

Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species

*May 28 and 29 Public
Meeting Presentation*



Purpose of Public Meeting

- Inform you of the process and analysis to develop a long-term strategy for flood damage reduction and aquatic species enhancement
- Gain your input prior to conducting a benefit cost analysis and other analyses to compare different scenarios and strategies for reducing flood damage and enhancing aquatic species.

CHALLENGE: NEED FOR FISHERY ENHANCEMENT

- Salmon populations are 15-25% of historic levels.



Upper Chehalis (5/31/2010)
JAMES E. WILCOX / WILD GAME FISH
CONSERVATION INTERNATIONAL

CHEHALIS BASIN SALMON & TROUT

OCEAN PHASE

The salmonid lifecycle involves adults maturing in the ocean, migrating back to their home streams and spawning, embryos incubating, fry emerging, juveniles growing, and smolts migrating to the estuary to acclimate to saltwater and moving out into the ocean

WHAT SALMON NEED IN FRESHWATER HABITAT

- Cool, clean water
- Appropriate water depth, quantity and flow velocities
- Upland and riparian (stream bank) vegetation to stabilize soil & provide shade
- Clean gravel for spawning and egg-rearing
- Large woody debris to provide resting and hiding places
- Adequate food
- Varied channel forms

SPAawning PHASE

Chinook
Chinook (Oncorhynchus tshawytscha) Average size: 28-32" (2-3 lbs), up to 50" (50 lbs) - Fall spawning, May, 8 months run

Coho
Coho (Oncorhynchus kisutch) Average size: 20-24" (2-3 lbs), up to 30" (30 lbs) - Fall spawning, May, 8 months run

Chum
Chum (Oncorhynchus keta) Average size: 20-24" (2-3 lbs), up to 30" (30 lbs) - Fall spawning, May, 8 months run

Steelhead
Steelhead (Oncorhynchus mykiss) Average size: 20-24" (2-3 lbs), up to 30" (30 lbs) - Spring spawning, May, 8 months run

Ball trout
Ball trout (Salvelinus leucomaenis) Average size: 8-12" (1-2 lbs), up to 15" (15 lbs) - Spring spawning, May, 8 months run

Cutthroat
Cutthroat (Oncorhynchus clausen) Average size: 10-12" (1-2 lbs), up to 15" (15 lbs) - Spring spawning, May, 8 months run

www.chehalisbasinpartnership.org

Challenge: History of Flood Damage



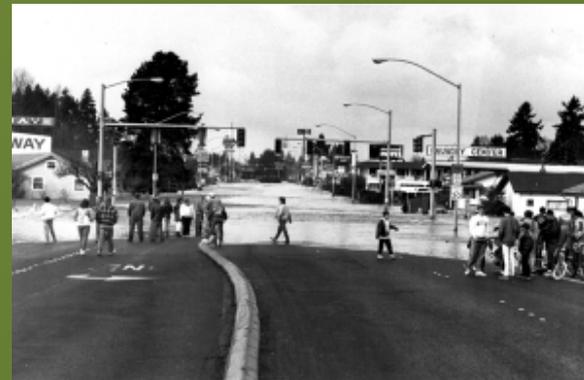
March 1910



December 1933



January 1974



November 1990

Changing the Long History Political Failure

- No action since 1933.
- More than 830 studies.
- Today is different . . .

Aquatic
Species
Surveys,
2013



Adna Levee, 2013

CHEHALIS RIVER BASIN FLOOD AUTHORITY

City of Montesano
Home of the Tree Farm
www.montesano.ca

Another Chehalis Basin Flood Protection Project
www.ezview.wa.gov

Wastewater Treatment Plant Flood Prevention Dike

Schedule → February 2014 to April 2014

Budget → \$511,153

Benefit → Protecting essential public infrastructure for all Basin residents

STELLAR J
An engineering consulting company

Parametrix

QR code

Montesano WWTP, 2014



Airport Levee, 2014

CHEHALIS RIVER BASIN FLOOD AUTHORITY

- ▶ Grays Harbor County
- ▶ City of Aberdeen
- ▶ City of Cosmopolis
- ▶ City of Montesano
- ▶ City of Oakville
- ▶ Lewis County
- ▶ City of Centralia
- ▶ City of Chehalis
- ▶ City of Napavine
- ▶ Town of Pe Ell
- ▶ Thurston County
- ▶ Town of Bucoda



Current Projects Underway in the Chehalis Basin

GRAYS HARBOR COUNTY

1. Burger King Trail/Dike
2. Dike Bank of Wishkah North of Highway
3. Market Street Dike
4. Southside Dike/Levee Certification
5. Oxbow Lake Reconnection
6. Sickman-Ford Overflow Bridge
7. Mill Creek Dam Improvement
8. Elma-Porter Flood Mitigation
9. Satsop River Floodplain Restoration (Phase I)
10. Wishkah Road Flood Levee
11. Revetment for Montesano Road, Sewage Treatment
12. Satsop River Floodplain Restoration (Phase II)

BASIN-WIDE PROJECTS

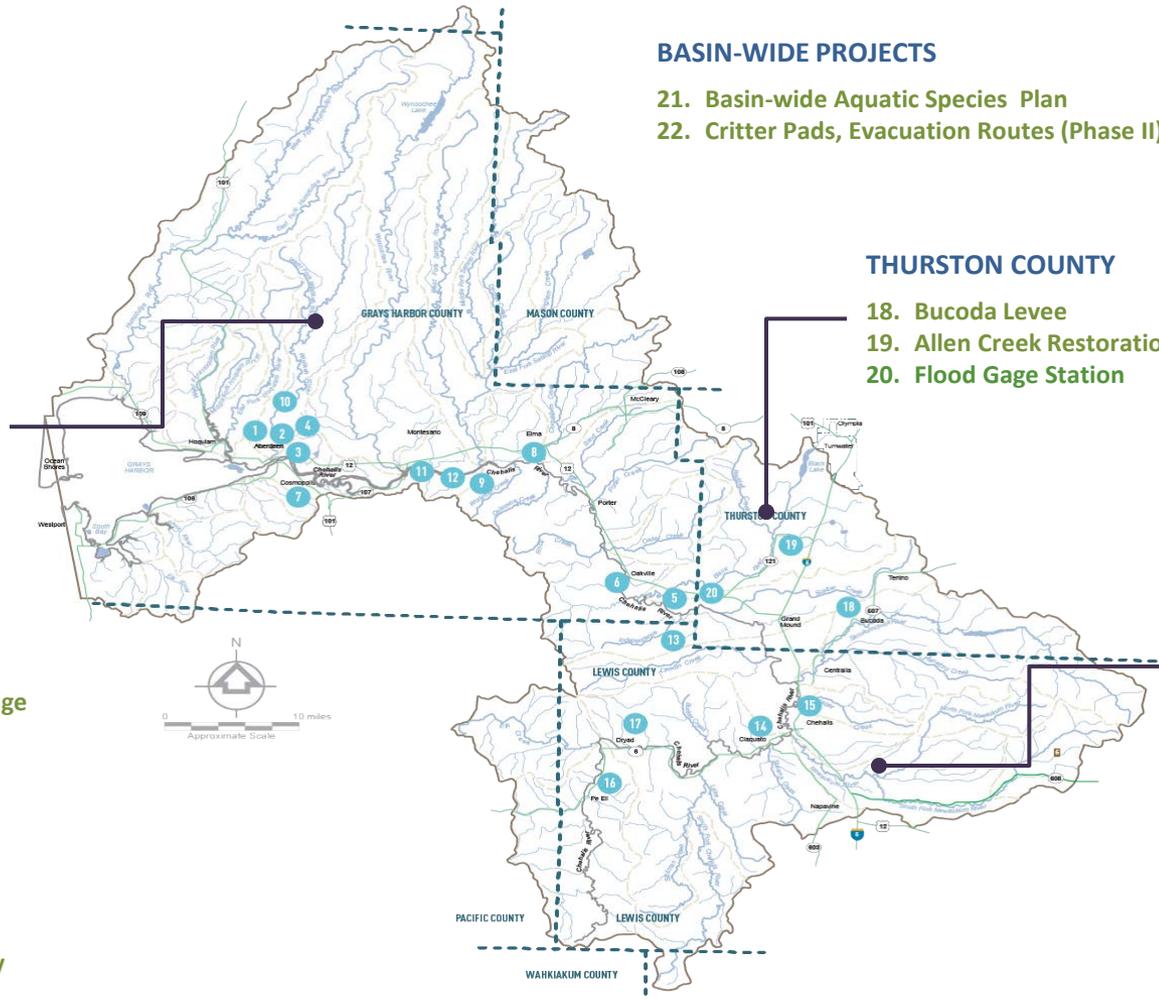
21. Basin-wide Aquatic Species Plan
22. Critter Pads, Evacuation Routes (Phase II) and Geomorphic Analysis

