Skagit River General Investigation Study
Scoping Meeting Comments

City of Burlington

August 10, 2011
Topics

1. Importance of upstream flood storage, Baker in particular
2. Sterling
3. BNSF Skagit River Bridge
Importance of Upstream Flood Storage
Flood Risk Reduction Impact of Additional Flood Storage

• With additional **Baker** flood storage in place (139,000 AF in accordance w/ Baker advance drawdown targets), Skagit peak flow reduction will be 13,000 – 18,000 cubic feet per second
  – Reduces downstream surface water elevation **1.5 feet**
  – Coordination w/ downstream storage (40,000 – 60,000 acre-feet in the Nookachamps basin) reduces **another 1.5 feet**

• Similar reductions can occur from **Ross** storage and operation

• **At least 3-4 feet flood reduction in total**
Goal of Flood Storage
(from our perspective)

• **Zero outflow** from these basins for an appropriate time prior to and following the Skagit flood peak at Concrete

• Adequate storage at the beginning of a large Skagit flood for both the Ross and Baker basins to capture their own 100-year event

• *We think the data indicates these goals can be achieved, and benefit all interests*
Flood Storage Authorized

• Ross: 120,000 AF
• Baker: 74,000 AF

Flood Storage Needed

• Ross: 150,000 AF
• Baker: 140,000 AF

*Baker flood storage is not enough!!!*
Baker Storage

• Importance of flood storage in the Baker basin is extremely well-documented

• See PI Engineering tech memo, “Analysis of Flood Control Storage at Baker River Project,” 27 Aug 2004

• Note Baker inflow hydrographs for the October 2003 Skagit flood of record
October, 2003 Baker River Project Inflow
(Corps of Engineers, Hydrology and Hydraulics Report, August 2004)
What is enough flood storage?

• Enough storage to enable Baker outflow to go to zero 12 hours before and 12 hours following the Skagit flood peak at Concrete

• 139,000 acre-feet, consistent with the Baker drawdown reservoir target elevations, is about right to achieve this

• Coincidentally, this amount of storage is often provided in the Baker system and is consistent with the Interim Protection Plan to protect Chinook Salmon
Flood Control Reservoir Operations
Water Spilled or Used for Generation
Prior to Flood Peak at Concrete October 2003 Flood

<table>
<thead>
<tr>
<th></th>
<th>Lower Baker</th>
<th>Ross</th>
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<tbody>
<tr>
<td>Oct 16\textsuperscript{th}-21\textsuperscript{st}:</td>
<td></td>
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<tr>
<td>Generation:</td>
<td>42,496 AF</td>
<td>(11,600 Combined)</td>
</tr>
<tr>
<td>Spillway:</td>
<td>84,565 AF</td>
<td></td>
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<tr>
<td>Total Outflow:</td>
<td>127,061 AF</td>
<td>11,600 AF</td>
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| Oct 16\textsuperscript{th}-21\textsuperscript{st}: | Upper Baker / Shannon | Ross |
| Storage       | 103,013      | 175,107 AF      |

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<thead>
<tr>
<th>Total storage/spill</th>
<th>Baker</th>
<th>Ross</th>
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<tr>
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<td>230,074 AF</td>
<td>186,707 AF</td>
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Typical Baker Reservoir Operation

- Average winter pool elevations for 5 representative water years: 130,000 AF
- Interim Protection Plan allows 156,000 AF
- Approx 100-year storage need 140,000 AF
Baker FERC Settlement Agreement

- “Hard” flood storage to increase from 74,000 acre-feet to 103,000 acre-feet
- **Drawdown in advance of flood to achieve 139,000 acre-feet**
- Additional “hard” storage (107(b)) must be accepted by the Corps; however, 107(c) enables drawdown in advance of any COE operation
<table>
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<tr>
<th>Flood Event</th>
<th>Release During Skagit Peak</th>
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<tbody>
<tr>
<td>1990 (1)</td>
<td>8,500 cfs (Skagit 149,000)</td>
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<tr>
<td>1990 (2)</td>
<td>13,000 cfs (Skagit 146,000)</td>
</tr>
<tr>
<td>1995</td>
<td>12,000 cfs (Skagit 159,000)</td>
</tr>
<tr>
<td>2003</td>
<td>4,600 cfs (Skagit 166,000)</td>
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Atmospheric River generates flooding
Upper Baker Dam

Top of Dam  735.77'

Full Pool  727.77'

Existing Flood Control  711.56'

Avg. Winter Level  704.16'

Proposed Imminent Flood Target  704.92'

Water Quality Level  685'

Minimum Generating Pool  677.77'

Intake  637.77'

(2) 13.5 Dia. Steel Penstocks
(Intake Gates - 20' x 16')
Lower Baker Dam

Top of Dam: 450.62'

Full Pool: 442.35'

Proposed Flood Control: 428.55'

Avg. Winter Level: 428.03'

Proposed Imminent Flood Target: 423.66'

Spillway Crest: 398'

Water Quality Level: 386'

Minimum Generating Pool: 373.75'

Intake: 333.75'

Spillway Gates: (3) 17'H x 7.36'W

22' Dia. Concrete-Lined Penstock
Sterling

• Recent hydraulic modeling indicates a Skagit 100-year flood will put \(50,000\) cfs and \(130,000\) acre-feet of water out of the system to the north at Sterling.

• Current “handshake” sandbag height is 45.27’ NAVD in this location; water surface is 49’ NAVD.

• GI needs to strongly consider letting water out of the system at this location.
Existing Condition: Sterling Overflow
50,000 cfs, 130,000 acre-feet
BNSF Skagit River Bridge

- Built in 1916
- Pressure flow is a major issue
- Skagit 100-year surface water elevation at the bridge = 47.4 NAVD
  - Bridge bottom chord mid-channel is 46.4
  - Bridge bottom chord overbank is 42.8
- This bridge is a hazard to the adjacent levees and to itself
Max Water Surface Elevation (180,000 cfs)

- Existing
- Levee Set Back - Option
- Levee Setback with Sand Remove
Max Warer Surface Elevation (200,000 cfs)

- **Existing**
- **Levee Set back - Option**
- **Levee Setback with Sand Remove**

Elevation (ft)

River Miles

[Graph showing elevation changes along river miles for different scenarios.]