSS Features

- Full basin model from the headwaters of the mainstem and major tributaries, down to the Northerly International Boundary with Mexico
- Simulates the system on a monthly time step over decades to assess long-term system conditions
- Gives a range of potential future conditions
  - Reservoir levels
  - Releases
  - River flows
- Physical layout
  - Reservoirs: 12
  - Diversions: ~225
  - Natural inflow points: 29
- Model Components: 365 objects
  - Feature of basin (ex. Reservoir, Data, Reach)
- Outputs of Interest
  - Lake Mead elevation
  - Lake Powell elevation, inflow, release
  - Delivery reductions
CRSS Model Assumptions

• CRSS Model
  o December 2019 version

• Hydrology
  o “Direct Natural Flows” (a.k.a., “Observed Hydrology”) 112 years
  o “Stress Test” (1988—2017) 30 years

• Operational Rules include Guidelines & DCP, extended through 2045

• Minute 323 – Binational Water Scarcity Contingency Plan

• Upper Basin Demand
  o Projection in “as-is” model
  o 15% reduction to projected increase
**CRSS—Raw Output**

Direct Natural Flows, no Upper Basin adjustment

The result of a single hydrologic "trace" run through CRSS

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5/19/20. All data subject to change.
Direct Natural Flows, no Upper Basin adjustment

Note: The data for this chart shown at the 5/19/20 RPAG meeting was inadvertently shifted forward in time by one year. The version shown here is corrected.
CRSS—Sorted by Severity (i.e., driest traces at bottom)

Direct Natural Flows, no Upper Basin adjustment

Note: The data for this chart shown at the 5/19/20 RPAG meeting was inadvertently shifted forward in time by one year. The version shown here is corrected.
CRSS—Annual Probabilities

Direct Natural Flows, no Upper Basin adjustment

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Note: The data for the chart on the left shown at the 5/19/20 RPAG meeting was inadvertently shifted forward in time by one year. The version shown here is corrected.
Overview of Recovery Modeling
Projected P1-3 On-River Use

- On-River use is overwhelmingly agricultural
- Annual fluctuations due to climate, commodity prices, cropping practices, etc.
- Directly affects available supply for P4 users (On-River & CAP)
Projected P1-3 On-River Use

- On-River use is overwhelmingly agricultural
- Annual fluctuations due to climate, commodity prices, cropping practices, etc.
- Directly affects available supply for P4 users (On-River & CAP)

Historic Projected

• 0.5%/yr Growth

RPAG, 5/19/20. All content subject to change. #17
Overview of Recovery Modeling

Elevation of Lake Mead → Supply to AZ → Use by On-River P1-3 → Supply to CAP → Supply by CAP Priority → Impact to NIA & M&I Firmed by AWBA

Supply to On-River P4 → Impact to P4 M&I Firmed by AWBA
P4 On-River—Current Use

Diversion Entitlements - 164,652 AF

Agricultural Use: 54 KAF
M&I Use: 37 KAF

Firmed by AWBA

Historic Projected

RPAG, 5/19/20. All content subject to change. #19
P4 On-River—Projected Use, 2045

Diversion Entitlements - 164,652 AF

- Agricultural Use: 54 KAF
- M&I Use: 48 KAF
- Firmed by AWBA

Historic | Projected

1%/yr Municipal Growth

Diversion

CU

RPAG, 5/19/20. All content subject to change. #20
CAP Shortage & Firming
Overview of Recovery Modeling

Elevation of Lake Mead → Supply to AZ → Use by On-River P1-3 → Supply to CAP → Supply by CAP Priority → Impact to NIA & M&I Firmed by AWBA

Supply to On-River P4 → Impact to P4 M&I Firmed by AWBA
CAP Priority Pools – Firmed Portions

Total Available = 186,557 AF

Acre Feet

NIA = 201 KAF
M&I = 597 KAF
Ag Pool = 300 KAF
Other Excess = 141 KAF
Indian = 337 KAF
P3 = 68 KAF

Firmed by USBR
Firmed by AWBA
Cities & Industry
Long-Term Contracts

RPAG, 5/19/20. All content subject to change. #23
Total Available = 186,557 AF

NIA = 201 KAF

M&I = 554 KAF

Ag Pool = 245 KAF

Other Excess = 247 KAF

Indian = 333 KAF

P3 = 68 KAF

~48 KAF

2018

2020

Recent CAP Use
Current vs Projected Demand

2020

2045

Available supply reduced due to assumed 0.1% annual growth rate in On-River P1-3 demands