THURSTON COUNTY

18. Bucoda Levee
19. Allen Creek Restoration
20. Flood Gage Station

LEWIS COUNTY

13. Oxbow Reconnection at RM 78
14. Adna Levee
15. Airport Levee (Phase I)
16. Wastewater Treatment Plant Flood Prevention
17. Critter Pads, Evacuation Routes (Phase I)



STATUS: Finished / Underway

Governor's Chehalis Basin Work Group

- Appointed by Gov. Gregoire (2012); Re-confirmed by Gov. Inslee (2013).
- Developed Framework, \$28.2 capital budget (2013-15).
- Tasked by Governor recommend next steps for water retention; I-5; Other Basin improvements; Aquatic species enhancement.
- Members are:
 - David Burnett (Chairman Chehalis Tribe).
 - Karen Valenzuela (Thurston County Commissioner, Vice-Chair Flood Authority).
 - Vickie Raines (Mayor Cosmopolis, Chair Flood Authority).
 - J. Vander Stoep (Private Attorney, Pe Ell Alternate Flood Authority).
 - Jay Gordon (President Washington Dairy Federation and Chehalis Farmer).
 - Rob Duff (Governor's Natural Resource Advisor).
 - Keith Phillips (Governor's Energy and Environment Advisor).

Enhancing Aquatic Species

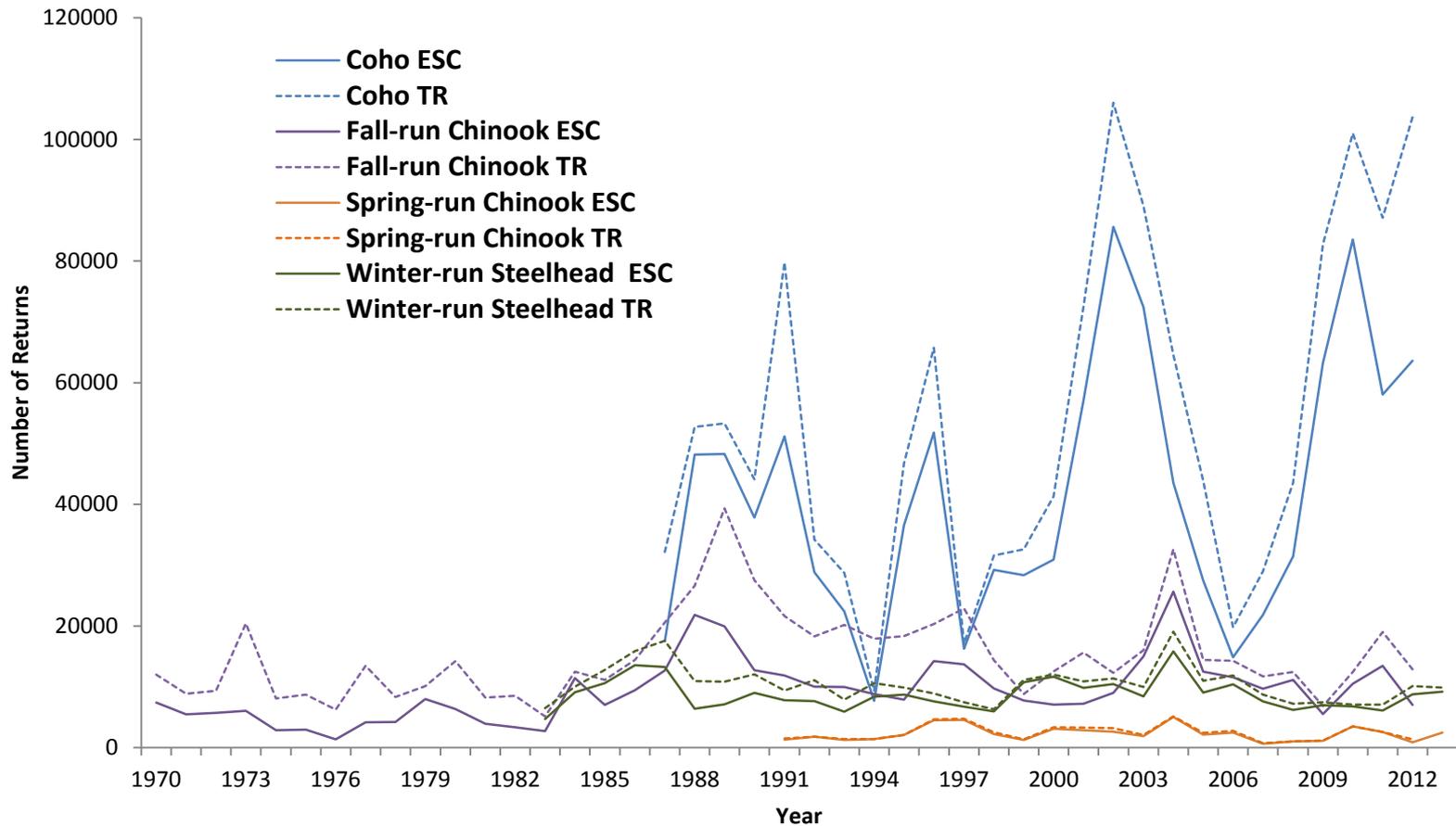


Species

22 key species evaluated

- Spring Chinook, Fall Chinook, Coho and Winter Steelhead
- 11 Other fish
- 7 Other Aquatic Species

Salmon Runs

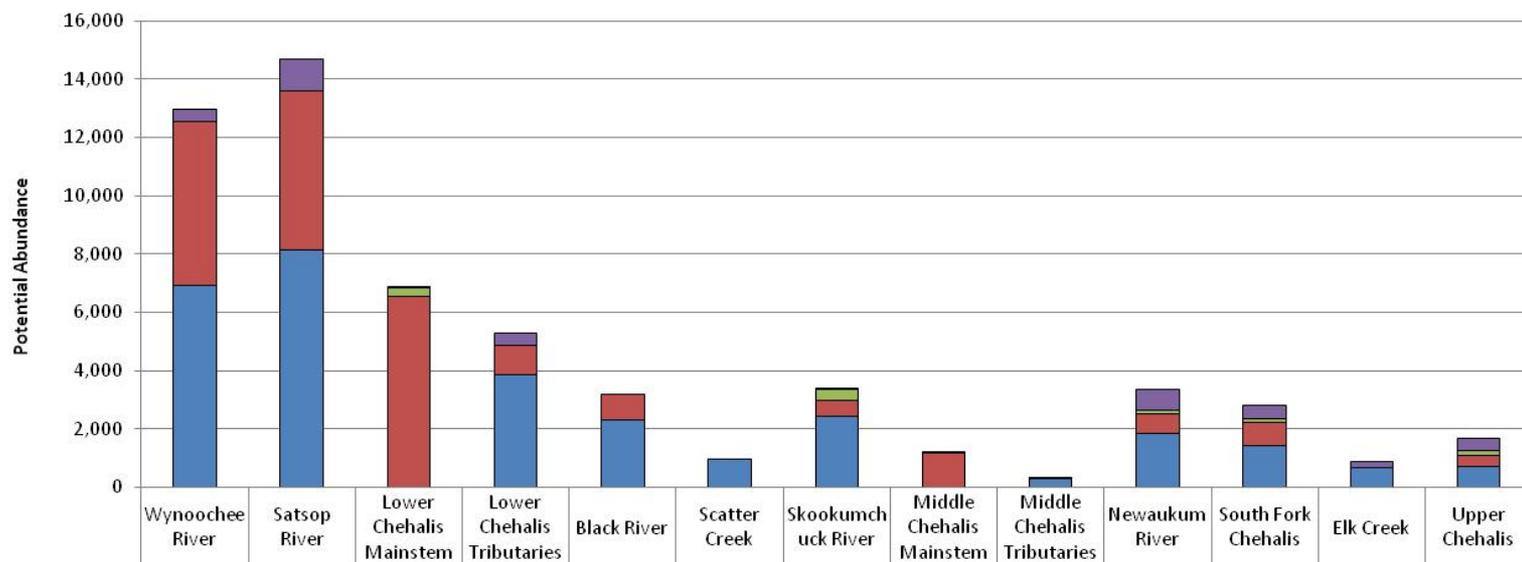


Salmon – Habitat Potential

Species	Current	Natural Conditions	Habitat Impairment
Spring Chinook Salmon	3,349	15,287	78%
Fall Chinook Salmon	25,459	46,052	45%
Coho Salmon	24,144	78,986	69%
Winter-run Steelhead	4,557	8,102	44%

