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

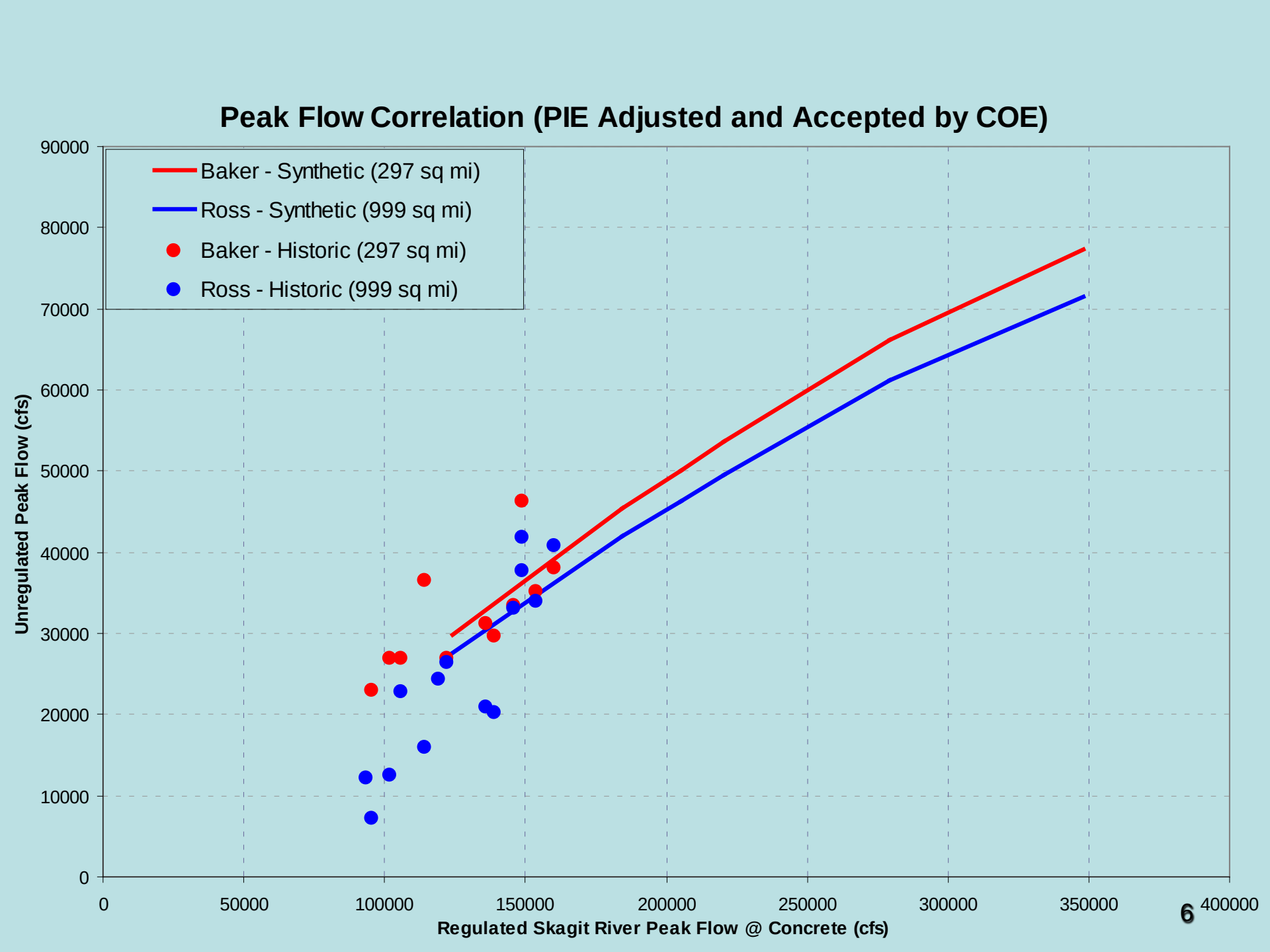
Flood Risk Reduction Impact of Additional Flood Storage

- 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)

- **<u>Zero outflow</u>** 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*


Peak Flow Correlation (PIE Adjusted and Accepted by COE)
Baker - Synthetic (297 sq mi)
Ross - Synthetic (999 sq mi)
Baker - Historic (297 sq mi)
Ross - Historic (999 sq mi)
Unregulated Peak Flow (cfs)
Regulated Skagit River Peak Flow @ Concrete (cfs)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
0
50000
100000
150000
200000
250000
300000
350000
400000

