ENGINEERING EVALUATION OF AWSA DIVERSION AND STORAGE PROPOSALS

Presented by:
Craig W. Hoover, P.E.
Bohannan Huston Inc.
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PHASE I - Background

▲ BHI contracted by ISC for Gila Standby Engineering Services May 2013
▲ Completed Preliminary Engineering Report (PER) for Gila River Diversion, Conveyance and Storage Alternatives April 2014
▲ April 2014 PER based on:
  – Records research
  – Site investigations
  – Appraisal Level Engineering Analysis
PHASE I - Analysis

- Gila River from Turkey Creek to Mangas Creek in the Cliff-Gila Valley
- Initially considered 22 side canyons / locations for storage
- Developed Initial Screening Matrix – Reduced to 13 canyons
- Refined Canyon Evaluation Matrix – Reduced to 8 canyons
- Evaluated 8 diversion types
PHASE I Results

▲ Recommended diversion structure:
  – Low profile concrete weir with tilted wedge-wire screen (Coanda screen)

▲ Potential Storage at 6 Canyons:

<table>
<thead>
<tr>
<th>Spar</th>
<th>Pope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maldonado</td>
<td>Sycamore</td>
</tr>
<tr>
<td>Winn</td>
<td>Dix</td>
</tr>
</tbody>
</table>

▲ Three alternatives with cost estimates
PHASE II Scope

May 2014 BHI contracted to refine assessment of Phase I findings:

– Geomorphologic review
– Diversion site investigation / hydraulic modeling
– Geophysical/geotechnical field work
– Further evaluation of Spar and Winn Canyons
– Evaluation of pumping options
PHASE II Scope (cont.)

- Evaluation of diversion structure and tunnel conveyance
- Assessment of solar power
- Development of new alternatives with costs
- Evaluation of diversion / storage in Virden Valley
- Final Phase II PER
PHASE II Methods

▲ Desktop research

▲ Geomorphology study
  – Diversion point investigation
  – Hydraulic modeling
  – Sediment transport modeling (diversion & tunnel)

▲ Geotechnical / geophysical field work
  – To characterize soils at storage sites
  – To determine depth to bedrock
PHASE II Results: Alternative 1

- **Diversion:**
  - Location: Upstream of the confluence of Brock Canyon
  - Method: Coanda Screens (350 cfs)

- **Storage:**
  - Location: Spar, Winn, Pope, and Sycamore Canyons
  - Method: Lined earthen dam
PHASE II Results: Alternative 1

▲ Conveyance:
- Tunnel from diversion to Spar by gravity
- Buried pipes from Spar to other reservoirs by gravity

▲ Delivery from:
- Spar: Release water for environmental use
- Winn: Release / pump back water for Ag use
- Pope: Pump water over the Divide along Hwy 180 for M&I use
PHASE II Results: Alternative 2

▲ Diversion:
  - Location: Upstream of the confluence of Brock Canyon
    • Method: Coanda Screens (200 cfs)
  - Location: Downstream of Turkey Creek
    • Method: Infiltration Galleries (150 cfs)

▲ Storage, Conveyance and Delivery:
  - Same as Alternative 1
PHASE II Results: Alternative 3

▲ Diversion:
- Location: Downstream of confluence of Spar Canyon
  - Method: Coanda Screens (350 cfs)

▲ Storage:
- Location: Spar, Winn, and Pope Canyons
  - Method: Lined earthen dam
PHASE II Results: Alternative 3

▲ Conveyance:
- Pump from diversion to Spar
- Buried pipes from Spar to other reservoirs by gravity

▲ Delivery from:
- Spar: Release water to the river (Ag & Env. use)
- Pope: Pump water over the Divide to Mimbres Basin along Hwy 180 (M&I use)

<table>
<thead>
<tr>
<th>Canyon Name</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spar</td>
<td>46,037</td>
</tr>
<tr>
<td>Winn</td>
<td>10,713</td>
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<tr>
<td>Pope</td>
<td>8,732</td>
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<tr>
<td><strong>Total Volume</strong></td>
<td><strong>65,482</strong></td>
</tr>
</tbody>
</table>

Capital Cost: $703 M
O&M Cost: $8.0 M
Power Generation Concepts for Pumping

▲ Solar Arrays
- Solely from Solar Energy: Not feasible
- Interconnected to PNM grid
- Recommended for:
  • SWRWS pump stations
  • Winn Pump Station to pump 50 cfs (not 10 cfs)

▲ Hydro-Turbines:
- Recommended for SWRWS pipeline to Deming
- Contingent upon PNM allowances
Diversion & Storage in Virden

▲ BHI developed 5 alternatives

– Cost per AF is 5 -10 times the cost per AF of Alternative 1 for Cliff-Gila
  • Significant increase in tunnel length
  • Reduction in project storage volume from 65,000 AF to 6,000 AF
Conclusion

▲ New surface diversion point: Upstream of confluence of Brock Canyon

▲ Recommended diversion structures:
  – Subsurface: Infiltration Galleries (up to 150 cfs)
  – Surface: Coanda Screens (200 to 350 cfs)
Conclusion

▲ HDPE liners with clay subgrade layer to control seepage
▲ Establish an agreement with PNM to efficiently use solar arrays and hydro-turbines to offset energy
▲ All alternatives meet the project objectives
Gila Phase II Diversion Structure

Plan View Rendering

Perspective Rendering

Bohannan Huston