Value Planning Study Review

- 6 Step Job Plan
  - Information Phase
  - Function Analysis
  - Creativity Phase
  - Evaluation Phase
  - Development Phase
  - Presentation Phase

- Intensive / Compressed Time

- Team Consensus
  - Implementation Phase
# Value Planning Study Review

- **Value Planning Team (Team) Expertise:**

<table>
<thead>
<tr>
<th>TEAM EXPERTISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Water Resources Engineering</td>
</tr>
<tr>
<td>Dam Engineering</td>
</tr>
<tr>
<td>Geotechnical Engineering</td>
</tr>
<tr>
<td>Constructability and Costing</td>
</tr>
<tr>
<td>Ecology and Environmental Compliance</td>
</tr>
<tr>
<td>Geomorphology and Sediment Transport</td>
</tr>
<tr>
<td>Materials Engineering</td>
</tr>
<tr>
<td>Geology</td>
</tr>
<tr>
<td>Tunneling</td>
</tr>
<tr>
<td>Hydrology, Water Modeling and Yield</td>
</tr>
<tr>
<td>Hydraulics and Water Conveyance</td>
</tr>
<tr>
<td>Value Study Facilitation</td>
</tr>
</tbody>
</table>
Value Planning Study Schedule

- Site Visit
  - June 11 & 12, 2015
  - Value Planning Team, ISC, Reclamation, US Forest Service, TNC, GSFWC, Local Irrigators, NM Audubon Society

- Study Team Project Briefing
  - June 15, 2015

- Study
  - June 15 - 19, 2015
Divert, Convey, Store, and Deliver
- Target 13,000 ac-ft storage in Phase One
- Diversion and conveyance sized for max 350 cfs (CUFA limits)
- Meet environmental and agricultural needs

• Least Amount of Cost

• Expandable to Phase Two and Phase Three
  - Phase 2 may provide additional storage (above 13,000 ac-ft) or other additions such as reservoir lining.
  - Phase 3 - Target total project storage of 46,000 ac-ft and conveyance to Mimbres Basin.
New Mexico Unit - Background

- In 2004 AWSA allowed New Mexico to divert 140,000 af/10 years by means of exchange of CAP water in Arizona.

- AWSA provides indexed funding: Up to $128 million of non-reimbursable funding.

- New Mexico notified Department of Interior of intent to construct Unit Nov 24, 2014.

- New Mexico CAP Entity and Department of Interior to sign Unit Agreement by Nov 24, 2015.

- AWSA names Reclamation lead agency for environmental compliance, New Mexico co-lead.

- Record of Decision required by December 31, 2019.
Value Study Objectives

• Better develop and compare New Mexico Unit alternatives
• Develop technically sound alternatives
• Investigate ways to reduce costs
New Mexico Unit – Previous Studies


New Mexico Unit – Problem Statement

The Team developed the following problem statement:
Develop alternatives for a functional project of the New Mexico Unit.
The team defined a functional project as:

• Divert, convey max 350 cfs, and store water with a target of 13,000 ac-ft of storage in Phase One, supplying Cliff-Gila and Virden agriculture while meeting environmental needs
• Least amount of cost
• Ensure alternative is expandable to allow for total project build-out to the Mimbres Basin. Phase Two and Phase Three to include additional target storage of 46,000 ac-ft and conveyance to Mimbres Basin.
Preferred Diversion Locations
Value Planning Study Statistics