Flood Storage Authorized

- Ross: 120,000 AF
- Baker: 74,000 AF

Flood Storage Needed

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

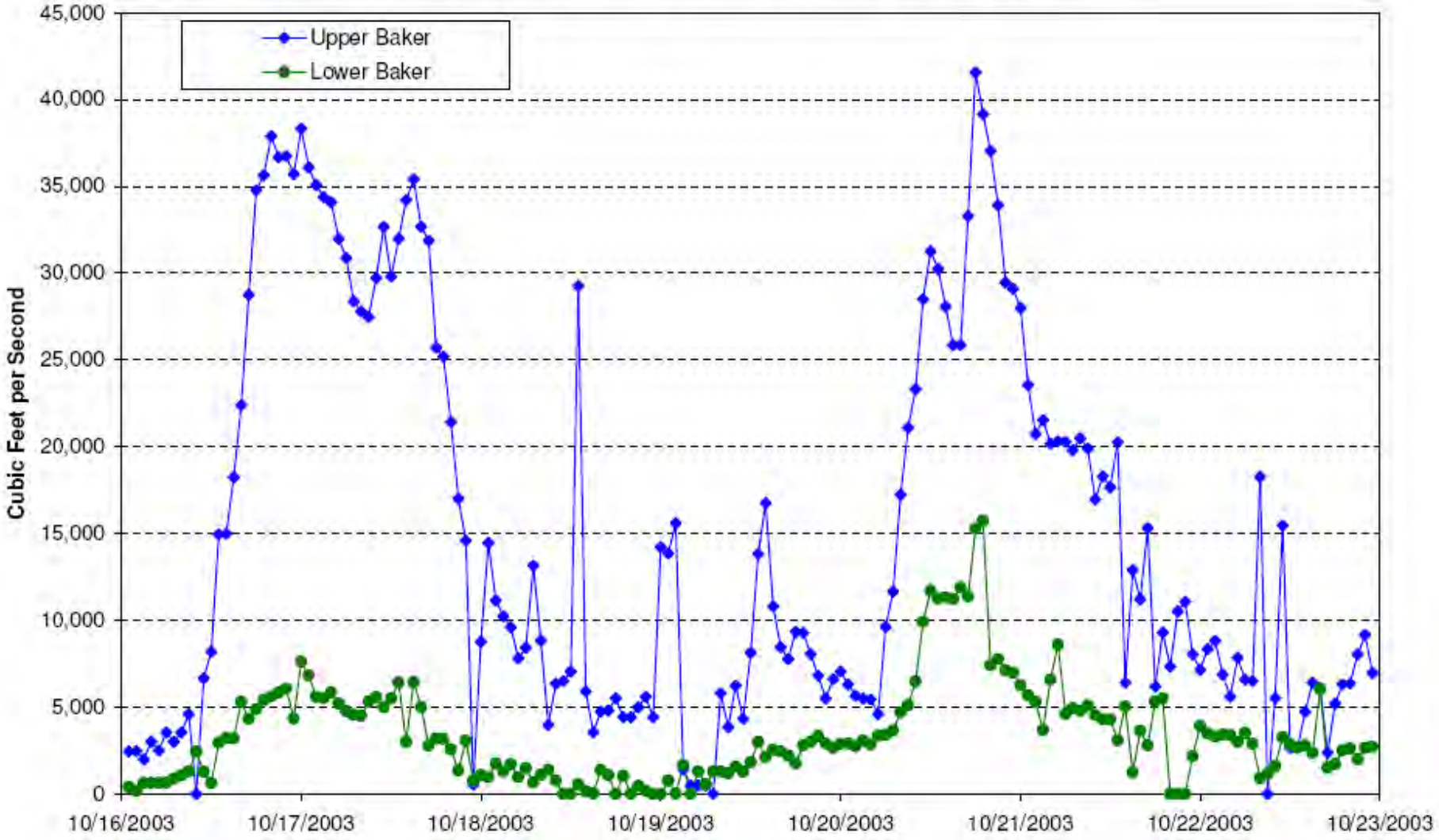
Baker flood storage is not enough!!!

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

	LowerBaker	Ross
Oct 16th-21st:		
Generation:	**42,496 AF**	**(11,600**
Spillway:	**84,565 AF**	**Combined)**
Total Outflow:	**127,061 AF**	**11,600 AF**

