Bow River Operations 2016/17

Trans Alta and Alberta Environment and Parks
5 Year Water Management Agreement

Flood and Drought Mitigation Using Hydroelectric Reservoirs
Presentation

- South Saskatchewan River Basin – Bow River Sub Basin
- Driver for changing an Operational Culture – 2013 City of Calgary Flood
- Public/Private Partnership – a case study
- Reservoir Operations
  - Flood Attenuation
  - Drought Mitigation
- Key Messages
Calgary, Alberta – June 2013 Flood
Estimated $5 Billion in Damages
Response to the 2013 Floods: Leverage existing water management infrastructure in the Upper Bow River Basin for flood attenuation

Benefits:

• Maximizing existing infrastructure
• Immediate water management options
• Potential for flexible water management options
  • Manage for flood
  • Manage for drought
• Situational/Oppportunistic

Challenge: Privately owned dams with no drought or flood mitigation component in their licenses to operate
The Bow River Basin
A Diversity of Users
**Diverse Objectives**

Aquatic Health Interests – natural flow regime
Irrigation Districts – Fill sooner, use later
Power Generation – high reservoir/fluctuating river
Urban Centre's – reservoirs as low as possible for as long as possible
Floodplain Residents – reservoirs as low as possible for as long as possible
Fisheries – less reservoir fluctuation/strategic seasonal river flows
River Recreation – steady flows
Reservoir Recreation – high reservoir year round
Water Management Services Agreement
April 1st, 2016 to April 1st, 2021

Between the Province of Alberta and Trans Alta Utilities
Alberta Environment and Parks / Trans Alta Agreement

• 5 Year Term

• Includes Kananaskis System and Ghost Reservoir

• Dual Mandate and Objectives
  • Flood Attenuation
  • Drought Mitigation

• Improved water management flexibility

• Compensation to offset commercial loss to the Utility ($5.5 M / year)
Bow River Basin

Kananaskis System

Spray

Minnewanka

Ghost Reservoir

Kananaskis System
Ghost Reservoir
Ghost Reservoir

- **Flood Mitigation - Primary Use**
  - Provide flood attenuation storage during the highest risk period
  - Protect flood plain properties and infrastructure (City of Calgary and outlying communities)
  - May 16th to July 7th
Ghost Reservoir Elevations

Control Period

Historical Operations

Modified Operations

May 16th

July 7th

Ghost level was drawdown to 1185m and refilled in two weeks

Ghost level was drawdown to 1187m and refilled in two weeks

Ghost level was drawdown to 1185m and refilled in three weeks

Ghost level was drawdown to 1187m and refilled in three weeks

Normal operations
Kananaskis System
Hedging Against Drought
Alberta Environment and Parks / Trans Alta Agreement

Kananaskis System

- Upper Kananaskis Lake
- Lower Kananaskis Lake
- Barrier Reservoir

- Drought Mitigation Primary Use
  - Water Bank?
  - Augment instream flow needs
  - Critical Water Needs (City of Calgary, Irrigation Districts, others)
  - Year round availability
Kananaskis Facilities Virtual Reservoir 2016
(Combined available volumes from Barrier, Upper and Lower Kananaskis Reservoirs)

Modified Operations

Hypothetical Supplement Scenario (additional ~15 cms for 28 days)
Operational Decision Making

- Snowpack/Water Supply Outlook
- Assessment of seasonal flood risk
- Assessment of seasonal drought risk
- Weather trends/cycles
- Irrigation demand
- Soil moisture monitoring and conditions
- Ability (both time and water volume) to restore reservoir levels
- Public Safety, environmental and recreational considerations
- Operational experience
- Situational and dynamic
Key Messages

- Transparency – daily web information, real time data available, seasonal reports, water supply outlooks
- Partnerships (inclusive) – Communities, Utilities, Irrigation Districts, Recreational Groups, Public, Provincial Regulator, First Nations
- Communications – news releases, open houses every spring
- Adaptive – daily decision making based on rapidly changing conditions and informing accordingly, real time response to immediate water demands

“We can’t seem to make anyone happy but we can try to make some people less mad!”
Thank You
How to get information......

