2012 Hydrograph Development Status

March 8, 2011
2011 Process

• Developed flexible constraints under MLFF
• Tested under 3 hydrologic scenarios
• Presented to Western
• Presented to AMWG
• AMWG recommended to Secretary
• Adopted by Secretary
• Agreed to more inclusive process in 2012
2011 Experiences

• 2011 method has been successfully applied
• Effects will be determined at year end
• Some complications with maintenance and unit outages
• Lower releases (than permitted) in the winter may be desirable to retain sediment in anticipation of a spring HFE
2012 Hydrograph Development

• Start with 2011 Hydrograph
• Consider operating experiences from 2011
• Look to improve the combination of cost and benefit
• 2012 Hydrograph recommendation will need to be within existing environmental compliance
• Non-MLFF ideas referred to LTEMP
Round 1
2012 Hydrograph Parameter Analysis
Monthly Volumes Distributions for 9.3 maf Release
Upper Marble Canyon (RM30)

137 ktons or 24 percent increase in sand retention for the period.

Flows in 2011 are all the same for the 4 scenarios.
Lower Marble Canyon (RM61)

- Sand Retention (ktons)

- Lower Marble Canyon (RM61)

33 ktons
# Example of Power Cost Detail

**Scenario:** +/-100k acre feet/month

<table>
<thead>
<tr>
<th>On-Peak</th>
<th>Off-Peak</th>
<th>Total</th>
<th>Ave Price ($/MWh)</th>
<th>Monthly Net Revenue ($1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>12,824</td>
<td>1,365</td>
<td>14,189</td>
<td>40.75 31.75</td>
</tr>
<tr>
<td>Nov</td>
<td>17,599</td>
<td>4,444</td>
<td>22,043</td>
<td>40.75 31.75</td>
</tr>
<tr>
<td>Dec</td>
<td>13,717</td>
<td>2,234</td>
<td>15,951</td>
<td>40.75 31.75</td>
</tr>
<tr>
<td>Jan</td>
<td>4,661</td>
<td>1,002</td>
<td>5,664</td>
<td>42.00 33.75</td>
</tr>
<tr>
<td>Feb</td>
<td>-53,725</td>
<td>-6,970</td>
<td>-60,695</td>
<td>38.50 29.50</td>
</tr>
<tr>
<td>Mar</td>
<td>-49,712</td>
<td>-17,488</td>
<td>-67,200</td>
<td>38.60 28.50</td>
</tr>
<tr>
<td>Apr</td>
<td>2,188</td>
<td>0</td>
<td>2,188</td>
<td>38.75 23.75</td>
</tr>
<tr>
<td>May</td>
<td>45,885</td>
<td>7</td>
<td>45,892</td>
<td>38.50 23.50</td>
</tr>
<tr>
<td>Jun</td>
<td>42,906</td>
<td>14</td>
<td>42,920</td>
<td>39.00 24.00</td>
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<tr>
<td>Jul</td>
<td>75,939</td>
<td>2,789</td>
<td>78,728</td>
<td>47.00 30.50</td>
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<tr>
<td>Aug</td>
<td>54,060</td>
<td>646</td>
<td>54,706</td>
<td>47.00 30.50</td>
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<tr>
<td>Sep</td>
<td>37,316</td>
<td>35</td>
<td>37,350</td>
<td>47.00 30.50</td>
</tr>
<tr>
<td>Tot</td>
<td>203,658</td>
<td>-11,922</td>
<td>191,736</td>
<td>41.55 29.15</td>
</tr>
</tbody>
</table>
## Summary of Round 1

<table>
<thead>
<tr>
<th>Restriction Level</th>
<th>Additional Power Costs</th>
<th>Tons in Marble Canyon</th>
<th>Additional Tons Retained in Marble Canyon</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>$1,748,000</td>
<td>746,000</td>
<td>170,000</td>
</tr>
<tr>
<td>150</td>
<td>$868,000</td>
<td>681,000</td>
<td>105,000</td>
</tr>
<tr>
<td>200</td>
<td>$245,000</td>
<td>622,000</td>
<td>46,000</td>
</tr>
<tr>
<td>None</td>
<td>$0</td>
<td>576,000</td>
<td>0</td>
</tr>
</tbody>
</table>
Sand Retention

![Graph showing the relationship between power costs and sand retention. The x-axis represents power costs in thousands of dollars, ranging from $0 to $2,000,000. The y-axis represents sand retention in ktons, ranging from 0 to 180. The graph includes two data points: one at ($0, 40) and another at ($1,000,000, 160).]
Comparison of Unrestricted vs. +/- 100 kaf

• The +/-100 kaf scenario retained 170 ktons in Marble Canyon

• Historically HFE’s have deposited about 600 ktons above 8000 cfs level (somewhat independent of sediment input)

• Starting with a higher bed load could be expected to help reduce the net loss of sediment from the system by an HFE.

• Additional Cost = $1.75m
Sand Budget Illustration 1
(Fixed HFE but with Higher Retention)
Assumes: No change in HFE, Historic budget

530 ktons to beach and eddy

880 ktons goes down the river

1,410 ktons eroded from bed load

1,700 ktons >> 290 ktons (Unrestricted Scenario)
or
1,700 ktons + 170 ktons = 1,870 ktons >> 460 ktons (2011 Scenario)
Sand Budget Illustration 2
(Larger HFE Triggered by Retention)
Assumes: 10% Larger HFE Triggered due to Higher Retention
10% more to beach, eddy, and export

530 + 50 ktons to beach and eddy

River

880 + 88 ktons goes down the river

1,410 + 138 ktons eroded from bed

1,870 ktons >> 322 ktons

10% Larger HFE triggered
Next Steps – Round 2

• Add possible November 2011 HFE to all runs to better simulate starting conditions for 2012
• Scenario 5 – run +/- 25 kaf restriction
• Scenario 6 – run +/- 50 kaf restriction
• Scenario 7 – run +/- 100 kaf restriction
• Scenario 8 – run +/- unrestricted
• Scenario 9 - run targeted August-Oct restriction
  – (August 800 kaf)
  – (Sept/Oct at 5yr Steady Flow Test levels)
Upper Marble Canyon (RM30)

Target August sediment inputs for retention

Sand Retention (ktons)


Red: +/- 100 KAF  Blue: +/- 150 KAF  Green: +/- 200 KAF  Purple: Unrestricted
Round 2
2012 Hydrograph Parameter Analysis
Monthly Volumes Distributions for 9.3 maf Release
Add
Round 2
Power Costs