	Upper Baker / Shannon	Ross
Oct 16th-21st:		
Storage	**103,013**	**175,107 AF**

	Baker	Ross
Total storage/spill	**230,074 AF**	**186,707 AF**

Typical Baker Reservoir Operation

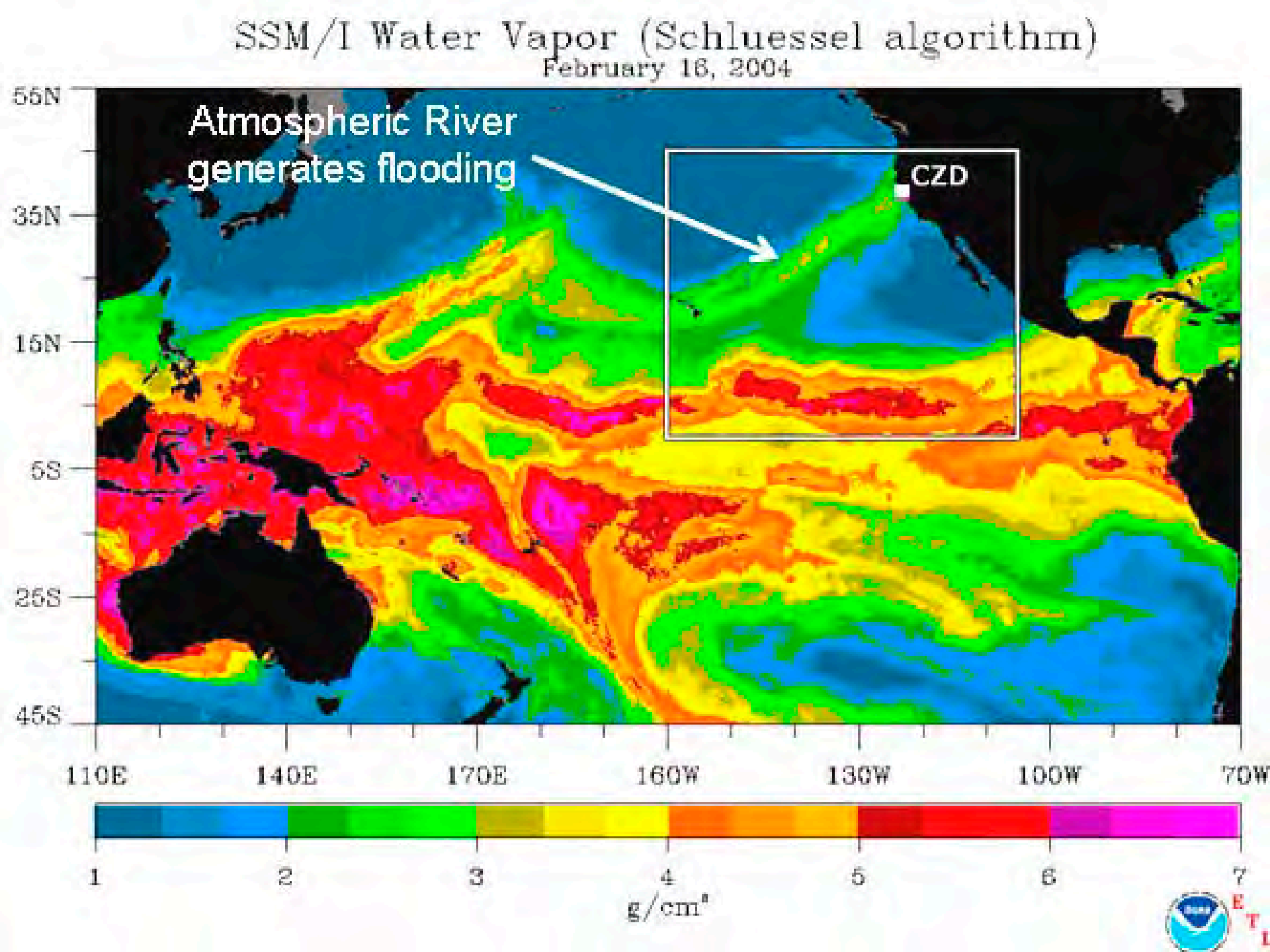
- Average winter pool elevations for 5 representative water years:
  130,000 AF
- Interim Protection Plan allows
  156,000 AF
- Approx 100-year storage need
  140,000 AF