Salmon Habitat Potential by Sub-Population

Habitat Potential for Chehalis Basin Salmonid Populations



Steelhead - Current	438	1,083	42	434			57	15	12	713	424	199	447
Spring Chinook - Current			267				347	0		156	163	11	153
Fall Chinook - Current	5,618	5,460	6,563	1,010	916		581	1,186	4	661	772	23	371
Coho - Current	6,911	8,125		3,845	2,289	954	2,415	0	290	1,845	1,435	652	717

Other Fish and Aquatic Species



Northern Pikeminnow



Olympic Mudminnow



Oregon Spotted Frog



Redside Shiner



Largescale Sucker



Longnose Dace



Sculpin (6 species)



Western Toad

Limiting Factors

- Most prevalent are
 - Barriers
 - Riparian degradation
 - Water quantity and quality (flows and temperature)
 - Sedimentation
 - Channel complexity and stability (lack of wood)
 - Loss of floodplain habitat/connectivity

Effects of Climate Change (mainstem Chehalis River)

Species	Climate Change
Spring Chinook	-100%
Coho	-5%
Winter Steelhead	-62%

- Percentages are changes in medians of last 10 years in time series (2091-2100), compared to current conditions

Enhancement Scenarios Modeled

1. Remove/improve barriers to fish passage (culverts) – benefit to coho, steelhead and fall Chinook (not spring Chinook)
2. Riparian enhancement in managed forests – all stocks
3. Riparian enhancement to restore 50% of Spring Chinook spawning reaches outside of managed forests, combined with restoring large wood attribute by 50% in same reaches; includes mainstem – all stocks

Enhancement Costs and Results

Scenario	Cost Range (\$ M)	Spring Chinook	Coho	Fall Chinook	Winter steelhead
1. Culverts	26 - 50	0%	12%	3%	24%
2. Managed forests	-	15 - 26%	11 - 22%	6 - 9%	8 - 15%
3. Non-managed forests	37 - 84	40 - 76%	17 - 28%	6 - 11%	7 - 12%
Total	63 - 134	55 - 102%	40-62%	15 - 23%	39 - 51%

Reducing Flood Damage



2007 Storm: \$938M Basin-wide damage



Exit 77 (I-5) in Chehalis
STEVE RINGMAN / SEATTLE TIMES



City of Centralia
STEVE RINGMAN / SEATTLE TIMES



State Route 6,
West of Adna
MIKE SALSBUURY / AP



← Photos Source: LEWIS COUNTY,
DIVISION OF EMERGENCY MANAGE

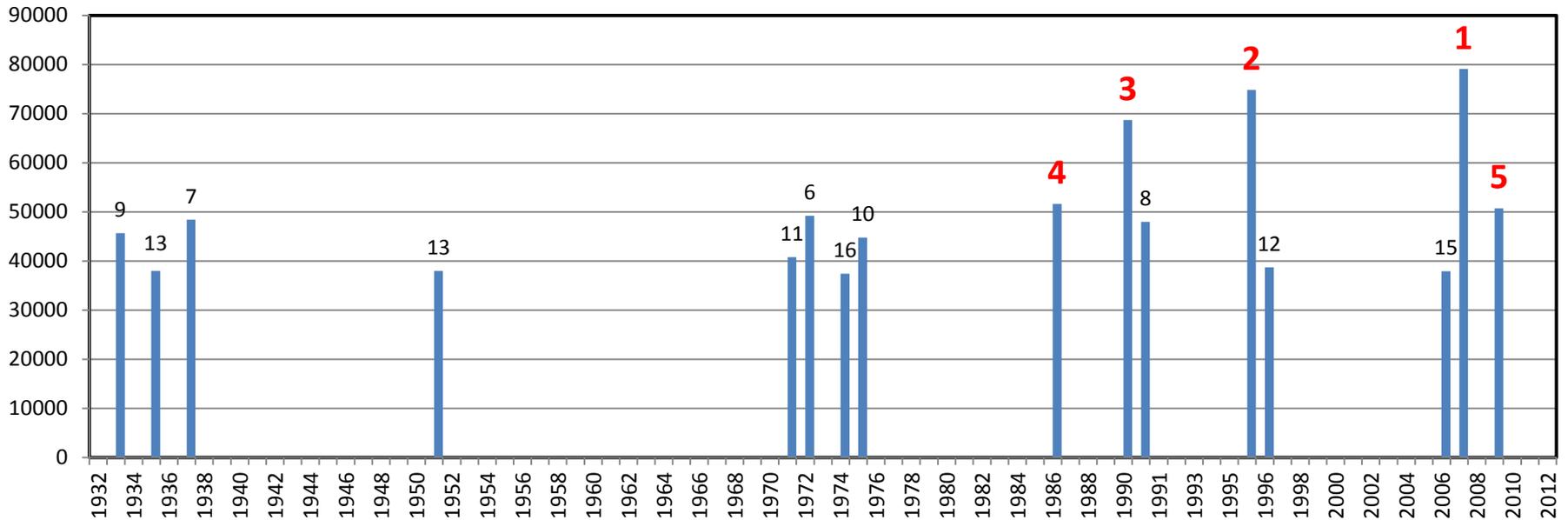
RANKED HIGH-FLOW EVENTS:

Chehalis River Flow Rates near Grand Mound (cubic ft./sec.)

Interstate 5 closed 1990, 1996, 2007, 2009

Five largest events have all occurred since 1986 -- Frequent floods are getting worse and damage is increasing . . .

100 year flood estimate increase 33% in last 30 years.



Climate Change Effects on Peak Flows

Latest report from the UW Climate Impacts Group (CIG) suggests:

- Rain dominant basins (like the Chehalis) will see increase in 100-year flood of 11% to 26%
- Does not include projected changes in heavy rainfall
- New study suggests increase may be 10 – 50% or more (forthcoming paper)

State of Knowledge Report

**Climate Change Impacts and Adaptation
in Washington State:**
Technical Summaries for Decision Makers

Prepared by the
Climate Impacts Group
University of Washington
December 2013



W COLLEGE OF THE ENVIRONMENT
UNIVERSITY of WASHINGTON

Structures Affected – Climate Change 18 percent increase

Summary of Structures At Risk of Flooding in Chehalis River Floodplain

Number of Structures	Baseline	100-Year w Climate Change	
	100-Year	100-Year	Change vs Base
Flooded	1384	2202	59%
>1.0 feet	829	1462	76%
>2.0 feet	489	830	70%
>3.0 feet	293	481	64%
>4.0 feet	155	301	94%
>5.0 feet	76	161	112%
Assessed Value of Improvements Inundated (\$Million)	\$137	\$255	86%

Ruckelshaus Center Report

- Required by 2011 Legislature.
- Summarized what is known about potential projects.
- Created a common base of understanding.

<http://ruckelshauscenter.wsu.edu/ChehalisFlooding.html>

The screenshot shows the website for the William D. Ruckelshaus Center at Washington State University. The page features a navigation menu on the left with links for Home, I Want to Give, Contact Us, About Us, Services, Project Criteria, Projects, Publications, and News/Media. The main content area is titled "Chehalis Flooding" and includes sections for "Upcoming Policy Workshop" and "Project Description". The "Upcoming Policy Workshop" section states that the workshop will be held on November 13, 2013, from 8:30am to 4:30pm at the Great Wolf Lodge in Centralia, WA, and is open to the public. The "Project Description" section notes that the Chehalis Basin has repeatedly flooded over the past decades, with seven major floods in the past 30 years alone, including a 2007 flood that caused over \$900 million in damages and a 2010-11 flood that closed Interstate 5 and a major rail line for days. To the right of the main content, there is a "Documents and Resources" section with links to the "January 2014 Chehalis Basin Strategy" (2 MB PDF) and the "November 13 policy workshop slide deck" (12 MB PDF). Another link is provided for the "Chehalis Basin Strategy Overview for 2013-2015" (437 KB PDF).