- 29 Ideas Generated
- 12 Alternatives
- 10 Design Considerations

Criteria and Weighting for Ranking Alternatives

- Storage Capacity for Phase One – 18%
- Storage Capacity for All Phases – 15%
- Capital Cost for Phase One – 19%
- Capital Cost for All Phases – 15%
- OM&R Energy Cost for All Phases – 11%
- Potential Environmental Impacts for All Phases – 10%
- Impacts to Existing Infrastructure for All Phases – 4%
- Permitting Complexity for All Phases – 8%
<table>
<thead>
<tr>
<th>Alternative</th>
<th>Weighted Score</th>
<th>Ranking</th>
<th>Meets Phase One Target</th>
<th>13,000 ac-ft Phase One Costs</th>
<th>Costs for All Three Phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 9A - Small Winn / Large Winn</td>
<td>333.3</td>
<td>1</td>
<td>Yes</td>
<td>$340M</td>
<td>$800M</td>
</tr>
<tr>
<td>Alternative 9B - Small Bell / Large Bell</td>
<td>318.1</td>
<td>2</td>
<td>Yes</td>
<td>$375M</td>
<td>$840M</td>
</tr>
<tr>
<td>Alternative 4 - Large Pope / Greenwood</td>
<td>306.4</td>
<td>3</td>
<td>Yes</td>
<td>$320M</td>
<td>$945M</td>
</tr>
<tr>
<td>Alternative 1 - Small Spar / Upper Spar</td>
<td>292.8</td>
<td>4</td>
<td>No</td>
<td>$245M</td>
<td>$835M</td>
</tr>
<tr>
<td>Alternative 8 - Small Greenwood / Greenwood</td>
<td>284.2</td>
<td>5</td>
<td>Yes</td>
<td>$410M</td>
<td>$775M</td>
</tr>
<tr>
<td>Alternative 7 - Original Winn / Small Greenwood</td>
<td>282.2</td>
<td>6</td>
<td>No</td>
<td>$110M</td>
<td>$685M</td>
</tr>
<tr>
<td>Alternative 5 - Large Garcia / Greenwood</td>
<td>280.0</td>
<td>7</td>
<td>Yes</td>
<td>$370M</td>
<td>$985M</td>
</tr>
<tr>
<td>Alternative 9C - Small Winn / Greenwood</td>
<td>254.7</td>
<td>8</td>
<td>Yes</td>
<td>$340M</td>
<td>$1,005M</td>
</tr>
<tr>
<td>Alternative 9D - Small Bell / Greenwood</td>
<td>254.7</td>
<td>8</td>
<td>Yes</td>
<td>$390M</td>
<td>$1,050M</td>
</tr>
<tr>
<td>Alternative 2 - Small Pope / Greenwood</td>
<td>246.7</td>
<td>9</td>
<td>No</td>
<td>$340M</td>
<td>$930M</td>
</tr>
<tr>
<td>Alternative 3 - Small Garcia &amp; Small Pope / Greenwood</td>
<td>243.3</td>
<td>10</td>
<td>Yes</td>
<td>$450M</td>
<td>$1,035M</td>
</tr>
<tr>
<td>Alternative 6A - Small Spar / Greenwood</td>
<td>241.1</td>
<td>11</td>
<td>No</td>
<td>$245M</td>
<td>$1,030M</td>
</tr>
</tbody>
</table>

Total Possible Score = 500

Colors indicate score ranges:
- Green: Score 300-500
- Yellow: Score 275-300
- Orange: Score 250-275
- Red: Score 225-250
Alternatives 9A and 9B
Winn and Bell Canyons

Winn - Phase 1
- Divert at Diversion 2A
- 2–mile tunnel
- 1.5-mile siphon
- 3.8-mile open channel canal
- 13,000 ac-ft reservoir
- $340M

Bell - Phase 1
- Same as Winn thru siphon
- 6-mile canal to Bell Canyon
- 13,000 ac-ft reservoir
- $375M

MAP KEY
Existing Diversions
U - Upper Gila
F - Ft. West
G - Gila Farm
R - Riverside
C - Clark
B - Bill Evans
2A - Proposed Diversion
2A    Proposed Diversion
Reservoir  
Channel  
Tunnel  
Pipe  
Gila Wilderness

1 Mile
Alternatives 9A and 9B
Winn and Bell Canyons – Phase 2/3

• “Small” Winn storage capacity limited by topography.
• Raise Small Winn Dam and lengthen dam crest to incorporate abutment ridge lines to increase storage capacity to 46,000 ac-ft.
• Borrow for dam raise generated from reservoir basin to increase storage.
• Lined reservoir
• Bell similar approach.
• Total Winn = $800M; Total Bell = $840M
Alternatives 9A and 9B Winn and Bell Advantages, Disadvantages, Ranking

**Advantages**
- Lowest cost options for Phase 1 with 13,000 ac-ft storage
- Gravity flow for Phase 1 storage and increased storage
- Shorter tunnel
- Able to add additional storage
- Second lowest cost alternative for Phase 3

**Disadvantages**
- Phase 1 requires siphon under/across Gila River
- Phase 3 requires siphon across Gila River for Mimbres conveyance
- Lining anticipated to reduce seepage into alluvial and Gila conglomerate foundation

**Ranking** — Winn 9A - 1st overall; Bell 9B - 2nd overall
**Alternative 4 – Large Pope / Greenwood**

**Phase I**: Pope Canyon; 13,000 acft; Ring Dam w/Exc adds 7,000 acft

**Final**: Greenwood Canyon; adds 47,000 acft; pump from GW to Mimbres
**Alternative 4 – Large Pope / Greenwood**

**Costs:** Phase 1 – $320M, Final total $945M: $24k/acft, $16k/acft

**Advantages:**
- Alternative is easily phased
- All on east side of Gila Valley; closer to Mimbres, no Gila crossing
- Both canyons are dry or intermittent flow with minimal habitat of concern
- Pope is suitable for gravity supply to Upper Gila diversion point

**Disadvantages:**
- Impacts 2 canyons
- Requires open canal conveyance
- US 180 must be relocated; but SH 211 would not
- SH 211 limits ring dam excavation and fill balancing; requiring > excavation
- High earthwork Q’s; $8M exc with 1M embankment; high waste