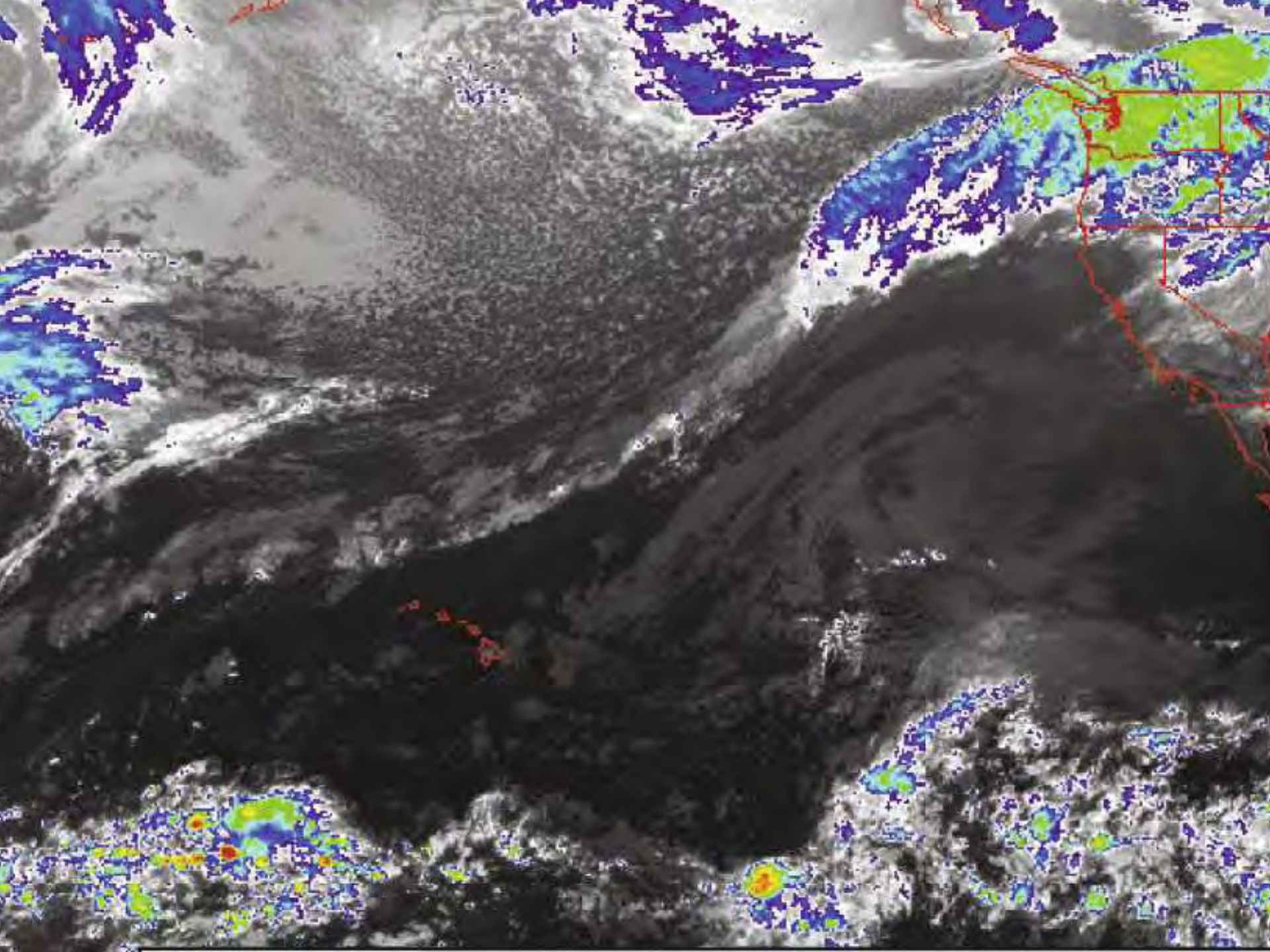
Baker FERC Settlement Agreement

- “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

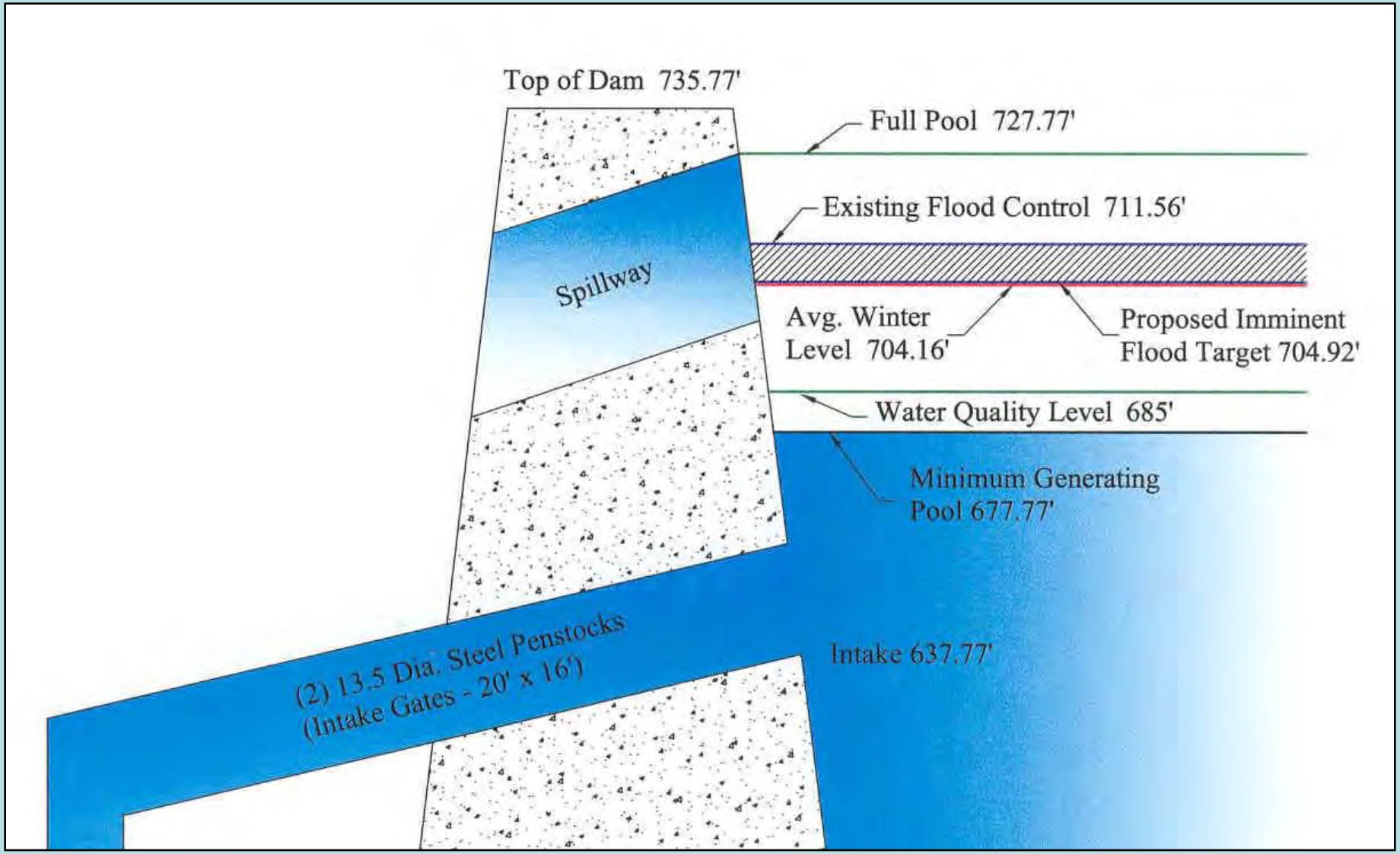
Lower Baker releases, recent floods

Flood Event	Release During Skagit Peak	
1990 (1)	8,500 cfs	***(Skagit 149,000)***
1990 (2)	13,000 cfs	***(Skagit 146,000)***
1995	12,000 cfs	***(Skagit 159,000)***
2003	4,600 cfs	***(Skagit 166,000)***