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UNIVERSITY of WASHINGTON

THE WILLIAM D. RUCKELSHAUS CENTER
UNIVERSITY OF WASHINGTON

Chehalis Flooding

Upcoming Policy Workshop

The Chehalis Basin Strategy "Reducing Flood Damage and Enhancing Aquatic Species" Policy Workshop will be held on November 13, 2013 from 8:30am - 4:30pm at the Great Wolf Lodge in Centralia, WA. This workshop is open to the public. For more information, read the [agenda](#).

Project Description

The Chehalis Basin has repeatedly flooded over the past decades. There have been seven major floods in the past 30 years alone. The 2007 flood caused over \$900 million in private and public damages, as well as closed Interstate 5 and a major rail line for days. The 2010-11

Documents and Resources

Read the [January 2014 Chehalis Basin Strategy](#) (2 MB PDF)

View the November 13 policy workshop [slide deck](#) (12 MB PDF)

Read the [Chehalis Basin Strategy Overview for 2013-2015](#) (437 KB PDF)

Reducing Flood Damage - Feasibility Analyses

- Water Retention Feasibility.
- Protection of I-5.
- Floodproofing and Small Projects
- Land Use Changes.

Water Retention Structure Options Selected for Evaluation

- Flood Retention RCC* Dam (FR-RCC)
- Multipurpose RCC Dam (MP-RCC)
- Multi-purpose Rockfill Dam (MP-Rockfill)

*Roller Compacted Concrete (RCC)

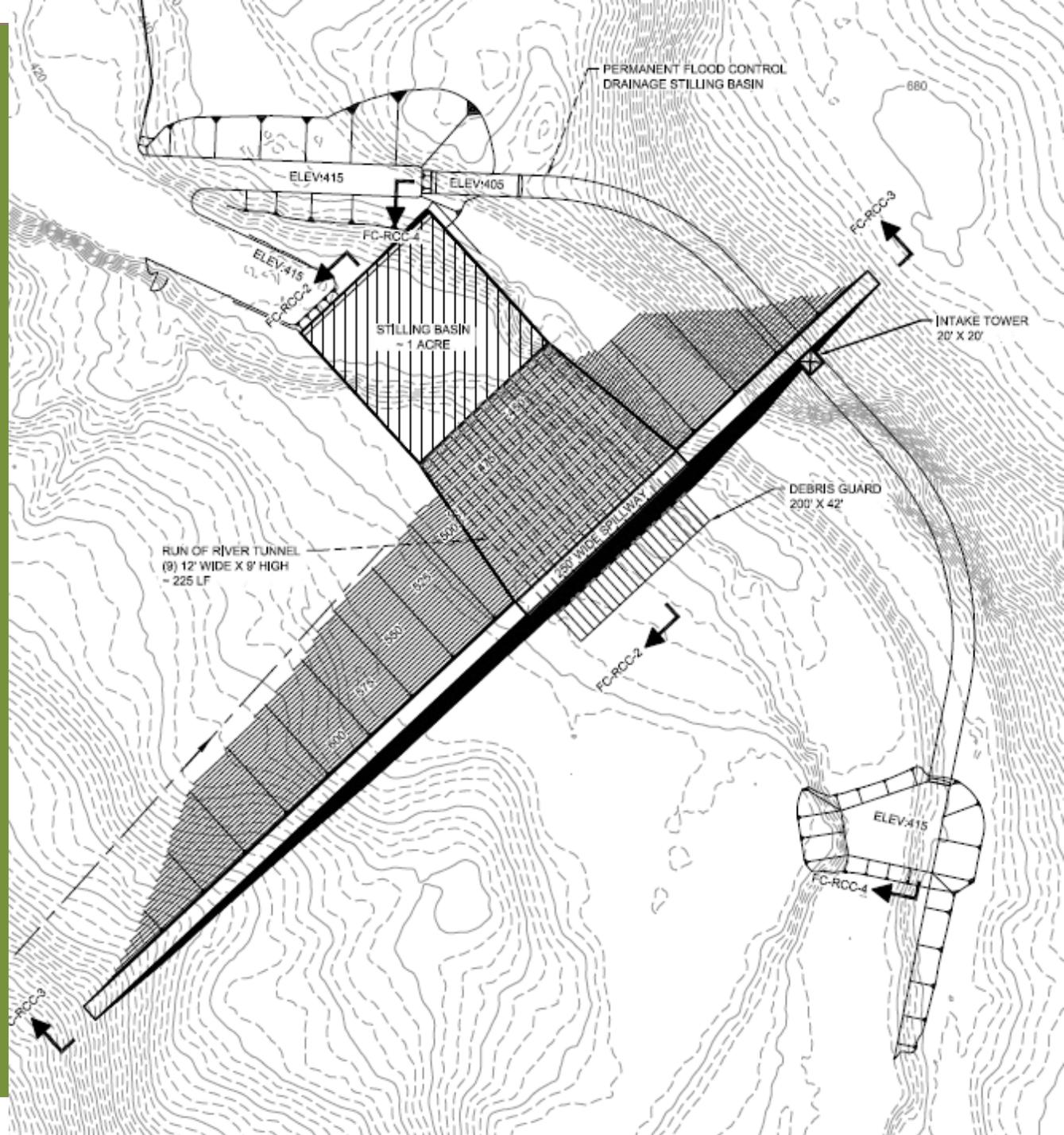
Flood Retention Only Reservoir



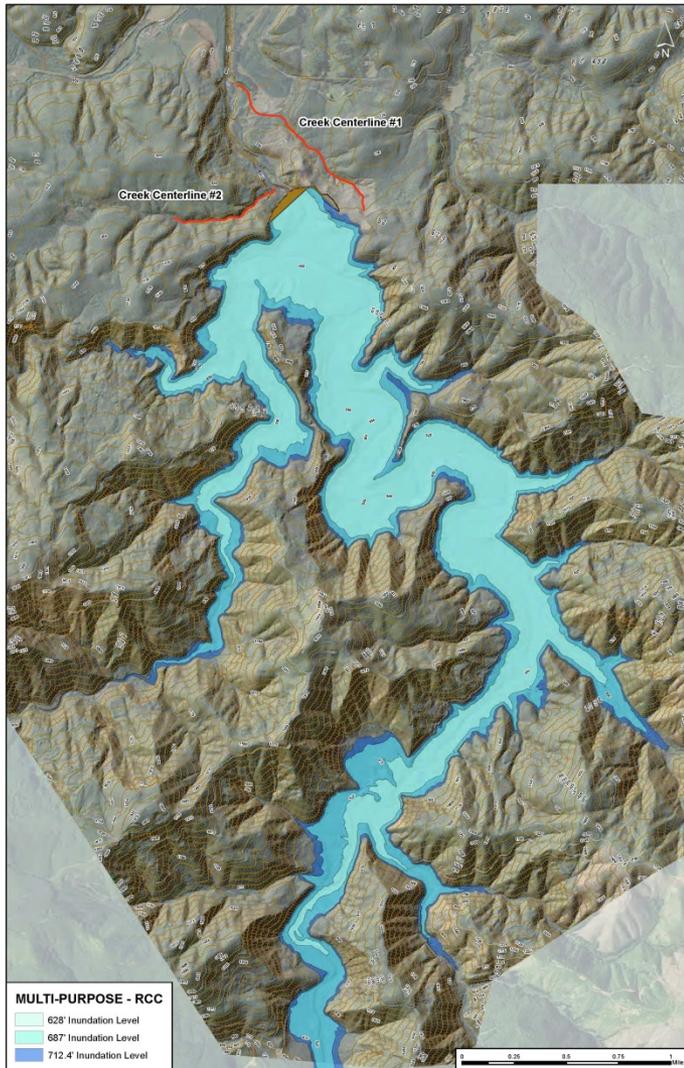
- Dam Height = 227'
- Spillway Crest Elev. = 628
- Dam Crest Elev. = 654
- Area = 860 Acres
- River Inundation Length = 6.8 mi
- Maximum Storage = 65K acre/feet