For “Real Time” information download the Alberta Rivers Application on your I-phone or Android device.

If you have questions or would like more information e-mail us at: ghost-kananaskis@gov.ab.ca
## Bow River at Calgary Potential Flow Reduction

<table>
<thead>
<tr>
<th>Year</th>
<th>Bow at Calgary Recorded Peak Flows ($m^3/s$)</th>
<th>Bow at Calgary Peak Flow ($m^3/s$) with best reduction for Ghost Reservoir starting elevation of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1185 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1187 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1189.4 m</td>
</tr>
<tr>
<td>1995</td>
<td>500</td>
<td>375 (125)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 (100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>470 (30)</td>
</tr>
<tr>
<td>2005</td>
<td>790</td>
<td>510 (280)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>530 (260)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>650 (140)</td>
</tr>
<tr>
<td>2013</td>
<td>1840</td>
<td>1450 (390)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1520 (320)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1660 (180)</td>
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</table>
Bow River Basin Review Group

• Initiated by the Government of Alberta in the fall of 2015.
• Jointly Chaired by Alberta Environment and Parks and the City of Calgary.
• Strategic opportunities to reduce future flood damage, improve reliability of water supply and protect the long term health of the basin.
• Spring 2017 report back.
System Supplemental Flows vs. Potential Available Volume

<table>
<thead>
<tr>
<th>Duration vs Volume</th>
<th>10,000,000 m³</th>
<th>20,000,000 m³</th>
<th>30,000,000 m³</th>
<th>40,000,000 m³</th>
</tr>
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<tbody>
<tr>
<td>7 Days</td>
<td>16 m³/s</td>
<td>32 m³/s</td>
<td>50 m³/s</td>
<td>66 m³/s</td>
</tr>
<tr>
<td>14 Days</td>
<td>8 m³/s</td>
<td>16 m³/s</td>
<td>25 m³/s</td>
<td>33 m³/s</td>
</tr>
<tr>
<td>21 Days</td>
<td>6 m³/s</td>
<td>11 m³/s</td>
<td>16 m³/s</td>
<td>22 m³/s</td>
</tr>
<tr>
<td>28 Days</td>
<td>4 m³/s</td>
<td>8 m³/s</td>
<td>12 m³/s</td>
<td>17 m³/s</td>
</tr>
</tbody>
</table>

- Timing, available volume and duration of flows are critical factors.
- Upper Lake: 2500 dam³/foot  
  Lower Lake: 1600 dam³/foot
- Not sustainable – draining the system
Ghost Reservoir
Operation Objective – Flood Mitigation

• Control Period – May 16\textsuperscript{th} to July 7\textsuperscript{th} – Province has the ability to set and adjust reservoir target elevations (up to 2 m lower than historical averages)
• May 1\textsuperscript{st} – Province provides Trans Alta (TA) intended reservoir target levels for the control period based on antecedent conditions
• Elevations set based on potential flood risk
• TA maintains intended target levels within 0.3 m during the control period
• TA assumes control of their reservoir for events which would see a deviation of greater than 0.3 m including planned or unplanned outages, flood operations or dam safety emergency
• Upon resolution of the event TA returns to the intended target level as soon as reasonably possible
Kananaskis System Operation Objective – Drought Mitigation

- Potential to supplement flows in the main stem of the Bow River by utilizing storage in the Kananaskis sub-basin
- Province has “purchased” the ability to set intended reservoir elevations
- The intended levels will be followed unless additional water releases are directed by the province
- Social (i.e.: recreation) and Environmental (i.e.: fisheries, IO’s, Winter Flows) constraints must be considered.....these reservoirs are in a Provincial Park.
2016 – An Interesting Year

Key decision influencers:

• Extremely warm and dry conditions prevailed throughout winter 2015/16.
• March/April recorded record low precipitation, low soil moisture conditions.
• Plains snow was exhausted much earlier than average in 2016.
• Mountain snowmelt was exhausted much earlier than normal (approx. 3-4 weeks earlier than normal).
• Rivers saw peak runoff flows much sooner than normal.
• Natural flows dropped off much sooner than normal and reservoirs were at risk of not filling.
• *If it had not started raining in July it would have been a very interesting year!*