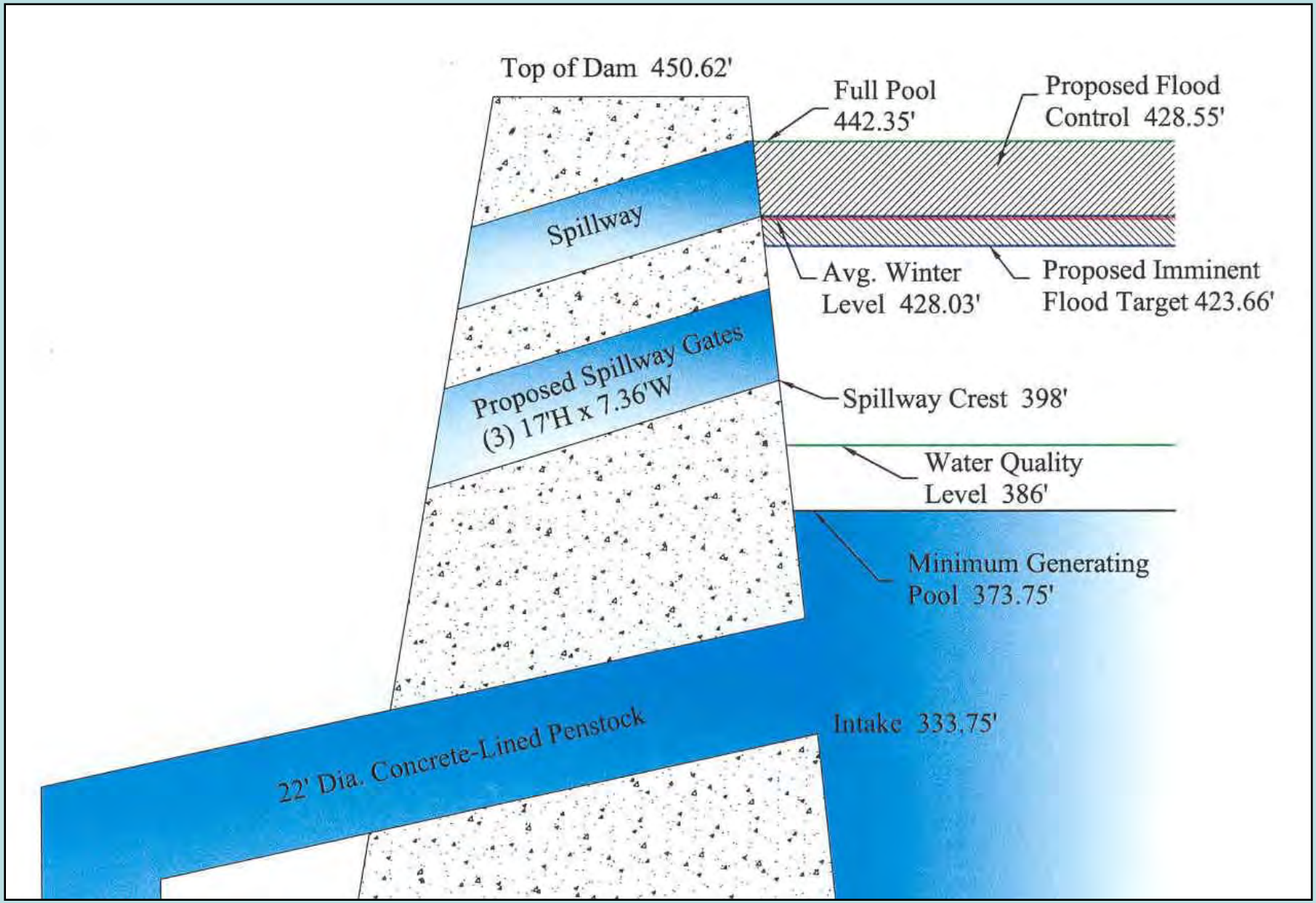

SSM/I Water Vapor (Schluessel algorithm)
February 16, 2004
Atmospheric River
generates flooding
CZD
55N
35N
15N
5S
25S
45S
110E
140E
170E
160W
130W
100W
70W
1
2
3
4
5
6
7
g/cm²