Flood Retention Only RCC Dam

Footprint = 6 acres

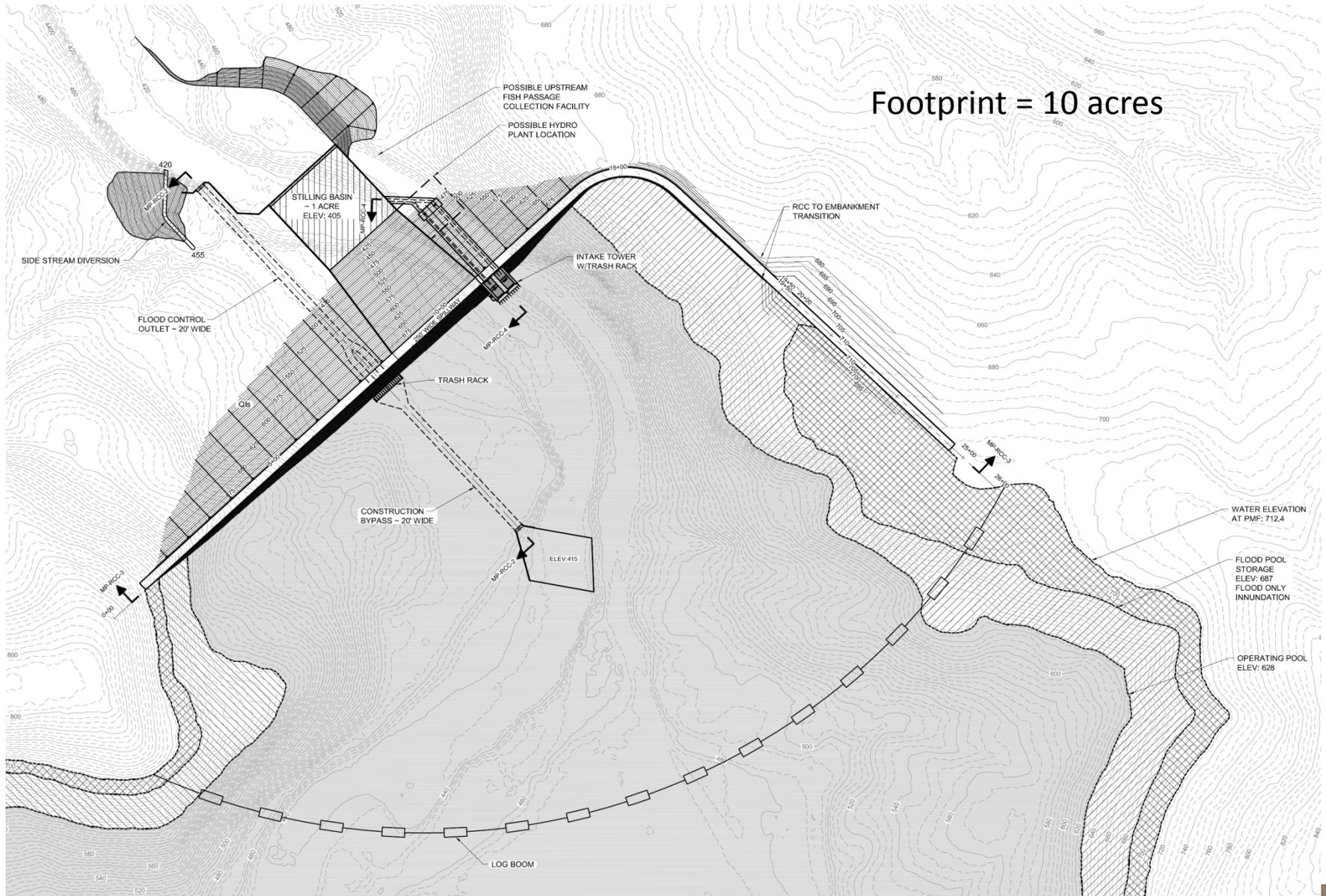


Multi-purpose Reservoir Overview



- Dam Height = 287'
- Spillway Crest Elev. = 687
- Dam Crest Elev. = 714
- Area = 1,307 Ac
- River Inundation Length = 7.5 mi
- Maximum Storage = 130K acre/feet

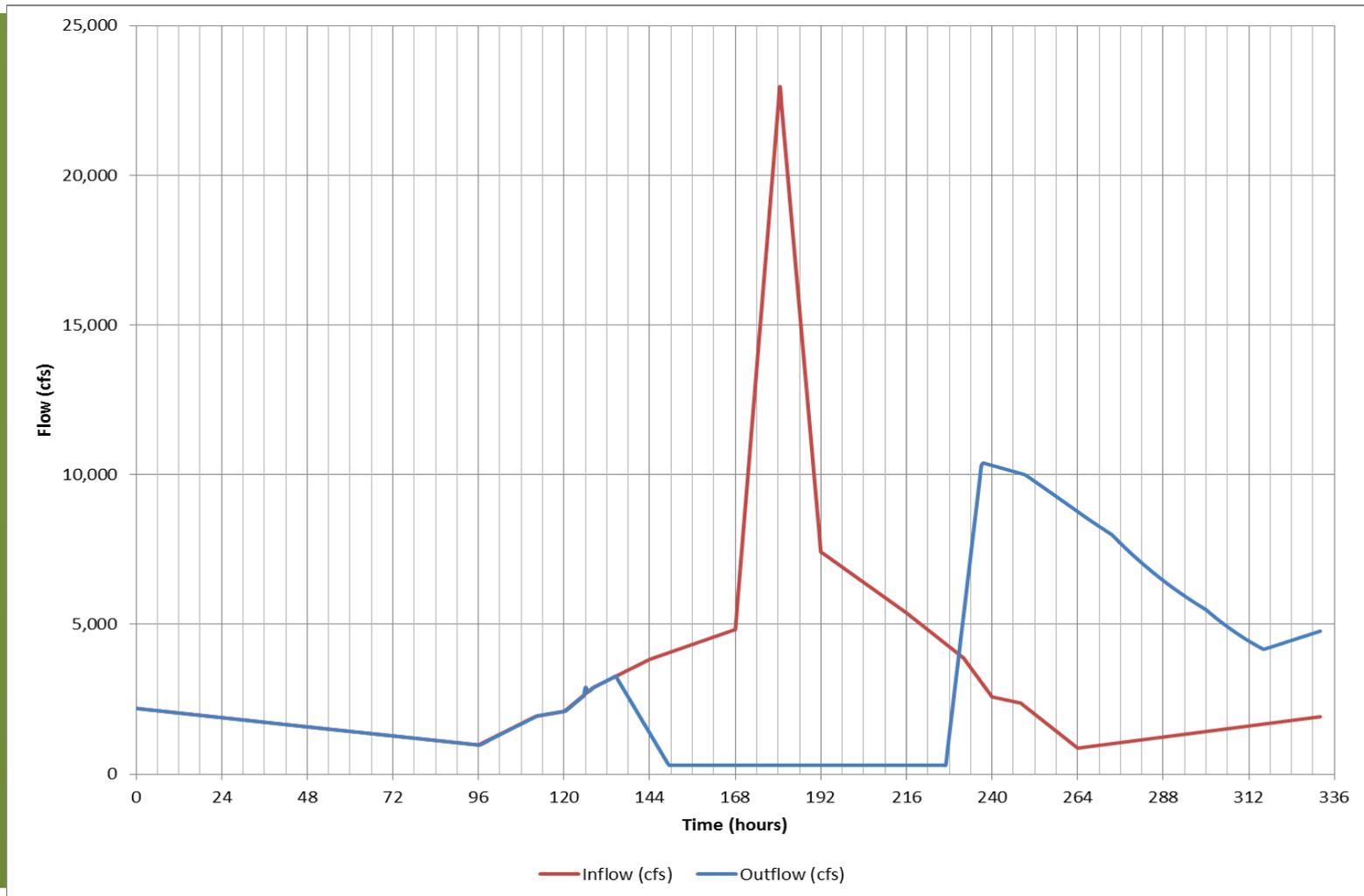
Multi-purpose RCC Dam



Objectives for Dam Operation

- Provide flood reduction in downstream areas
- Preserve geomorphic processes downstream
- Maintain slope stability in reservoir
- Keep rate of change in flows downstream within accepted limits to minimize fish stranding
- Store water during winter and release during summer for fisheries and water quality enhancement (Multi-purpose Alternative)

Reservoir Inflow/Outflow during Large Flood – 100-Year Flood



Summary of Flood Reduction Benefits

- Used 1 percent of time based on historic record
- Reduces flows by @15% for 10-100 year
- 100 year to 40 year event, 1.5 feet lower in Centralia, 0.5 lower in Montesano.
- I-5 Closed less frequent and for less time

	100 Year	With Dam	Difference	Climate
Floodplain Structures	1384	821	563	2202
Value of Structures (\$Mil)	\$137	\$73	\$64	\$255

- Multi-purpose increases summer low flows by factor of 3-6.

