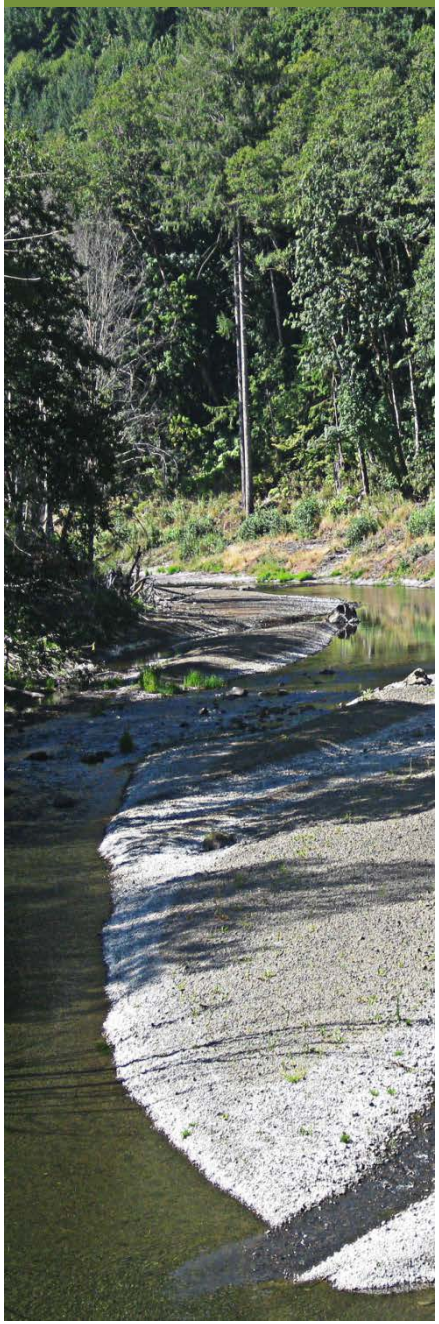
Chehalis River Basin Design Storm Selection

Policy Workshop

November 13, 2013



Presentation Overview

Doty Gage Peer Review

- Peak discharge
- Volume

Events for Hydraulic Modeling

- Design floods for economic analysis
- Recent historical flood events

Doty Gage Peer Review

Peak Discharge

USGS estimate of peak discharge likely high

USGS 63,100 cfs ± 15%

WSE estimate 52,600 cfs ± 20%

Effect of change on flood frequency at Doty is small

- 500-year reduced from 54,000 cfs to 50,000 cfs
- 100-year reduced from 37,000 cfs to 35,000 cfs
- 25-year reduced from 25,000 cfs to 24,000 cfs
- 10-year unchanged (20,000 cfs)

Doty Gage Peer Review

Peak Discharge

Dam break not likely a big contributor to peak discharge at Doty

No flood wave observed at Doty

Potential increase in discharge at Doty less than 1000 cfs

Doty Gage Peer Review

Volume

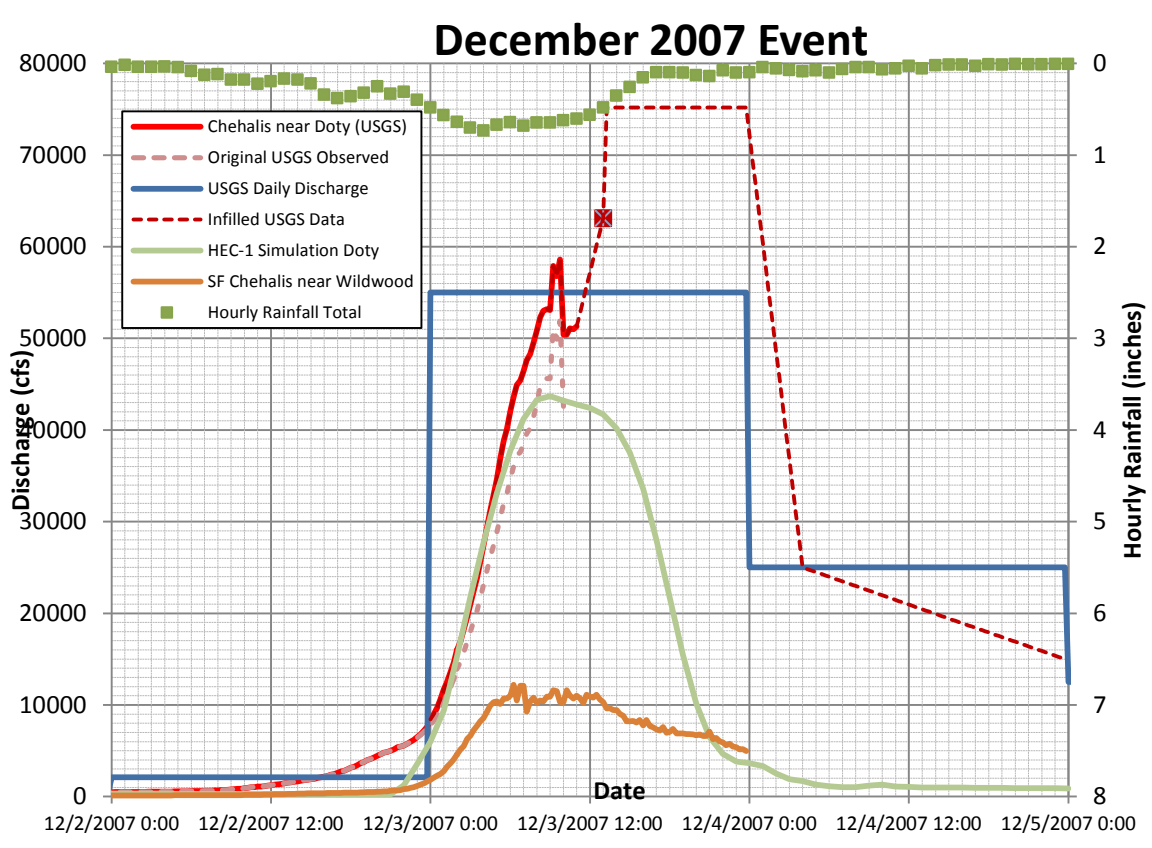
USGS mean daily flow for December 2007 is too high