Upper Baker Dam



Lower Baker Dam




Ross Dam
22 October 2003

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

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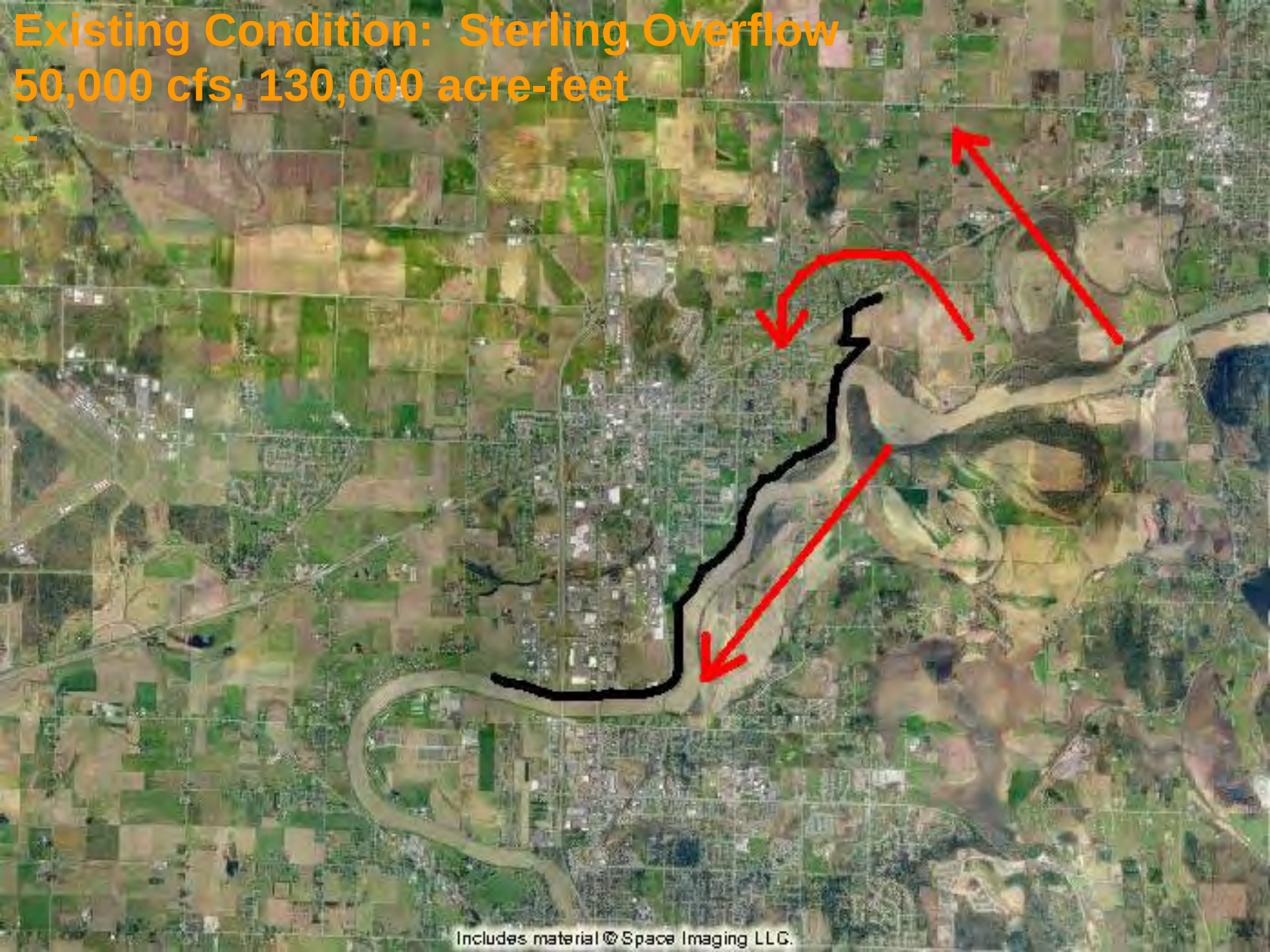
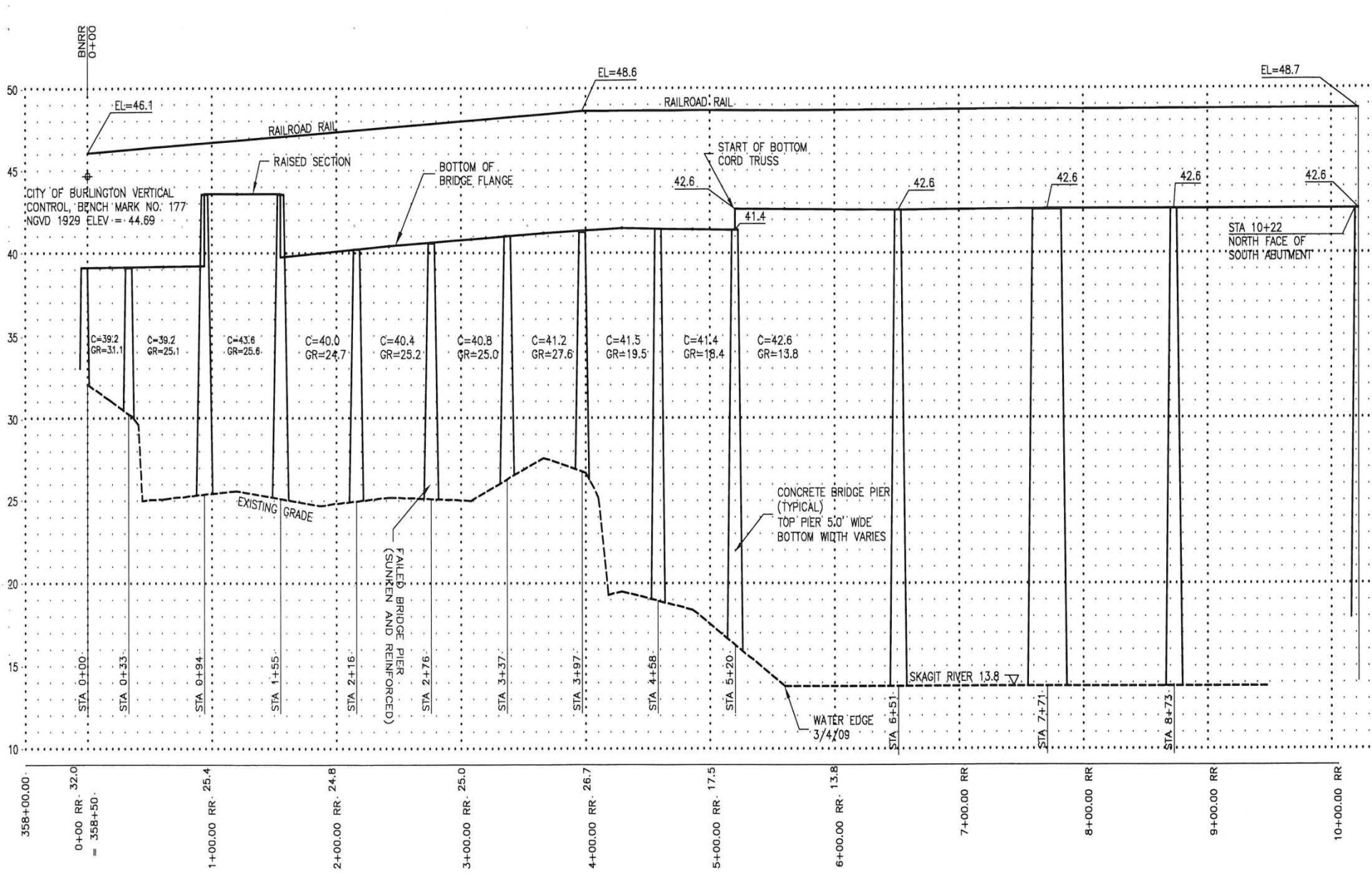