Water Retention Cost Comparison (Mitigation costs not included)

Alternative	Preliminary Class 5 Cost Estimate 2014 \$M, Average Estimated Value and +/- Range				
	Dam	Fish Passage Upstream	Fish Passage Downstream	Hydropower	Total Range
Flood Only	265-421				265-421
Multi Purpose with Fish passage	322-512	10-18	17-30	20-25	369-585
Rock Fill Multi Purpose	408-566	40-70	27-47	20-25	495-708

Note: These costs are preliminary Class 5 estimates for screening purposes only.
They should not be used for budgetary purposes

Aquatic Species Impacts from Water Retention



Effects on Habitat Downstream

- Dam operation could affect:
 - Peak flows (sediment transport)
 - Sediment input (reservoir storage, change in bank erosion)
 - Large woody debris input/transport
- Potential Key Geomorphology/Habitat Effects
 - Substrate (spawning gravel, interstitial rearing, etc.)
 - Channel forming processes (meander rate, LWD input, holding pools, etc.)
 - Floodplain and off-channel connectivity

Summary at Basin Scale - EDT

Species	Current	Multi-purpose	Flood Retention 100%	Flood Retention 50%
Coho salmon		-2%	-3%	-2%
Fall Chinook		-3%	-3%	-3%
Spring Chinook		-2%	-12%	-10%
Winter Steelhead		-8%	-6%	-3%

Protecting I-5 and SR 6/12



Conceptual Alternatives to Protect I-5

- Raise I-5 using fill material – *Dropped*
 - Raise only
 - Raise and widen to six lanes
- Raise I-5 using a viaduct (long bridge with piers) - *Dropped*
- Relocate I-5 outside flood area - *Dropped*
- Construct I-5 express lanes – *On Hold*
- Construct I-5 temporary by-pass lanes – *On Hold*
- Protect I-5 with walls and levees – *Assessing*

Protect I-5 with walls and levees

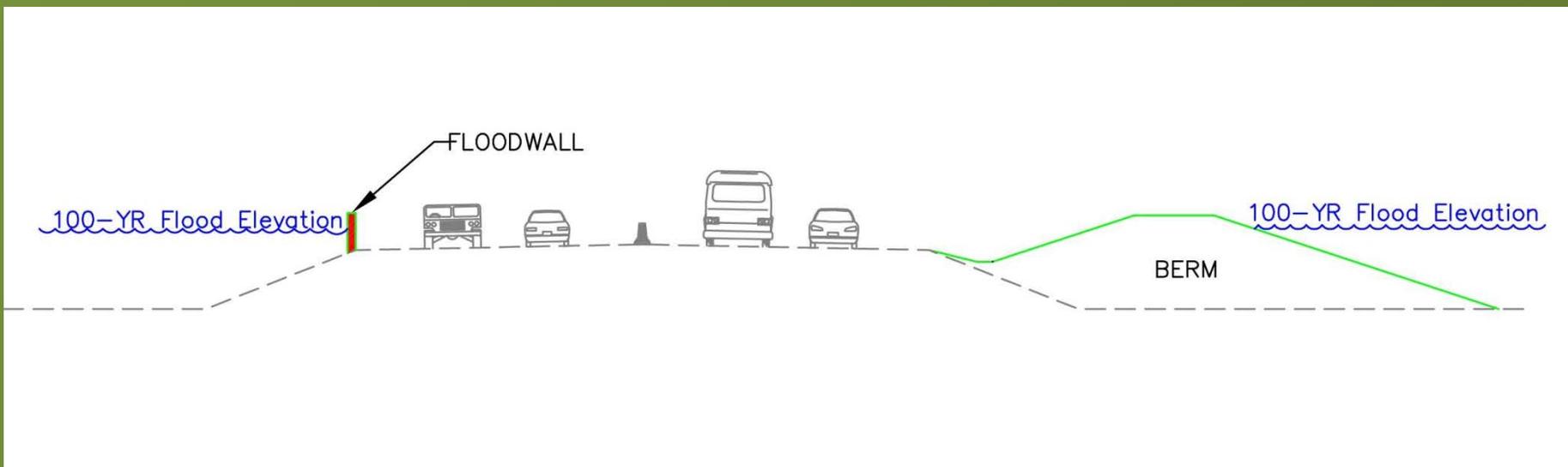
Approach

- Design Concept for Walls

- Install at edge of pavement
- Use to avoid impacts

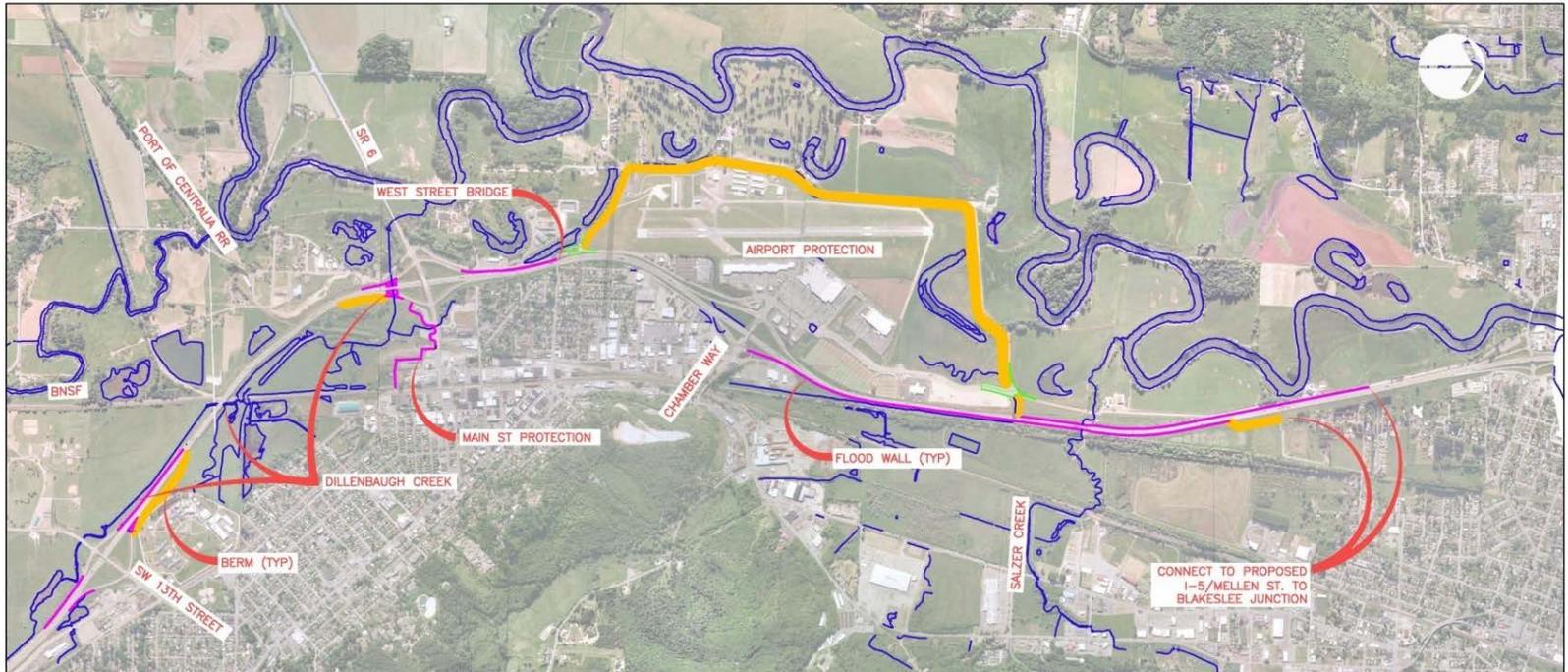
- Design Concept for Berms

- Use where adjacent ground is not too high
- Use to develop storm water treatment areas