<u>Volume affects how big a dam needs to be</u>

Hydrograph Volume

Basin average rainfall 16 inches

Basin runoff 32 inches



Design Floods for Economic Analysis

10-, 20-, 100-, 500-Year Events

Floods should:

- Focus on mainstem Chehalis (Grand Mound Gage)
- Generated by basin-wide events
- Tributary inflows based on historical data

Floods do not:

- Focus on single tributary design flood events
- Extreme high tide events
- Unusual conditions (dam break flood, etc)

Design Floods for Economic Analysis

Chehalis River at Grand Mound

Percent Chance Exceedence	Return Interval	Flow (cfs)
0.2	500	100,300
0.5	200	85,200
1	100	74,700
2	50	64,900
4	25	55,800
10	10	44,600
20	5	36,500
50	2	25,600

Basin-Wide Justification

Supported by Tributary Historical Data

Top 10 Historical Floods at Grand Mound were all major events at Doty, SF Chehalis, Newaukum, & Skookumchuck[1]

Gage No.	12027500			12020000	12021000	12025000	12026400
Gage Name	CHEHALIS RIVER NEAR GRAND MOUND, WA			CHEHALIS RIVER NEAR DOTY, WA	SOUTH FORK CHEHALIS RIVER AT BOISTFORT, WA	NEWAUKUM RIVER NEAR CHEHALIS, WA	SKOOKUMCHUCK RIVER NEAR BUCODA, WA
Water Year	Date	Peak flow (cfs)	Rank	Rank	Rank	Rank	Rank
2008	04-Dec-07	79,100	1	1	1	3	24
1996	09-Feb-96	74,800	2	2	3	1	1
1990	10-Jan-90	68,700	3	3		6	3
1987	25-Nov-86	51,600	4	9		5	25
2009	08-Jan-09	50,700	5	7	2	2	2
1972	21-Jan-72	49,200	6	4	8	10	6
1938	29-Dec-37	48,400	7				
1991	25-Nov-90	48,000	8	6		7	4
1934	21-Dec-33	45,700	9				
1976	05-Dec-75	44,800	10	10	7	17	10

[1] Some Skookumchuck flows affected by dam.

Basin-Wide Justification
Supported by Historical Floods Patterns

Relative Contributions from Upper Chehalis and Cascade Tributaries for Top 10 Historical Floods[1]

Upper Chehalis Contribution

- Average: 66%
- Range: 58% to 85%

Cascade Tributaries Contribution

- Average: 34%
- Range: 15% to 42%

[1]Based on USGS historical peaks and mean daily flows

Recent Historical Floods

Model Calibration & Community Communication

February 1996 – broadly distributed rainfall and widespread flooding

December 2007 – focused in Upper Chehalis and Olympics, Skookumchuck flow reduced by dam

January 2009 – focused in Cascade tribs and lower watershed, still had large contribution from upper Chehalis

Flood Events for Hydraulic Modeling

Recommendation:

Four design storm events for input to economic analysis

- 10-year, 20-year, 100-year, 500-year

Three historical flood events to represent observed storm patterns

- February 1996, December 2007, January 2009

Similar to past analyses for Flood Authority and PUD