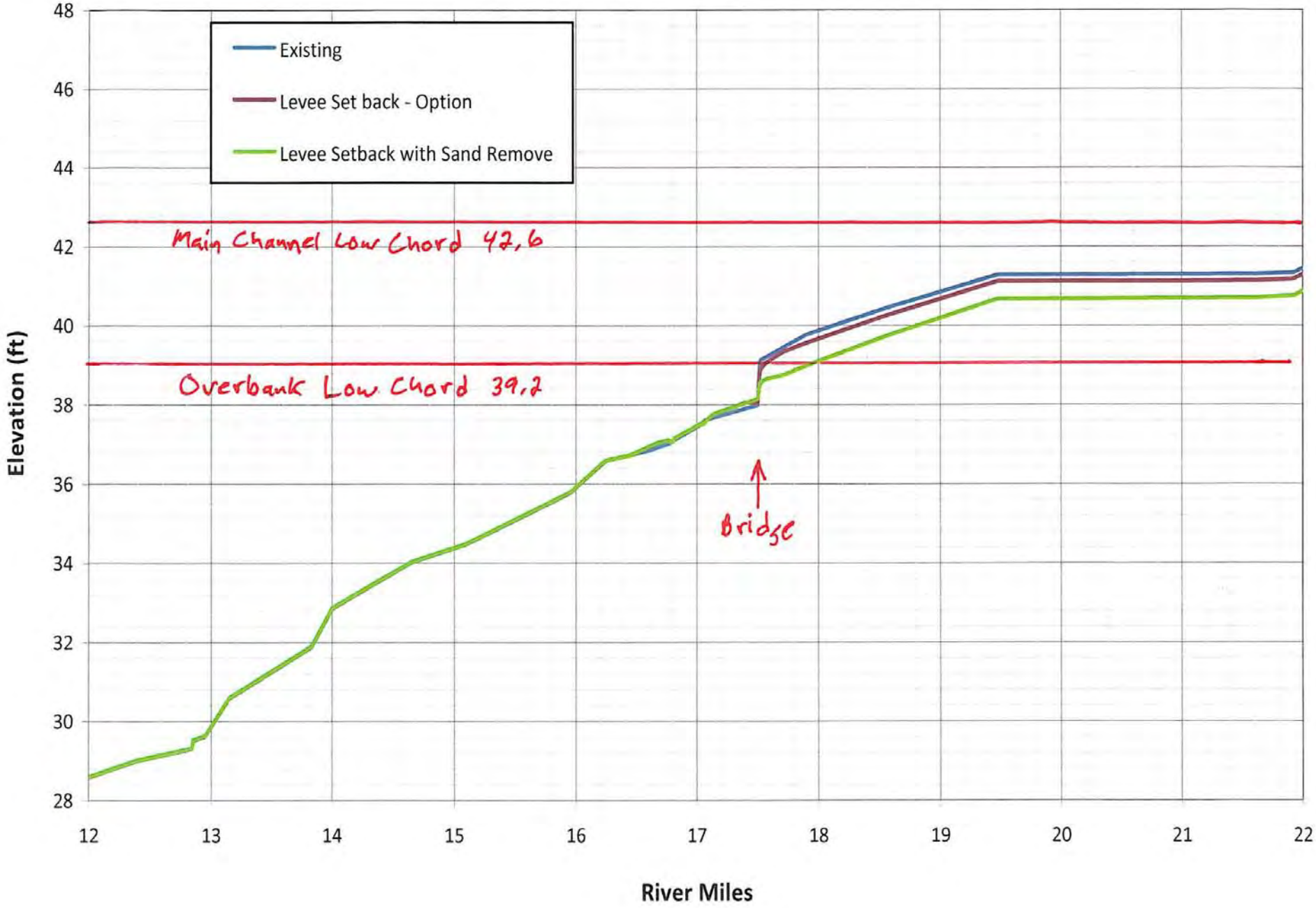
BNSF Skagit River Bridge

- 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

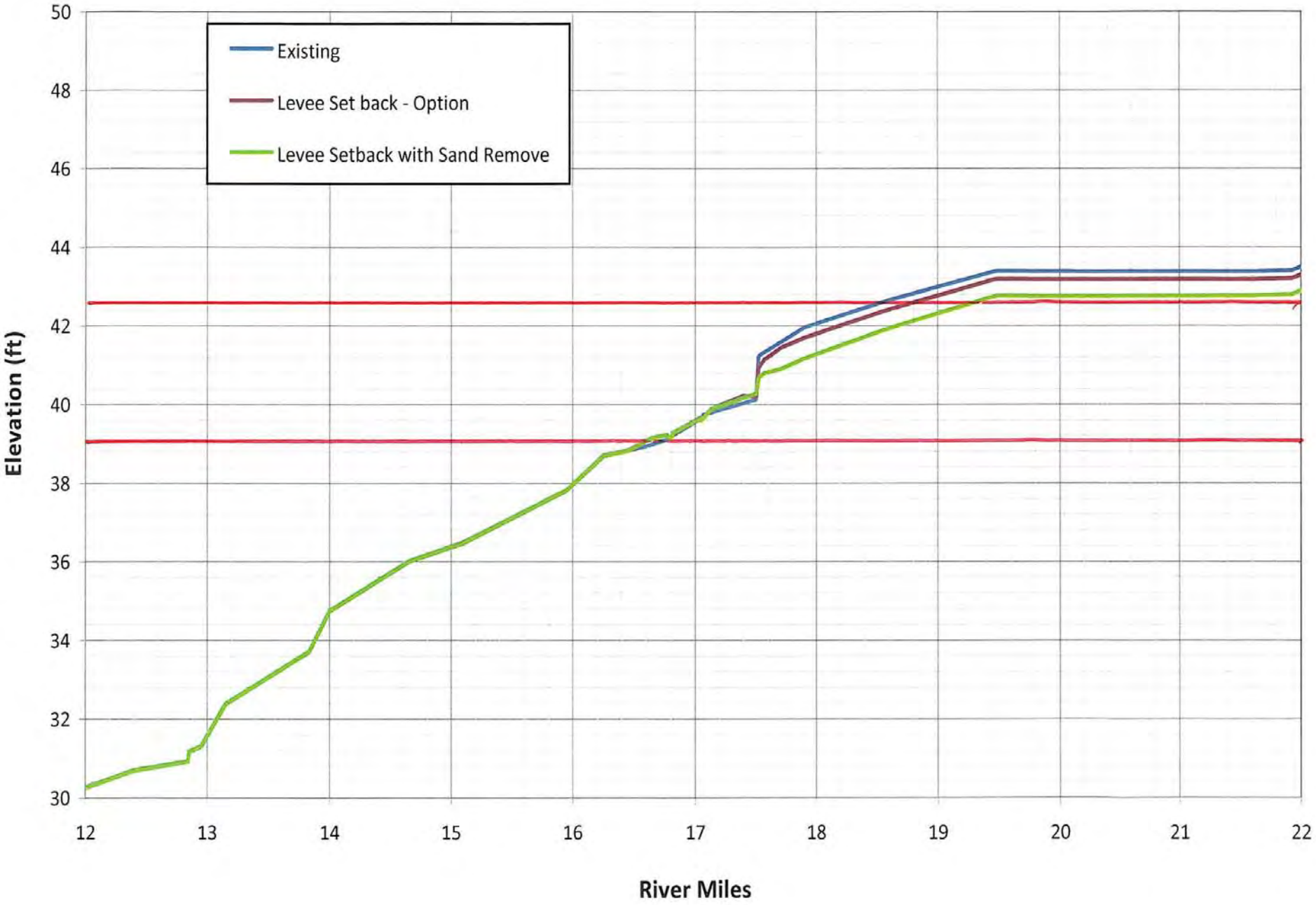
BNSF Skagit River Bridge Profile