Other Excess = 144 KAF

NIA = 317 KAF

Indian = 343 KAF

M&I = 686 KAF

P3 = 68 KAF

1.415 MAF

RPAG, 5/19/20. All content subject to change. #25
Current vs Projected Demand – **Tier 0** (192,000 AF)

**2020**
- Indian = 337 KAF
- M&I = 597 KAF
- NIA = 201 KAF
- Ag Pool = 249 KAF
- Other Excess = 141 KAF
- P3 = 68 KAF

**2045**
- Indian = 343 KAF
- M&I = 686 KAF
- NIA = 269 KAF
- Ag Pool = 249 KAF
- Other Excess = 144 KAF
- P3 = 68 KAF
Current vs Projected Demand – **Tier 1** (512,000 AF)

**2020**
- NIA = 130 KAF
- M&I = 597 KAF
- Ag Pool = 300 KAF
- Other Excess = 141 KAF
- Indian = 337 KAF
- P3 = 68 KAF

**2045**
- NIA = 317 KAF
- M&I = 636 KAF
- Other Excess = 144 KAF
- Indian = 343 KAF
- P3 = 68 KAF
Current vs Projected Demand – Tier 2a (592,000 AF)
Current vs Projected Demand – **Tier 2b** (640,000 AF)

2020

- **NIA = 2 KAF**
- **Ag Pool = 300 KAF**
- **Other Excess = 141 KAF**
- **Indian = 337 KAF**
- **M&I = 597 KAF**
- **P3 = 68 KAF**

2045

- **NIA = 317 KAF**
- **Other Excess = 144 KAF**
- **NIA = 317 KAF**
- **Indian = 309 KAF**
- **M&I = 542 KAF**
- **P3 = 68 KAF**
Current vs Projected Demand – Tier 3 (720,000 AF)

2020

- NIA = 201 KAF
- M&I = 545 KAF
- Ag Pool = 300 KAF
- Other Excess = 141 KAF
- Indian = 312 KAF
- P3 = 68 KAF

2045

- NIA = 317 KAF
- M&I = 491 KAF
- Ag Pool = 300 KAF
- Other Excess = 144 KAF
- Indian = 280 KAF
- P3 = 68 KAF
Effect of P1-3 Projected Growth in Demand

- **Historic**
  - NIA = 317 KAF
  - M&I = 491 KAF
  - Other Excess = 144 KAF
  - Indian = 280 KAF
  - P3 = 68 KAF

- **Projected**
  - 0.1% Growth

(Acre Feet vs. Time Graph)

RPAG, 5/19/20. All content subject to change. #31
Effect of P1-3 Projected Growth in Demand

Historic Projected

0.5% Growth

RPAG, 5/19/20. All content subject to change. #32
Long-Term Storage Credits Example

Tier 1 – (512,000 AF)

Accrual of LTSCs

Other Excess = 141 KAF
Ag Pool = 300 KAF
M&I = 597 KAF
P3 = 68 KAF

RPAG, 5/19/20. All content subject to change. #33
Updated Recovery Modeling
Overview of Recovery Modeling

Elevation of Lake Mead → Supply to AZ → Use by On-River P1-3 → Supply to CAP → Supply by CAP Priority → Impact to NIA & M&I Firmed by AWBA

Supply to CAP → Impact to P4 M&I Firmed by AWBA
Overview of Recovery Modeling

Supply to CAP

Total Available = 186,557 AF

NIA = 317 KAF
M&I = 542 KAF
Ag Pool = KAF
Other Excess = 144 KAF

P3 = 68 KAF
Indian = 309 KAF
RPAG, 5/19/20. All content subject to change. #36
Joint Recovery Model

• A tool for the three agencies to evaluate different recovery assumptions and scenarios
• Retains the shortage sequences from CRSS
Recovery Volumes: Trace 80

On River

NIA

M&I

Total

RPAG, 5/19/20. All content subject to change. #38
Recovery Volumes: Trace 10
Recovery Volumes: Trace 40

On River

NIA

M&I

Total

RPAG, 5/19/20. All content subject to change.
Recovery Volumes: All Traces

Note: The data for these charts shown at the 5/19/20 RPAG meeting was inadvertently shifted forward in time by one year. The versions shown here are corrected.
Recovery Volumes: All Traces, Same Scale

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Recovery Volumes: All Traces

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Recovery Volumes: **All Traces**

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Conclusions

• Primary Factors Affecting Recovery
  o Reductions and contributions required under Guidelines & DCP
  o Projected on-River consumptive uses
  o CAP contract and subcontract use

• Potentially large recovery volumes, but at low probabilities

• Other factors that can have an effect on recovery volumes
  o Post-2026 rules and policies
  o Demand management/conservation
  o Long-term storage credit accrual
Discussion