Protect I-5 with walls and levees

Project Cost: \$ 80 – 100 Million



Highway 6 and 12 Flooding



2007 Flooding on US 12 at Anderson Road

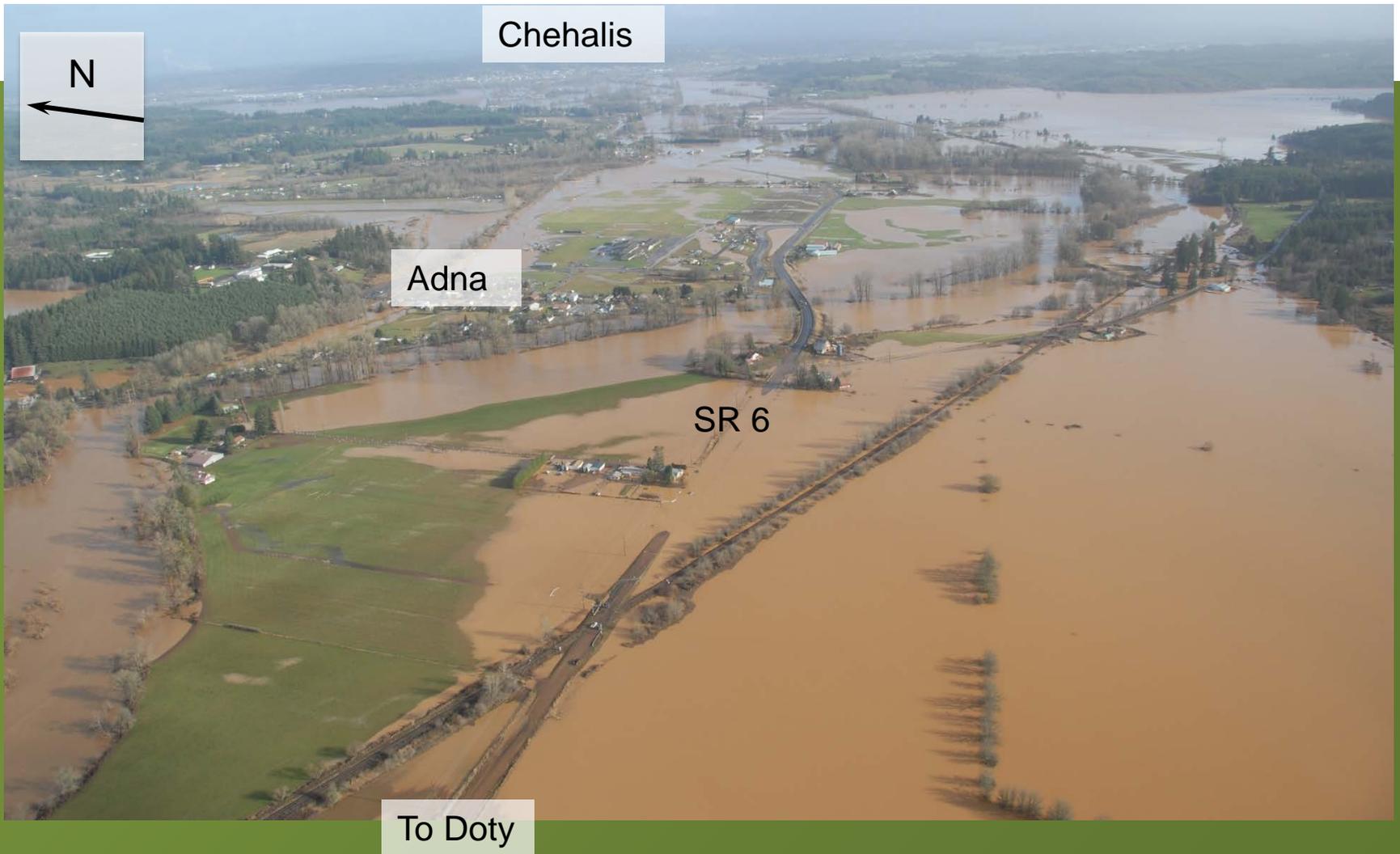
East of Black River Bridge



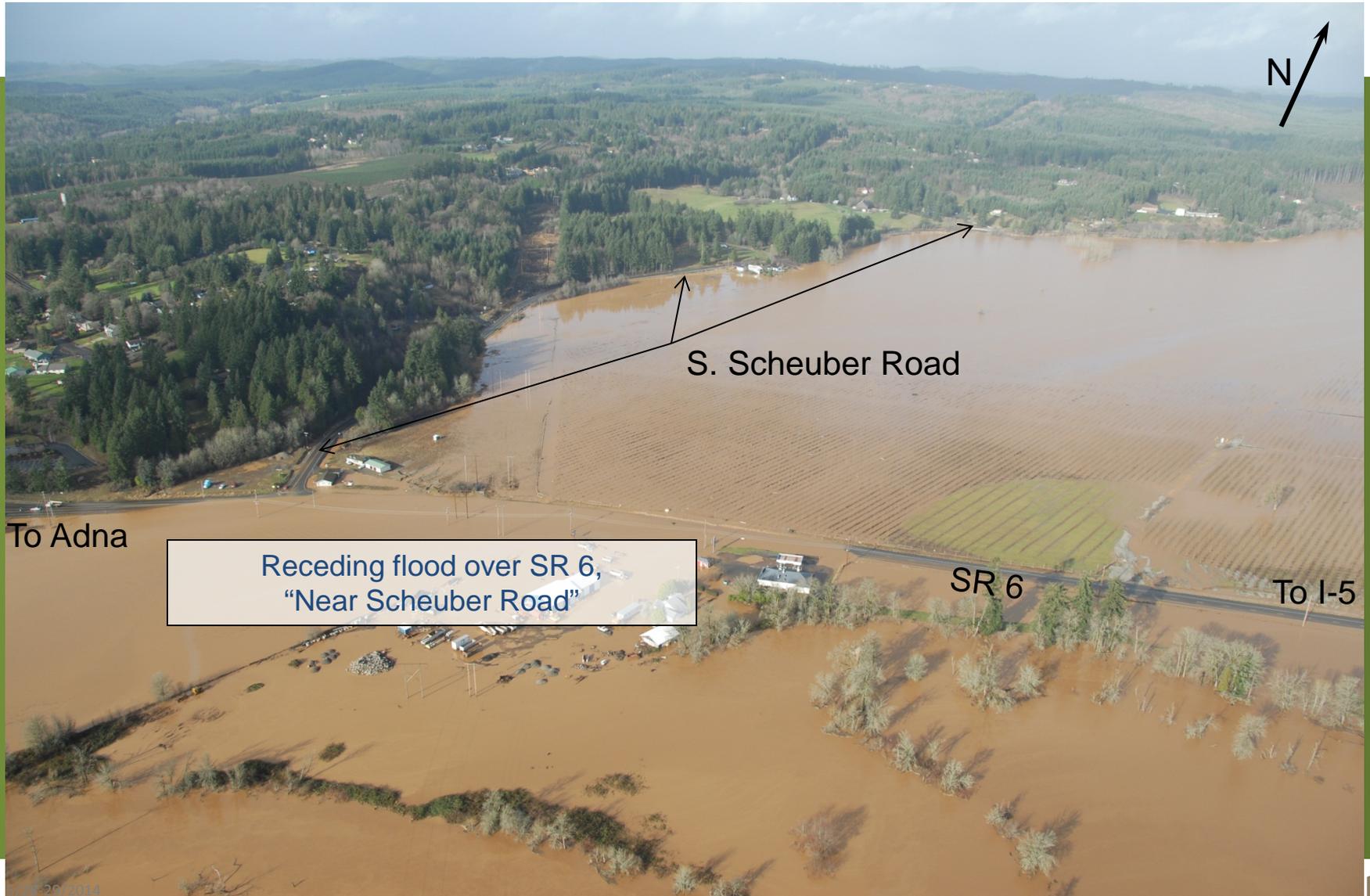
Looking East on US 12



2007 Receding Flood Over SR 6 Near Adna



2007 Flood Near Scheuber Road



2007 Flood Receding Near Boistfort Road



US 12 and SR 6 Improvements

(Pre-Scoping Estimates)

- US 12 – East of Black River \$ 12-15 Million*
- SR 6 – Near Adna \$ 11-14 Million*
- SR 6 – Near Scheuber Rd \$ 3-5 Million*
- SR 6 – Near Boistfort Rd \$ 4-6 Million*

Subtotal \$ 30-40 Million*

(Plus Other Flood Areas – Est. \$ 5-15 Million*)

*Does not include costs for mitigation
(100-year event with flood control structure)