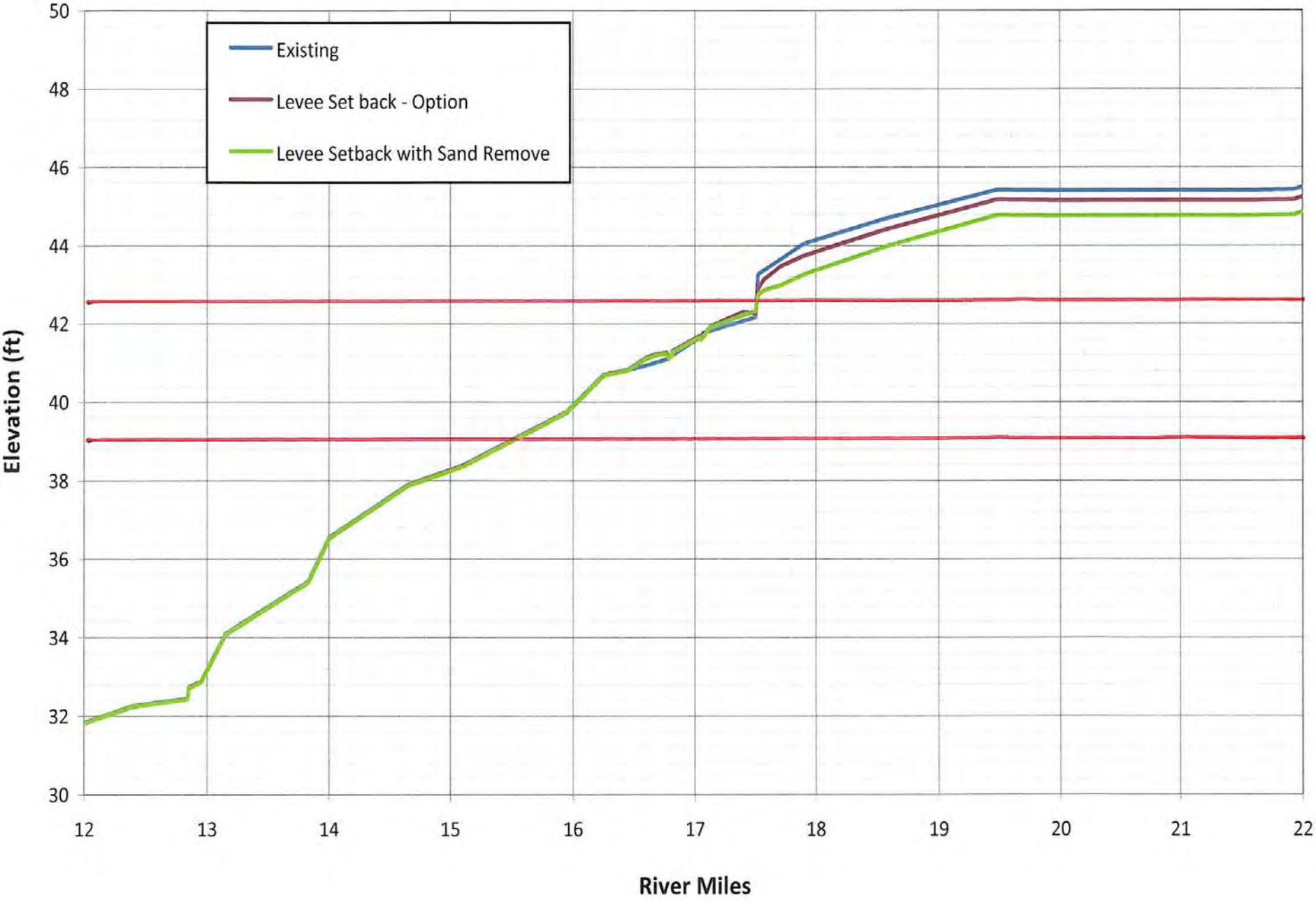
Max Warer Surface Elevation (141,000 cfs)



Max Warer Surface Elevation (160,000 cfs)



Max Warer Surface Elevation (180,000 cfs)



Max Warer Surface Elevation (200,000 cfs)