**Ranking:** 3\(^{rd}\) overall
- Fully functional Ph 1; favorable location, low environmental impact; 60k acft
- High costs – PH 1 and final
Alternative 1
Small Spar / Upper Spar

Phase 1 - $245M
Total Project - $845M
Primary Components

Phase 1
• 350 cfs Diversion at site 2A
• 1000 ft pipeline
• 3 mile 108-inch dia tunnel
• Lower Spar Reservoir – 1642 ac-ft

Other Phases
• Upper Spar Reservoir – 46,000 ac-ft
• Pump Station at Lower Spar
  • Included 50 cfs
• Short Pipeline to Upper Spar
• Conveyance to Deming
Alternative 1 – Small Spar and Upper Spar

**Advantages**
- Only impacts one canyon
- Provides gravity release to existing ditches and for environmental use
- Reservoir on East Side – Deming Pumping
- Small Spar – settling basin/forebay
- Third lowest level Phase 1 cost
- Fourth lowest total project cost

**Disadvantages**
- 1642 ac-ft of storage in Lower Spar does not meet Phase 1 target
- Requires pumping to upper reservoir – Higher O&M and energy costs
- With pump station capacity of 50 cfs, fill small reservoir in 2.8 days, thereby losing diversion opportunities. Likely need larger pump station

**Overall Ranking:** 4th overall
**Alternative 8**

**Diversion Location:** 2A

**Conveyance Option:** Tunnel to about Spar and then canal to Greenwood

**Storage Reservoir:** Greenwood Canyon

**Greenwood Phase 1:**
- Divergence, conveyance, storage
- 132-foot-high embankment

**Greenwood Total Project:**
- Raise dam to 187 feet high (55-foot raise)
- Pump to Deming
Phase 1 Storage: ~15,000 acre-ft
Phase 1 Cost: $410 million

Phase 2 Storage: ~47,000 acre-ft
Total Project Cost: $775 million
Alternative 8 – Advantages

• Single Canyon Site
  – Phase 1 storage of 15,000 acre-ft
  – Total project storage
  – No known critical habitat

• More favorable dam foundation
  – Rhyolite instead of conglomerate

• Close Access to pump to Deming, NM for total project
  – No additional infrastructure (inverted siphons, etc.)
Alternative 8 – Disadvantages

• Road relocations required
  – US highway 180 and county road

• High phase 1 cost
  – Close to total project build-out

• Requires pumping water deliveries back up the Cliff-Gila Valley

• Requires long conveyance from divergence
  – Open canal environmental impact
Alternative 8 – Ranking

5th overall

Low Score: High phase 1 cost and highway relocations

High Score: Efficient dam site located in single canyon
Alternative 7 – Original Winn/Small Greenwood

**Diversion Location:** 1

**Conveyance Option:** Open Channel

**Storage Reservoir:** Original Winn and Small Greenwood (as designed by Reclamation)

**Phases:**
1 - Diversion, Canal to Winn, Winn Reservoir: $110 M
2 and 3 - Canal to Greenwood, Greenwood Reservoir, Pipeline to Deming: $575 M

**Total Cost:** $685 M
Advantages:
• Greenwood Canyon is on the east side of the valley, which is suitable for pumping to Deming. No additional infrastructure (inverted siphon, etc) would be needed.
• Less head loss for open channel compared to buried pipe
• Lower cost for open channel compared to buried pipe

Disadvantages:
• Winn’s capacity would not satisfy target capacity nor needs for Phase I.
• Greenwood’s capacity would not meet the target capacity for Phase III.
• Inundation of two reservoirs, rather than one.
• Safety issues associated with open channel
• Environmental footprint of an open channel to convey 350 cfs
• Diversion 1 and part of conveyance to Winn on TNC-managed land

Ranking: 6/11
• Lowest cost for Phase I among all alternatives
• Phase I functionality questionable
Design Consideration – Lining

• All Reservoirs include Geomembrane Lining @ $3/sq ft

• Lining justified by:
  – Highly permeable soils – Sands
  – High Cost of the Water

• Covered vs Exposed
  – Exposed – 20 year design life
  – Covered – 50 to 100 year design life
Design Consideration – Lining

- Earthwork
  - Unlined - Follows natural topography
  - Lined - 3:1 sideslopes
- Regular Shape
  - Oval
  - Triangular
  - Rectangular
Design Consideration – Lining Cost

- Steps to Lining ($/sf)
  - Additional Excavation 0.44
  - Trim to Final Grade 0.77
  - Geomembrane w/ Geotextile Cushion 0.90
  - Soil Cover (2 ft thick) 0.88
  - TOTAL 3.00

- *Add 5% for Subgrade slopes at 3:1
Value Study Deliverables

1. Final presentation: Team to provide edits, comments, and complete estimates (~1-2 weeks)

2. Final report: Jeff Morris and company to finalize and transmit the Final Value Planning Report to ISC and Reclamation (by the end August 2015)