Small Projects



Process

- Identified a long list of projects through review of past reports and meetings with communities
- Developed criteria to prioritize projects
- Prepared a short list of 37 projects most likely to meet criteria
- Consultant team evaluated projects
- Floodproofing is also being evaluated in this task

Projects Selected for Additional Analysis Now

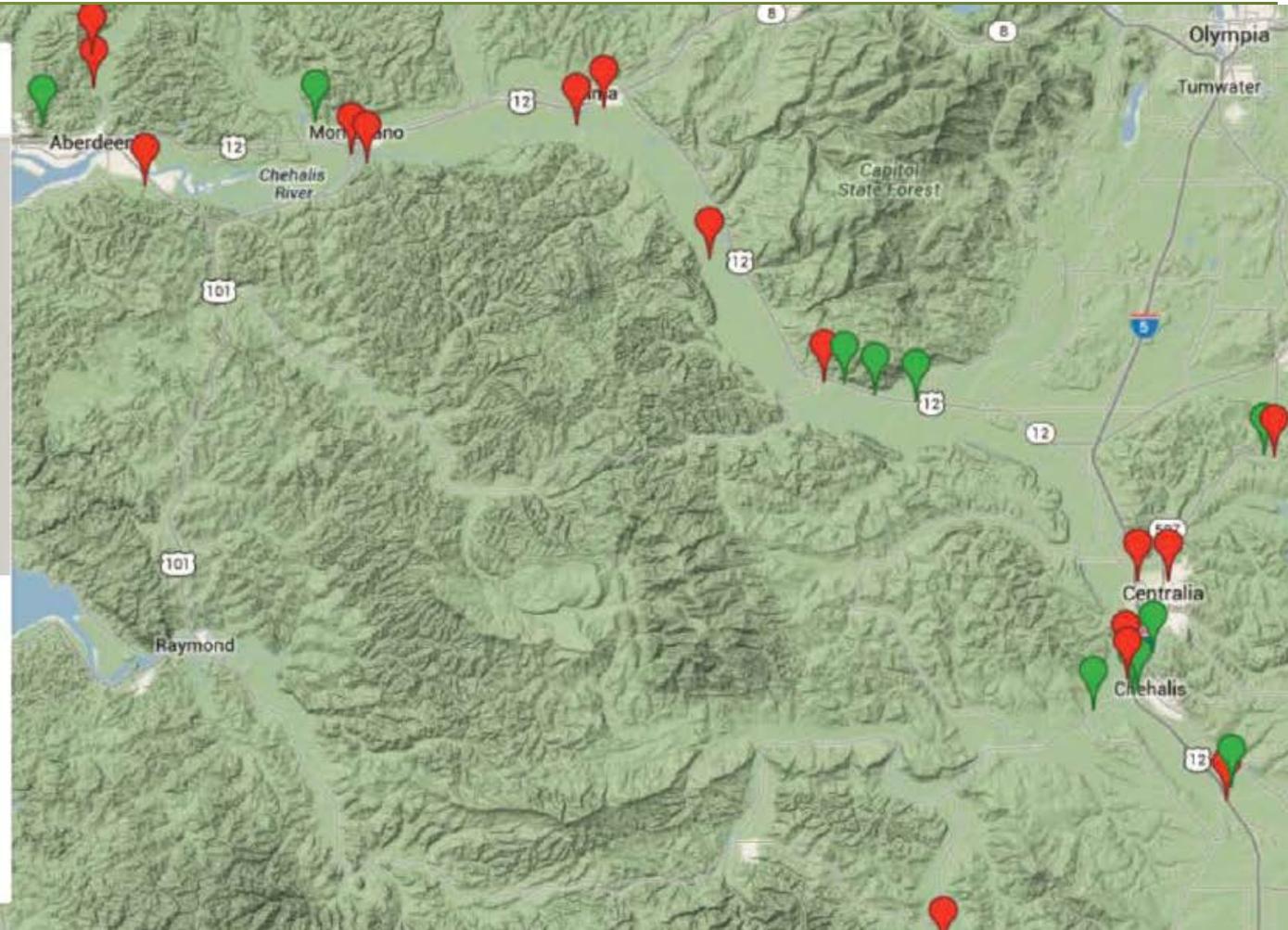
- City of Napavine, Kirkland Road Flooding
- WSDOT/Lewis County, SR 6 Overflow
- City of Chehalis, Dillenbaugh Creek Realignment
- City of Chehalis, Main Street Regrade
- Lewis County, Salzer Creek
- Town of Bucoda, Main Street Regrade
- Chehalis Tribe, Black River Bridge
- Chehalis Tribe, Roundtree Creek
- Grays Harbor County, Wynoochee Valley Road Regrade
- City of Aberdeen, Fry Creek
- Floodproofing all structures in floodplain

Project Locations

Local Small Projects

Small Projects (Current and Potent...)

-  Boistfort Water District, Wildwood
-  City of Aberdeen, Fry Creek
-  City of Centralia, China Creek
-  Lewis County, Salzer Creek
-  City of Centralia, Skookumchuck R
-  City of Chehalis, Airport Levee Pha:
-  City of Chehalis, Dillenbaugh Creek
-  City of Chehalis, Main Street Regra
-  City of Chehalis, Potential Storage
-  City of Cosmopolis, Mill Creek
-  City of Elma, Wastewater Treatme
-  City of Montesano, WWTP Lagoon/
-  City of Napavine, Kirkland Road Flc
-  City of Napavine, Newaukum River
-  City of Oakville, Subdivision Floodi
-  Confederated Tribes of the Chehali
-  Confederated Tribes of the Chehali



Floodproofing



Estimated Costs for Floodproofing

Baseline conditions 100-year event totals

Residential Structures - \$57,000,000

Commercial Structures - \$21,000,000

Agricultural Structures - \$14,000,000

Total - \$92,000,000

Floodproofing - Structures Affected

Summary of Structures At Risk of Flooding in Chehalis River Floodplain

Number of Structures	Baseline					With Dam and Airport Levee		
	Dec 07	500-Year	100-Year	20-Year	10-Year	Dec 07	500-Year	100-Year
Flooded	2040	3645	1384	372	175	753	2031	821
>1.0 feet	1368	2743	829	167	83	432	1306	459
>2.0 feet	820	1926	489	76	28	241	762	241
>3.0 feet	470	1159	293	22	7	139	471	117
>4.0 feet	263	657	155	6	2	65	300	54
>5.0 feet	159	385	76	1	0	28	158	25
Assessed Value of Improvements Inundated (\$Million)	\$238	\$411	\$137	\$30	\$13	\$64	\$206	\$73
Cost to Floodproof all Inundated Structures (\$Million)	\$146	\$273	\$92	\$20	\$9	\$46	\$149	\$50
Residential (\$ Mil)	\$107	\$205	\$57	\$10	\$4	\$28	\$101	\$28
Commercial (\$ Mil)	\$26	\$44	\$21	\$6	\$3	\$11	\$26	\$12
Agricultural (\$ Mil)	\$13	\$24	\$14	\$4	\$2	\$7	\$22	\$10

Floodproofing

- No environmental impacts from this alternative
- Cost is preliminarily estimated to be \$92 million – \$146 million (100-year to 2007 event)
- Costs rise by 75% when climate change is accounted for (from \$92 million to \$161 million for 100-year event)

Next Steps



Preliminary Cost Estimates

- Aquatic species enhancement
- Water retention
- I-5 Improvements
- Small projects
- Floodproofing homes and businesses
- Total cost depends on what options are included in recommendations
- Current price range for all \$500M to \$1.2 Billion (includes \$60M-\$100M improvements along I-5)

Governor's Work Group

Process Overview

- **Summer**

- Finalize preliminary designs for water retention and I-5 improvements, and assessment of costs, benefits and impacts.
- Finalize aquatics species enhancement plan.
- Assess local floodplain management.
- Conduct benefit/cost analysis and other comparisons

- **September**

- Technical and policy workshops, Flood Authority meeting, and public meetings on final results and input for recommendations

- **October -November 2014**

- Governor's Work Group finalizes recommendations to Governor and Legislature.

More Information

- <http://ruckelshauscenter.wsu.edu/ChehalisFlooding.html>
- <https://www.ezview.wa.gov/chehalisfloodauthority>

Your Questions and Comments

I-5 Under Water
BRUCE ELY /
OREGONIAN

